Ganga River Basin Management Plan-2015

Volume 10: Thematic Studies – Domestic and Industrial Pollution in Ganga Sub Basins

Centre for Ganga River Basin Management and Studies
Indian Institute of Technology Kanpur

VOLUME 10 OF 12

NATIONAL MISSION FOR CLEAN GANGA (NMCG)

NMCG is the implementation wing of National Ganga Council which was setup in October 2016 under the River Ganga Authority order 2016. Initially NMCG was registered as a society on 12th August 2011 under the Societies Registration Act 1860. It acted as implementation arm of National Ganga River Basin Authority (NGRBA) which was constituted under the provisions of the Environment (Protection) Act (EPA) 1986. NGRBA has since been dissolved with effect from the 7th October 2016, consequent to constitution of National Council for Rejuvenation, Protection and Management of River Ganga (referred to as National Ganga Council).

www.nmcg.in

CENTRE FOR GANGA RIVER BASIN MANAGEMENT AND STUDIES (cGanga)

cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this it is also responsible for introducing new technologies, innovations and solutions into India.

www.cganga.org

ACKNOWLEDGEMENT

This document is a collective effort of a number of experts, institutions and organisations, in particular those who were instrumental in preparing the Ganga River Basin Management Plan which was submitted to the Government of India in 2015. Contributions to the photographs and images for this vision document by individuals are gratefully acknowledged.

SUGGESTED CITATION

GRBMP by cGanga and NMCG

CONTACTS

Centre for Ganga River Basin Management and Studies (cGanga)
Indian Institute of Technology Kanpur, Kanpur 208 016, Uttar Pradesh, India

