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Assessment of Domestic Pollution Load from Urban Agglomeration in Ganga Basin: Hooghly Sub-Basin

GRBMP: Ganga River Basin Management Plan

by

Indian Institutes of Technology



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Preface

In exercise of the powers conferred by sub-sections (1) and (3) of Section 3 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government has constituted National Ganga River Basin Authority (NGRBA) as a planning, financing, monitoring and coordinating authority for strengthening the collective efforts of the Central and State Government for effective abatement of pollution and conservation of the river Ganga. One of the important functions of the NGRBA is to prepare and implement a Ganga River Basin Management Plan (GRBMP).

A Consortium of 7 Indian Institute of Technology (IIT) has been given the responsibility of preparing Ganga River Basin Environment Management Plan (GRBMP) by the Ministry of Environment and Forests (MoEF), GOI, New Delhi. Memorandum of Agreement (MoA) has been signed between 7 IITs (Bombay, Delhi, Guwahati, Kanpur, Kharagpur, Madras and Roorkee) and MoEF for this purpose on July 6, 2010.

This report is one of the many reports prepared by IITs to describe the strategy, information, methodology, analysis and suggestions and recommendations in developing Ganga River Basin Management Plan (GRB EMP). The overall Frame Work for documentation of GRBMP and Indexing of Reports is presented on the inside cover page.

There are two aspects to the development of GRB EMP. Dedicated people spent hours discussing concerns, issues and potential solutions to problems. This dedication leads to the preparation of reports that hope to articulate the outcome of the dialog in a way that is useful. Many people contributed to the preparation of this report directly or indirectly. This report is therefore truly a collective effort that reflects the cooperation of many, particularly those who are members of the IIT Team. Lists of persons who have contributed directly and those who have taken lead in preparing this report is given on the reverse side.

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1. Hooghly River Basin

The Hooghly River is formed by joining of two rivers, the Bhagirathi and the Jalangi River. Calcutta city, the capital of West Bengal and one of India's most important ports, is situated on the Hooghly River. South of Calcutta, the Hooghly is joined by the Damodar River and flows into the Bay of Bengal. Farakka Barrage, which was completed in 1971, diverted the Ganga water to Hooghly. The feeder canal from the barrage, which is about 25 miles long, was completed in 1975 and the barrage came into operation on April 21, 1975. The purpose of the barrage was to ensure that the Hooghly River would receive 40,000 cubic feet per second (cusecs) of water diverted from the Ganges on the assumption that the least flow would be around 50,000 to 55,000 cusecs; the remaining 10,000 to 15,000 cusecs would be released to East Pakistan². The width of the river increases with the attachment of various tributaries and it finally becomes an estuary with a width of about 24 km at saugor Lighthouse¹. *Table 1* shows the demography of the major cities situated along river Hooghly.

City	Area (sq.km)	Population (as in 2011)in lakhs
Baidyabati	12.09	121081
Chakdaha	15.36	132855
Budge Budge	9.06	76858
Bansberia	9.07	103799

Table 1: Demography of major cities on Hooghly River

1.1 Pollution Load on the River Hooghly

As per the data available from UBL, all the major cities situated on the river Hooghly use surface water as the sole source for meeting the domestic demand apart from Baidyabati which uses some ground water. *Figure 1* shows the Total water extracted and the corresponding sewage generated in all the major cities.

As per the data available from UBL Baidyabati and Bansberia are the cities on the river that has STPs having total installed capacities of 6 MLD and 2.3 MLD. None of the other major cities situated along the river Adiganga have an installed STP.

The pollution load on the river in terms of BOD₅, COD and TKN is estimated based on the per capita contribution for all the major cities. *Figure 2a & 2b* shows the spatial distribution of the pollution load on the river.