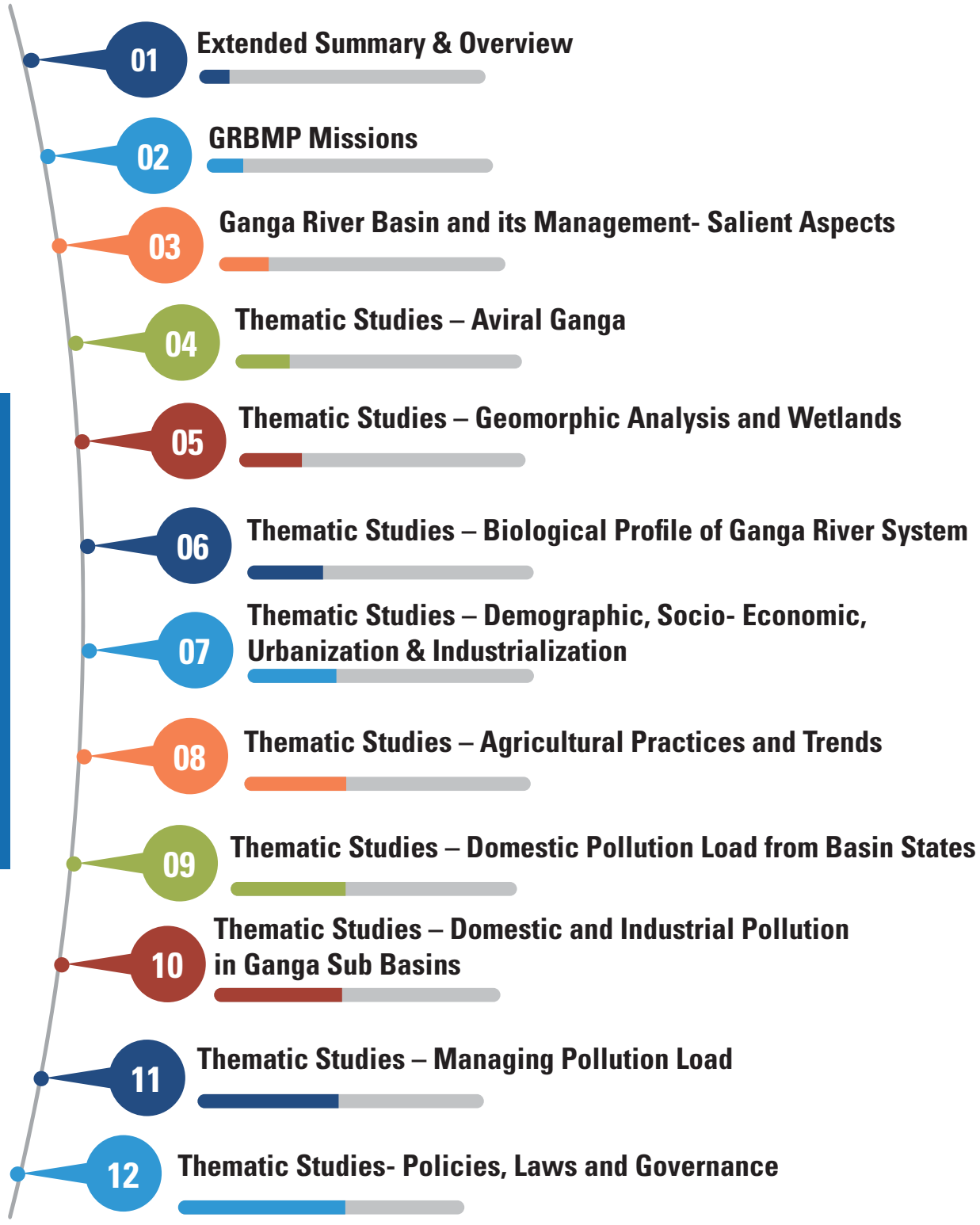
or

National Mission for Clean Ganga (NMCG)
Major Dhyan Chand National Stadium, New Delhi 110 002, India

GANGA RIVER BASIN MANAGEMENT PLAN - 2015

Volume 10: Thematic Studies – Domestic and Industrial Pollution in Ganga Sub Basins

12 VOLUMES



Ganga river in Himalayas mountains

Assessment of Some Aspects of Provisioning Sewerage Systems

in Urban Agglomeration of Ganga Basin

GRBMP: Ganga River Basin Management Plan

by

Indian Institutes of Technology







IIT Bombay | **IIT Delhi** | **IIT Guwahati** | **IIT Kanpur** | **IIT Kharagpur** | **IIT Madras** | **IIT Roorkee**

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 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 (GRBMP). 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 GRBMP. 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.

Dr Vinod Tare
Professor and Coordinator
Development of GRBMP
IIT Kanpur

The Team

1. A A Kazmi, IIT Roorkee *kazmifce@iitr.ernet.in*
2. A K Gupta, IIT Kharagpur *akgupta18@rediffmail.com,akgupta@iitkgp.ac.in*
3. A K Mittal, IIT Delhi *akmittal@civil.iitd.ernet.in*
4. A K Nema, IIT Delhi *aknema@gmail.com*
5. Ajay Kalmhad, IIT Guwahati *kajay@iitg.ernet.in*
6. Anirban Gupta, BESU Shibpur *guptaanirban@hotmail.com*
7. Arun Kumar, IIT Delhi *arunku@civil.iitd.ac.in*
8. G J Chakrapani, IIT Roorkkee *gjcurfes@iitr.ernet.in*
9. Gazala Habib, IIT Delhi *gazalahabib@gmail.com*
10. Himanshu Joshi, IIT Roorkee *himanshujoshi58@gmail.com*
11. Indu Mehrotra, IIT Roorkee *indumfce@iitr.ernet.in*
12. I M Mishra, IIT Roorkee *imishfch@iitr.ernet.in*
13. Ligy Philip, IIT Madras *ligy@iitm.ac.in*
14. M M Ghangrekar, IIT Kharagpur *ghangrekar@civil.iitkgp.ernet.in*
15. Mukesh Doble, IIT Bombay *mukeshd@iitm.ac.in*
16. P K Singh, IT BHU *dr_pksingh1@rediffmail.com*
17. Purnendu Bose, IIT Kanpur *pbose@iitk.ac.in*
18. R Ravi Krishna, IIT Madras *rrk@iitm.ac.in*
19. Rakesh Kumar, NEERI Nagpur *r_kumar@neeri.res.in*
20. S M Shivnagendra, IIT Madras *snagendra@iitm.ac.in*
21. Saumyen Guha, IIT Kanpur *sguha@iitk.ac.in*
22. Shyam R Asolekar, IIT Bombay *asolekar@iitb.ac.in*
23. Sudha Goel, IIT Kharagpur *sudhagoel@civil.iitkgp.ernet.in*
24. Suparna Mukherjee, IIT Bombay *mitras@iitb.ac.in*
25. T R Sreekrishanan, IIT Delhi *sree@dbeb.iitd.ac.in*
26. Vinod Tare, IIT Kanpur *vinod@iitk.ac.in*
27. Vivek Kumar, IIT Roorkee *vivekfpt@iitr.ernet.in*