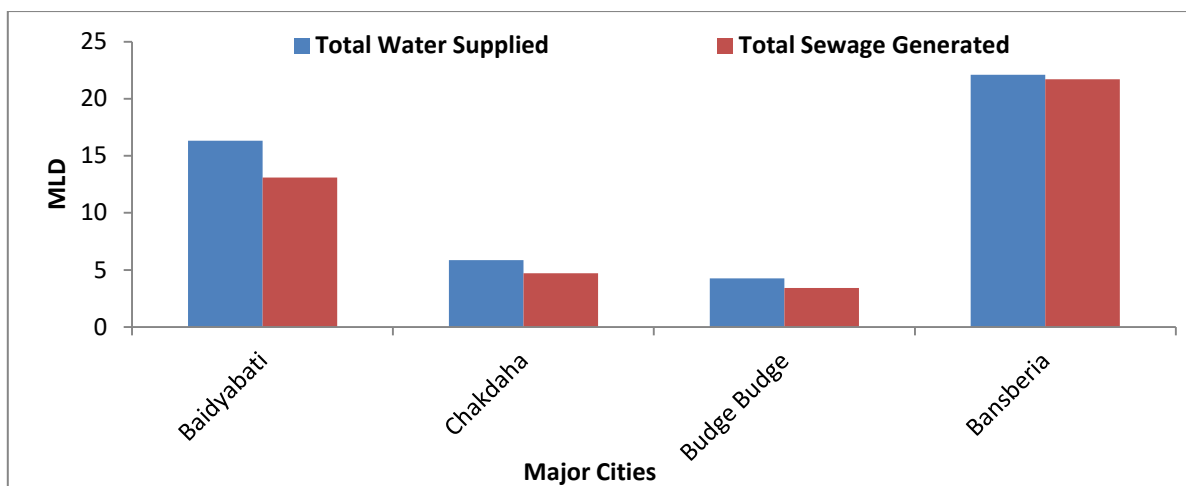


Figure 1: Total water utilization and sewage generation on Hooghly River.
(In MLD)

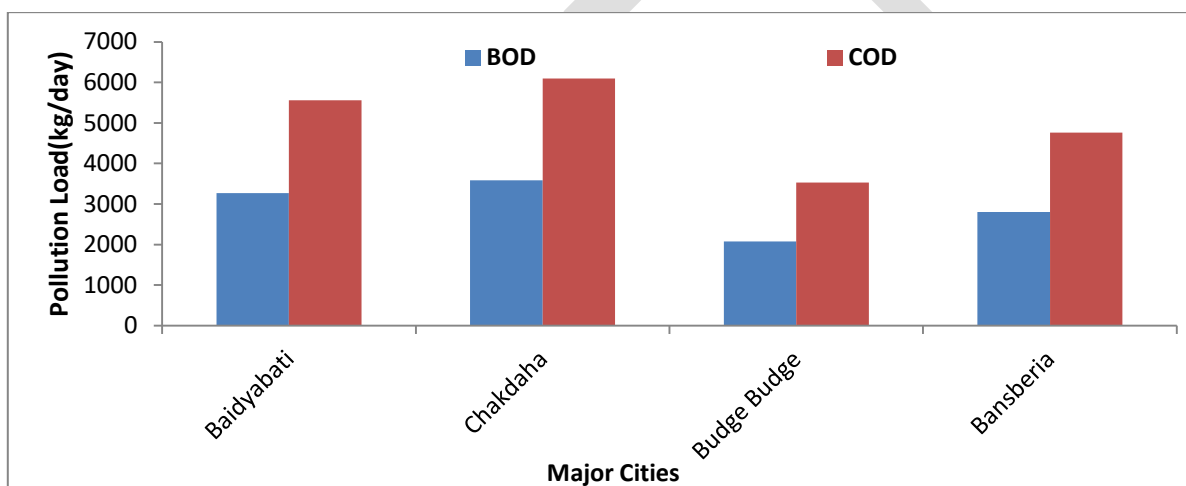


Figure 2a: Spatial distribution of estimated pollution load on Hooghly River.

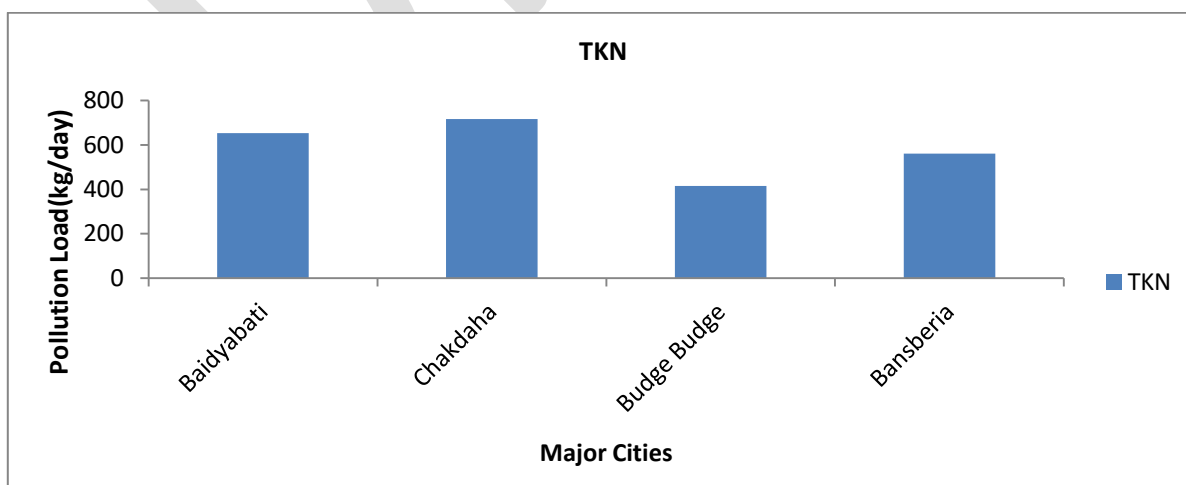


Figure 2b: Spatial distribution of estimated pollution load on Hooghly River.

Water Balance & Pollution Load (Domestic) Fact Sheet

City: Baidyabati Municipality		State: West Bengal	
S. No.	Items	:	Value
1	Total Area (sq km)	:	12.09
2	Population as in 2011	:	121081
3	Population Growth Rate as in 2011 (%)	:	11.87
4	Total Number of Wards	:	22
5	Population per Ward (Thousands)	:	5.5036
6	Total Number of Household as in 2011	:	30240
7	Number of Household per Ward	:	1375
8	Surface Water Supply (MLD)	:	15
9	Ground Water (GW) Supply (MLD)	:	Nil
10	Number of Bore Wells	:	Nil
11	Ground Water Extraction per Bore Well (MLD)	:	Nil
12	Number of Hand Pumps	:	21
13	Ground Water Extraction per Hand Pump (lpcd)	:	Nil
14	Number of Pumping Stations for Water Supply	:	Nil
15	Total Pumping Capacity (MLD)	:	Nil
16	Average Water Supply Rate from ULB Sources (lpcd)	:	Nil
17	Total Water Supply from ULB and Non-ULB Sources (MLD)	:	16.33
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)	:	Nil
19	Total Sewage Generation (MLD)	:	13.1
20	Per Capita Sewage Generation (lpcd)	:	107.9
21	Sewage Collection (MLD)	:	Not collected
22	Percentage of Sewage Collection (%)	:	Not Applicable
23	Number of STPs	:	2
24	Total Installed Capacity of STPs under GAP I & II (MLD)	:	6
25	Current Utilized Capacity of STPs (MLD)	:	Not Applicable
26	Percentage Utilization of Installed Capacity (%)	:	Not Applicable
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)	:	Not Applicable
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD ₅	: Not Applicable
		COD	: Not Applicable
		TKN	: Not Applicable
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD ₅	: 3269.187
		COD	: 5557.6179
		TKN	: 653.8374
30	Wastewater Disposal Means	:	Land and river
31	Name of River/Streams for Wastewater Disposal	:	Hooghly,
32	Number of Drains/Nallah for Wastewater Disposal	:	850
33	Number of Water Bodies	:	Not Counted
34	Gross Area of Water Bodies (sq km)	:	Not Measured
35	Area of Water Bodies as % of Total Area	:	0.21