Lead Persons

1. Vinod Tare, IIT Kanpur
2. Smriti Gupta, IIT Kanpur

Contents

1. Introduction

Government of India asked the consortium of 7 IITs (Indian Institute of Technology) to prepare Ganga River Basin Management Plan (GRBMP). One of the most important challenges/vision of the Consortium was to prepare an action plan for "Un-polluted Flow" or "Nirmal Dhara" in all rivers of the Ganga Basin. To achieve this objective of proper sanitation in towns of our country, an effective and efficient solid waste management is needed. The main approach to achieve the ultimate objective of "Nirmal Dhara" has been to identify the type of polluting wastes, their sources of generation (point and non-point sources), and the techno-economic feasibility of collecting and treating them for their safe environmental discharge and/or possible recycle or reuse. Figure 1.01 illustrates the main identification results and the tasks.

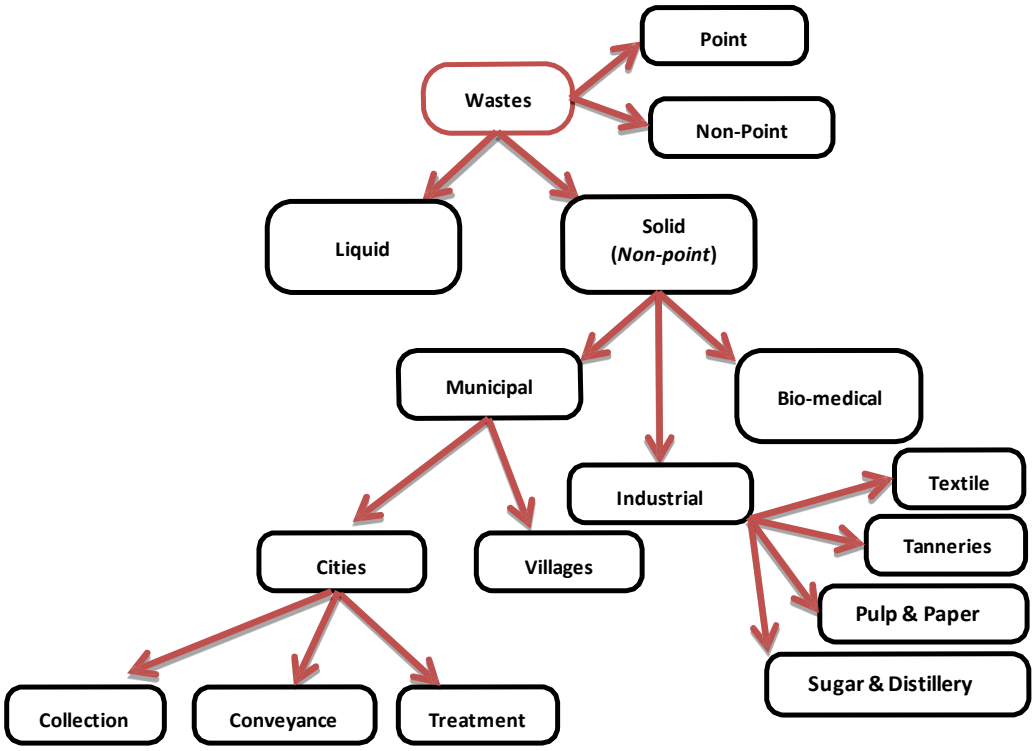


Figure 1.01: Types and Sources of Wastes and Main Identification Tasks (IIT GRBMP Report, 2013)

Solid waste is a major non-point source of pollution which adversely affects land, ground water, surface water bodies if not managed and treated properly. Among the three types of solid waste namely, municipal, industrial and bio-medical waste, municipal waste is a major concern because of its huge quantity.