Water Balance & Pollution Load (Domestic) Fact Sheet

City: Chakdaha Municipality		State: West Bengal	
S. No.	Items		Value
1	Total Area (sq km)	:	15.36
2	Population as in 2011	:	132855
3	Population Growth Rate as in 2011 (%)	:	52.77
4	Total Number of Wards	:	21
5	Population per Ward (Thousands)	:	4528
6	Total Number of Household as in 2011	:	23,229
7	Number of Household per Ward	:	1106
8	Surface Water Supply (MLD)	:	Nil
9	Ground Water (GW) Supply (MLD)	:	5.85
10	Number of Bore Wells	:	Nil
11	Ground Water Extraction per Bore Well (MLD)	:	NA
12	Number of Hand Pumps	:	253
13	Ground Water Extraction per Hand Pump (lpcd)	:	NA
14	Number of Pumping Stations for Water Supply	:	15
15	Total Pumping Capacity (MLD)	:	5.85
16	Average Water Supply Rate from ULB Sources (lpcd)	:	22.71
17	Total Water Supply from ULB and Non-ULB Sources (MLD)	:	5.85
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)	:	22.71
19	Total Sewage Generation (MLD)	:	4.7
20	Per Capita Sewage Generation (lpcd)	:	35.2
21	Sewage Collection (MLD)	:	NA
22	Percentage of Sewage Collection (%)	:	NA
23	Number of STPs	:	Nil
24	Total Installed Capacity of STPs under GAP I & II (MLD)	:	NA
25	Current Utilized Capacity of STPs (MLD)	:	NA
26	Percentage Utilization of Installed Capacity (%)	:	NA
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)	:	NA
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD ₅	: NA
		COD	: NA
		TKN	: NA
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD ₅	: 3587.1
		COD	: 6098.0
		TKN	: 717.4
30	Wastewater Disposal Means	:	River or Land
31	Name of River/Streams for Wastewater Disposal	:	Hooghly river
32	Number of Drains/Nallah for Wastewater Disposal	:	Not Measured
33	Number of Water Bodies	:	NA
34	Gross Area of Water Bodies (sq km)	:	Not Measured
35	Area of Water Bodies as % of Total Area	:	Not Measured

Water Balance & Pollution Load (Domestic) Fact Sheet

City: Budge Budge Municipality		State: West Bengal	
S. No.	Items		Value
1	Total Area (sq km)	:	9.06
2	Population as in 2011	:	76858
3	Population Growth Rate as in 2011 (%)	:	1.84
4	Total Number of Wards	:	20
5	Population per Ward (Thousands)	:	3,842
6	Total Number of Household as in 2011	:	13681
7	Number of Household per Ward	:	684
8	Surface Water Supply (MLD)	:	Nil
9	Ground Water (GW) Supply (MLD)	:	4.26
10	Number of Bore Wells	:	NIL
11	Ground Water Extraction per Bore Well (MLD)	:	NIL
12	Number of Hand Pumps	:	NA
13	Ground Water Extraction per Hand Pump (lpcd)	:	NIL
14	Number of Pumping Stations for Water Supply	:	NIL
15	Total Pumping Capacity (MLD)	:	NIL
16	Average Water Supply Rate from ULB Sources (lpcd)	:	35
17	Total Water Supply from ULB and Non-ULB Sources (MLD)	:	4.26
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)	:	35
19	Total Sewage Generation (MLD)	:	3.408
20	Per Capita Sewage Generation (lpcd)	:	44.3
21	Sewage Collection (MLD)	:	35.5
22	Percentage of Sewage Collection (%)	:	NA
23	Number of STPs	:	1
24	Total Installed Capacity of STPs under GAP I & II (MLD)	:	Under
25	Current Utilized Capacity of STPs (MLD)	:	Under
26	Percentage Utilization of Installed Capacity (%)	:	NA
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)	:	NA
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD ₅	: Not Available
		COD	: Not Available
		TKN	: Not Available
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD ₅	: 2075.166
		COD	: 3527.7822
		TKN	: 415.0332
30	Wastewater Disposal Means	:	Domestic
31	Name of River/Streams for Wastewater Disposal	:	Hooghly
32	Number of Drains/Nallah for Wastewater Disposal	:	NA
33	Number of Water Bodies	:	16
34	Gross Area of Water Bodies (sq km)	:	NA
35	Area of Water Bodies as % of Total Area	:	NA