In consideration of the magnitudes of municipal solid waste generation from different urban locales, urban settlements are divided into Class I Towns (having population over

100,000) and Class II Towns (having population between 50,000 to 100,000). The following main steps concerning solid waste management are considered essential.

1. All solid waste generated in Class I and Class II towns of GRB needs to be collected and transported efficiently ensuring proper hygiene and sanitation.
2. Segregation of the collected waste.
3. Suitable treatment or disposal methods should be meted out to different types of waste.
4. Minimum landfill Concept needs to be ensured to prevent environmental hazards.
5. Recycling of optimum amount of recyclable or reusable waste is the need of the hour.

The above measures are essential to overcome the declining state of urban solid waste management in GRB. An appropriate techno-commercial frame work needs to be developed for sustainable solid waste management system for the urban centers.

A lot can be achieved if solid waste is considered as a "resource" rather than "dirt". Adequate disposal strategy with recycling as an integral part will provide an effective management of such huge amount of waste being generated in towns and cities of our country. The present study was thus initiated to persuade the policy makers and make them understand the costs and benefits in quantitative terms.

2. Background and Review of Literature

2.1. General

The genesis of this study has been the recommendations of the Environment Quality and Monitoring (EQP) Group of the Consortium of 7 IITs preparing the Ganga River Basin Management Plan to have "unpolluted flow" in the rivers of the basin and addresses one of the aspects which is provisioning of solid waste management systems in all urban agglomerations in the basin. Firstly, it is important to have an appropriate ballpark estimates of expenditure on provisioning solid waste management systems, and the tangible and intangible benefits that would accrue as solid waste management can be considered as one of the major activities which a municipality undertakes. A complete solid waste management system includes waste collection, waste conveyance and waste treatment.

A recent study by Central Pollution Control Board (CPCB), New Delhi has estimated through a survey of 299 Class-I cities in India that manual collection comprises 50%, while

collection using trucks comprises only 49% (CPCB, 2000).

Further India is facing challenges for efficient waste conveyance and treatment as well. Waste littering all over the place is not only aesthetically unpleasant but also affects public health, agricultural land, ground water and surface water. Hence to address these burning issues it is necessary to have an estimate of expenditure on having complete infrastructure for solid waste management for full coverage of urban agglomerations in the country, in general, and Ganga River Basin (GRB) in particular.

2.2. Cost Estimates of Solid Waste Management Systems: Conventional Approach

The Manual on municipal solid waste management - CPHEEO - Ministry of Urban Development (2000) briefly mentions following about planning and arriving at the cost of solid waste management projects.

a) Capital expenditure shall include all the costs such as civil construction, material supply and erection costs, land acquisition costs, engineering design and supervision charges, interest charge on loan, and
b) Operation and Maintenance cost, after the project is started, shall consider, amortization and interest charges on capital borrowing, expenditure made on staff, chemicals, energy, transport, repair work, all the equipment/tools, insurance and overheads.

The planning for such projects starts generally with a preliminary study to provide guidelines for suitable methods to be adopted. These studies are then used for the preparation of City Master Plan (CMP) and Detailed Project Report (DPR) for a particular town. Ideally CMPs should form the base for solid waste management systems. Currently only few towns have CMPs. And most of these are based on inadequate data and information.

2.2.1 Collection of Information

To calculate the expenditure on solid waste management systems, all the basic information is required to be collected. Some of the essential information/data includes,

a) population and number of households of the town,
b) per capita per day waste generation of that town,
c) identification of types of waste to be collected,
d) deciding the criteria for sweepers and equipment to be used,

e) City Master Plan, long-term comprehensive development plans for cities and towns, urban planning, city planning area, urbanization zone, and urbanization control area, land use plan, road plan, urban development as rezoning, residential estates, and industrial complexes, etc.,
f) possible locations for composting site, sanitary landfill site, site for setting up transfer stations and sorting cum treatment plant,
g) traffic and land use patterns of the city,
h) details of the roads like, length, width and conditions to ensure proper and efficient conveyance,
i) assessment of present coverage and future expansion possibilities,
j) preparation of service area maps and other relevant documents.

After collection of aforementioned information several other reports like feasibility reports, pre-feasibility reports, and identification reports are to be made. This generally ends with preparation of DPR which also looks at the salient features of financial and administrative aspects.