Water Balance & Pollution Load (Domestic) Fact Sheet

City: Bansberia Municipality		State: West Bengal	
S. No.	Items		Value
1	Total Area (sq km)	:	9.07
2	Population as in 2011	:	103799
3	Population Growth Rate as in 2011 (%)	:	-0.5871
4	Total Number of Wards	:	22
5	Population per Ward (Thousands)	:	4,718
6	Total Number of Household as in 2011	:	24237
7	Number of Household per Ward	:	1101
8	Surface Water Supply (MLD)	:	Nil
9	Ground Water (GW) Supply (MLD)	:	22.113
10	Number of Bore Wells	:	27
11	Ground Water Extraction per Bore Well (MLD)	:	0.81
12	Number of Hand Pumps	:	99
13	Ground Water Extraction per Hand Pump (lpcd)	:	Not Available
14	Number of Pumping Stations for Water Supply	:	27
15	Total Pumping Capacity (MLD)	:	0.81
16	Average Water Supply Rate from ULB Sources (lpcd)	:	100
17	Total Water Supply from ULB and Non-ULB Sources (MLD)	:	22.113 (ULB
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)	:	100 (ULB
19	Total Sewage Generation (MLD)	:	21.7
20	Per Capita Sewage Generation (lpcd)	:	208.7
21	Sewage Collection (MLD)	:	2.3
22	Percentage of Sewage Collection (%)	:	10.6
23	Number of STPs	:	2
24	Total Installed Capacity of STPs under GAP I & II (MLD)	:	2.3
25	Current Utilized Capacity of STPs (MLD)	:	0.3
26	Percentage Utilization of Installed Capacity (%)	:	NA
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)	:	NA
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD ₅	: Nil
		COD	: Nil
		TKN	: Nil
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD ₅	: 2802.57
		COD	: 4764.37
		TKN	: 560.51
30	Wastewater Disposal Means	:	River
31	Name of River/Streams for Wastewater Disposal	:	Hooghly and
32	Number of Drains/Nallah for Wastewater Disposal	:	Not counted
33	Number of Water Bodies	:	374
34	Gross Area of Water Bodies (sq km)	:	1.36
35	Area of Water Bodies as % of Total Area	:	15.02

1. Adiganga River Basin

Adiganga is one of the channels flowing from the southern Kolkata since a long time and is one of the distributary of Hooghly. A highly polluted river, also known as Tolly's nala, is considered sacred and has visitors who visit the shrine kalighat. The river with continuous construction of embankment and other structures is now virtually cut from the schemes of the city and has become highly silted. It passes through many localities such as New Alipor, Tallygunge, Chetla, Kalighat, Alipore, Bhabanipore, Khidirpore and Hastings before draining in Bay of Bengal.

City	Area (sq.km)	Population (as in 2011)
Bally	9.5	115715
Baruipur	9.5	53,500
Rajpur-Sonarpur	49.25	423806

Table 2: Demography of major cities on river Adiganga

1.1 Pollution Load on River Adiganga

As per the data available from ULB, all the major cities situated on the river Adi ganga use ground water as well as surface water as source for meeting the domestic demand. Only Rajpur-Sonarpur does not use surface water as a source. *Figure 1* shows the Total water supplied and the corresponding Total sewage generated in all the major cities.

As per the data available from ULB, there are no STPs functioning in the major towns shown above. The pollution load on the river in terms of BOD₅, COD and TKN is estimated based on the per capita contribution for all the major cities. *Figure 2a & 2b* shows the spatial distribution of the pollution load on the river from source to mouth.