2.2.2 Methodology

There are no detailed methods provided for cost estimation in the Manual on Solid Waste (2000), but, to arrive at the total annual fund requirements for the project execution, DPRs recommend that cost estimation of all the components of the project is prepared and thus annual requirement of funds for each year is worked out making due allowance for physical contingencies and annual inflation. Further it is required to prepare recurring annual costs of the project for the next few years (say 10 years) covering operation and maintenance expenditure for the entire system (staff, chemicals, energy, spare parts and other materials for system operation, transportation, etc.). The cost estimates are prepared considering the following points:

a) Outlining the basic assumptions made for unit prices, physical contingencies, price contingencies and escalation.
b) Summarising the estimated cost of each component for each year till its completion and working out total annual costs to know annual cash flow requirements.
c) Estimation of foreign exchange cost if required to be incurred.
d) Working out per capita cost of the project on the basis of design population, cost per tonne of the waste collected, conveyed and treated, and comparing these with the government norms, if any.

Once the estimation of cost of solid waste management systems is done, the need for an Institutional and Financial Plan rises which needs the identification of responsible and capable organization which can be trusted for the completion of the project and also the identification of all sources of funds for implementation of the project, indicating year-

by-year requirements from these sources, to meet expenditure as planned for completing the project as per schedule, stating how the interest during construction period will be paid, or whether it will be capitalized and will be paid in loan, explaining the procedures involved in obtaining funds from the various sources.

2.3. Cost Estimates of Solid Waste Management Systems: Other Approaches

The conventional approach followed is to follow the DPRs and prepare bill of quantities (BOQ) for various items and use unit costs to get the total expenditure. However, this approach requires availability of detailed design and specifications which in most cases are not available and preparation of DPRs and BOQs are not possible at the planning stage.

2.3.1 Waste Collection

Collection of solid waste requires huge manpower in form of sweepers, cart workers, drivers etc. and also small vehicles like mini-waste collectors to collect the waste from different localities. In order to have cost estimates, the first step is to evaluate the number of workers (sweepers, push-cart workers, etc.), number and type of vehicles, other equipment like brooms, bins etc. Generally the unit costs can be easily worked out for different settings. However, the other information is generally not available. Generally the operation and maintenance expenditures on waste collection is taken as the 10% of the capital cost.

2.3.2 Waste Conveyance

Waste conveyance requires large number of vehicles and thus operation and maintenance expenditures are very high (fuel cost, repair and maintenance of vehicles). Different types of vehicles can be used for transportation of waste and vary from city to city. The number of trips to be made and after deciding the location of transfer station/treatment site the distance to be travelled and thus incurred fuel cost is calculated. Generally the operation and maintenance expenditures on waste conveyance is taken as 30% of the capital cost.

According to a Guidance note (MoUD, 2009) following assumptions are taken to calculate the number of vehicles and cost of waste conveyance along with incurred fuel cost:

a) Quantum of waste generated/collected (TPD): 300
b) Rejects from composting facility (@35%) (TPD): 105
c) Vehicle capacity - long haul compactor truck (MT): 12
d) Average one-way distance to regional facility (km): 40
e) Maximum number of trips per truck per day: 3

f) Vehicle speed - including tipping time, stoppages and halts considered (average) (km/hr): 25
g) Vehicle mileage (km per litre): 4.5
h) Cost of vehicle (Rs.): 2,500,000
i) Maintenance of vehicle (% of Capex): 6%
j) Current diesel price (Rs./litre): 42
k) Salary of driver (Rs. per month): 8,000
l) Salary of helper (Rs. per month): 5,000

Following table*(MoUD, 2009) gives an idea for estimation of distance and cost calculation in waste conveyance

Table 2.01: Cost estimate for Transportation of Rejects for the Distances Varying from 40 km to 70 km