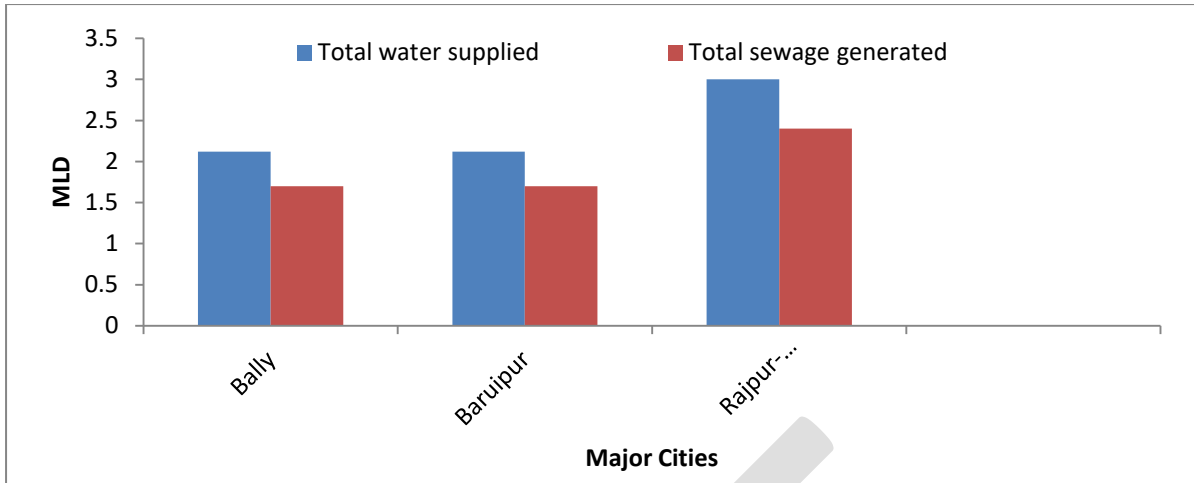


Figure 1: Total water supplied and Sewage Generation on Adiganga River. (In MLD)

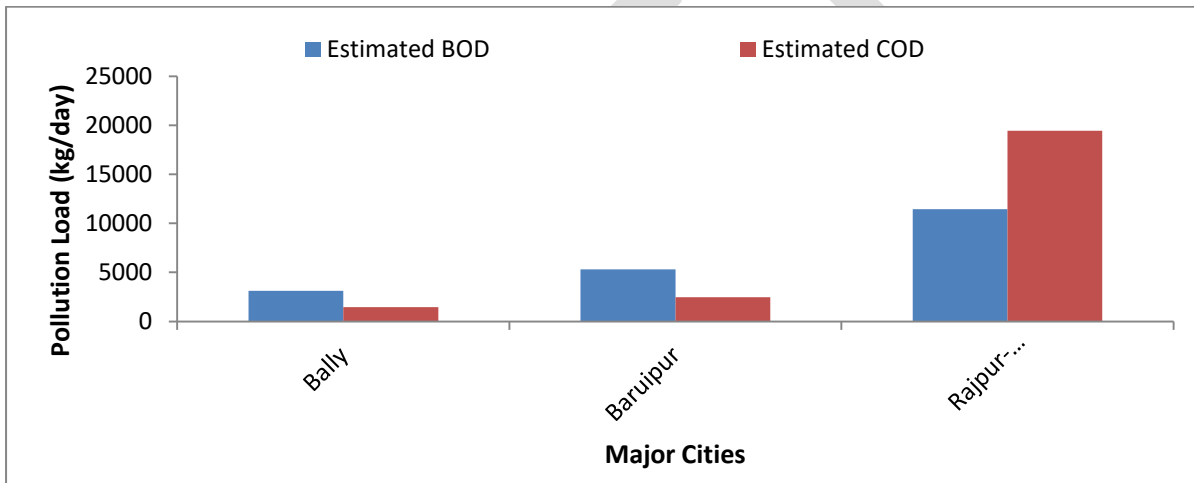


Figure 2a: Spatial distribution of estimated pollution load on Adiganga River.

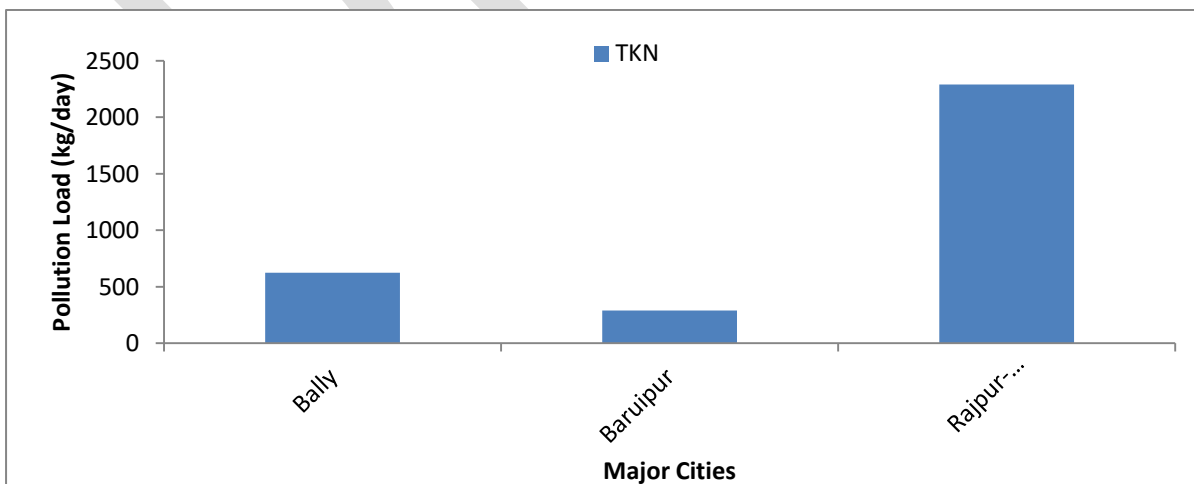


Figure 2b: Spatial distribution of estimated pollution load on Adiganga River.

Water Balance & Pollution Load (Domestic) Fact Sheet

City: /ULB: Bally Municipality		State: West Bengal	
S. No.	Items		Value
1	Total Area (sq km)	:	9.5
2	Population as in 2011	:	115715
3	Population Growth Rate as in 2011 (%)	:	157.35
4	Total Number of Wards	:	17
5	Population per Ward (Thousands)	:	3147
6	Total Number of Household as in 2011	:	13408
7	Number of Household per Ward	:	788
8	Surface Water Supply (MLD)	:	1.12
9	Ground Water (GW) Supply (MLD)	:	1
10	Number of Bore Wells	:	12
11	Ground Water Extraction per Bore Well (MLD)	:	0.25
12	Number of Hand Pumps	:	272
13	Ground Water Extraction per Hand Pump (lpcd)	:	Nil
14	Number of Pumping Stations for Water Supply	:	12
15	Total Pumping Capacity (MLD)	:	1
16	Average Water Supply Rate from ULB Sources (lpcd)	:	172.28
17	Total Water Supply from ULB and Non-ULB Sources (MLD)	:	2.12
18	Average Water Supply Rate from ULB & Non-ULB Sources	:	172.28
19	Total Sewage Generation (MLD)	:	1.7
20	Per Capita Sewage Generation (lpcd)	:	18.3
21	Sewage Collection (MLD)	:	2.1
22	Percentage of Sewage Collection (%)	:	NA
23	Number of STPs	:	Nil
24	Total Installed Capacity of STPs under GAP I & II (MLD)	:	Nil
25	Current Utilized Capacity of STPs (MLD)	:	Nil
26	Percentage Utilization of Installed Capacity (%)	:	Nil
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)	:	Nil
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD ₅	: Nil
		COD	: Nil
		TKN	: Nil
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD ₅	: 3124.3
		COD	: 5311.3
		TKN	: 624.9
30	Wastewater Disposal Means	:	River (Adi Ganga)
31	Name of River/Streams for Wastewater Disposal	:	Adi Ganga
32	Number of Drains/Nallah for Wastewater Disposal	:	17
33	Number of Water Bodies	:	NA
34	Gross Area of Water Bodies (sq km)	:	0.73
35	Area of Water Bodies as % of Total Area	:	8.062

Water Balance & Pollution Load (Domestic) Fact Sheet

City: /ULB Baruipur Municipality		State: West Bengal	
S. No.	Items		Value
1	Total Area (sq km)	:	9.5
2	Population as in 2011	:	53,500
3	Population Growth Rate as in 2011 (%)	:	18.98
4	Total Number of Wards	:	17
5	Population per Ward (Thousands)	:	3,147
6	Total Number of Household as in 2011	:	3147
7	Number of Household per Ward	:	789
8	Surface Water Supply (MLD)	:	1.12
9	Ground Water (GW) Supply (MLD)	:	1
10	Number of Bore Wells	:	12 (4 working)
11	Ground Water Extraction per Bore Well (MLD)	:	0.25
12	Number of Hand Pumps	:	272
13	Ground Water Extraction per Hand Pump (lpcd)	:	NA
14	Number of Pumping Stations for Water Supply	:	12(4 working)
15	Total Pumping Capacity (MLD)	:	1
16	Average Water Supply Rate from ULB Sources (lpcd)	:	39.62
17	Total Water Supply from ULB and Non-ULB Sources (MLD)	:	2.12 (ULB Source)
18	Average Water Supply Rate from ULB & Non-ULB Sources	:	39.62 (ULB
19	Total Sewage Generation (MLD)	:	1.7
20	Per Capita Sewage Generation (lpcd)	:	Not Mreasured
21	Sewage Collection (MLD)	:	Not collected
22	Percentage of Sewage Collection (%)	:	NA
23	Number of STPs	:	Nil
24	Total Installed Capacity of STPs under GAP I & II (MLD)	:	NA
25	Current Utilized Capacity of STPs (MLD)	:	NA
26	Percentage Utilization of Installed Capacity (%)	:	NA
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)	:	NA
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD ₅	: NA
		COD	: NA
		TKN	: NA
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD ₅	: 1444.5
		COD	: 2455.7
		TKN	: 288.9
30	Wastewater Disposal Means	:	River
31	Name of River/Streams for Wastewater Disposal	:	Adi Ganga
32	Number of Drains/Nallah for Wastewater Disposal	:	NA
33	Number of Water Bodies	:	161
34	Gross Area of Water Bodies (sq km)	:	0.73
35	Area of Water Bodies as % of Total Area	:	7.68

Water Balance & Pollution Load (Domestic) Fact Sheet

City: Rajpur -Sonarpur Municipality		State: West Bengal	
S. No.	Items		Value
1	Total Area (sq km)	:	49.25
2	Population as in 2011	:	423806
3	Population Growth Rate as in 2011 (%)	:	25.76
4	Total Number of Wards	:	35
5	Population per Ward (Thousands)	:	12,085
6	Total Number of Household as in 2011	:	105000
7	Number of Household per Ward	:	3000
8	Surface Water Supply (MLD)	:	Nil
9	Ground Water (GW) Supply (MLD)	:	3
10	Number of Bore Wells	:	26
11	Ground Water Extraction per Bore Well (MLD)	:	NA
12	Number of Hand Pumps	:	2200
13	Ground Water Extraction per Hand Pump (lpcd)	:	NA
14	Number of Pumping Stations for Water Supply	:	26
15	Total Pumping Capacity (MLD)	:	2.5
16	Average Water Supply Rate from ULB Sources (lpcd)	:	135
17	Total Water Supply from ULB and Non-ULB Sources (MLD)	:	3(ULB Source)
18	Average Water Supply Rate from ULB & Non-ULB Sources	:	135(ULB
19	Total Sewage Generation (MLD)	:	2.4
20	Per Capita Sewage Generation (lpcd)	:	5.7
21	Sewage Collection (MLD)	:	NA
22	Percentage of Sewage Collection (%)	:	NA
23	Number of STPs	:	Nil
24	Total Installed Capacity of STPs under GAP I & II (MLD)	:	Not Applicable
25	Current Utilized Capacity of STPs (MLD)	:	Not Applicable
26	Percentage Utilization of Installed Capacity (%)	:	Not Applicable
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)	:	Not Applicable
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD ₅	: Not Applicable
		COD	: Not Applicable
		TKN	: Not Applicable
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD ₅	: 11442.8
		COD	: 19452.7
		TKN	: 2288.6
30	Wastewater Disposal Means	:	Domestic
31	Name of River/Streams for Wastewater Disposal	:	Adi Ganga
32	Number of Drains/Nallah for Wastewater Disposal	:	NA
33	Number of Water Bodies	:	26
34	Gross Area of Water Bodies (sq km)	:	NA
35	Area of Water Bodies as % of Total Area	:	NA