Waste quantity (TPD) →	**10**				**20**				**40**				**75**			
One-way travel distance (between source and disposal site) in km →	**40**	**50**	**60**	**70**	**40**	**50**	**60**	**70**	**40**	**50**	**60**	**70**	**40**	**50**	**60**	**70**
C & T cost																
Capex (Rs. Crore)	0.18	0.18	0.18	0.18	0.18	0.36	0.36	0.54	0.36	0.54	0.54	1.08	0.72	1.08	1.08	1.98
Unit Capex (Rs./tonne)	49.32	49.32	49.32	49.32	24.66	49.32	49.32	73.97	24.66	36.99	36.99	73.97	26.30	39.45	39.45	135.62
O & M Cost (Rs. Lakh)	8.74	10.10	11.42	14.57	11.42	15.24	17.30	21.10	21.29	27.12	31.20	40.58	38.33	49.32	56.71	73.11
Unit O & M cost for transport (Rs./tonne)	239.4	276.7	312.9	399.2	156.4	208.8	237.0	289.0	145.8	185.8	213.7	277.9	140.0	180.2	207.2	267.1

*While this is an illustration of the argument, it is recommended that every ULB undertake an estimation of costs in its specific context to arrive at a financially viable distance for transporting waste (MoUD, 2009).

2.3.3 Waste Treatment

Estimation of waste treatment costs requires information on treatment technology adopted, unit costs and quantity of waste to be treated. In India, use of advanced treatment technologies is considered impractical and hence generally not practised. Use of landfills (mostly unsanitary) is widely used which is not a good option as such. The next commonly used process is composting. The cost of these is done by identifying the unit costs of all the items and cost of land acquisition for the same.

Generally the operation and maintenance expenditures on waste conveyance is taken as the 20% of the capital cost.

2.4. Concluding Remarks

The conventional solid waste management systems calls for segregation of solid waste at source only but this is not widely practised and hence the cost of segregation of solid waste is not available, which calls for proposing the strategies for waste segregation at either source or treatment plant.

The conventional approach for estimation of expenditure on provisioning solid waste management systems calls for detailed specifications of waste collection network, waste conveyance and waste treatment plants. The required information to get a ball park estimate is often not available at the planning stage. This creates the requirement of having a suitable approach for ballpark estimates of solid waste management systems at the planning stage which does not depend on the detailed specifications. Essentially not much published literature is available on such approaches and not much information could be obtained through practicing engineers, professionals and consulting organisation. It is reasonable to develop approaches based on information available on solid waste management systems in India and worldwide, for ballpark estimates of solid waste management systems with some reasonable assumptions.

3. Objectives and Scope

State of solid waste management infrastructure in India in general, and in Ganga River Basin in particular is extremely poor. Even though the adequate resources required to develop such infrastructure are mostly available but lack of awareness, bad habits of littering around, poor planning, and improper and unscientific treatment leads to a mess, and the waste generation is increasing at a rapid rate. The day is not very far away when all open lands in urban centers will become dumping grounds.

The Ministry of Environment & Forest (MoEF), created a framework in 2000, with the introduction of MSW (Management & Handling) Rules, 2000 under the Environment Protection Act, 1986 that entrusted the ULBs with the responsibility of managing MSW. But in most of the towns these guidelines are not followed efficiently and most of the MSWM budget is spent only on collection of the waste. Further lack of systematic execution and maintenance of the equipment decrease the collection efficiency after some time. As a result not much benefit has been seen and no viable model is in the sight. It is very vital that an appropriate techno- commercial frame work is developed for sustainable solid waste management system for the urban centers.

Solid waste management requires proper infrastructure, which is becoming complex due to the unplanned growth of urban centers and this is why the first and foremost prerequisite is to have an assessment of provisioning solid waste management system in economic sense. This necessity has been the genesis of the present study. Provisioning of solid waste management systems yields certain benefits depending upon the choice of technologies and components, their designs, and efforts and investments made. Because of all above mentioned reasons, Consortium of 7 IITs preparing the Ganga River Basin Management Plan (GRBMP) is considering complete and efficient collection of solid waste and treatment of waste in a scientific manner so that most of the waste could be recycled and/or reused and we approach towards the goal of "Minimum Landfill" instead of disposal in open lands, water bodies of urban agglomerations in the basin.

This study is a part of the larger framework of having "Unpolluted Flow" in rivers and aims at estimating the financial requirements for provisioning of solid waste management system in all Class I and Class II towns of the Ganga River Basin (GRB) with the objectives of recycle/reuse of the waste along-with "Minimum Landfill". Following specific objectives are set for this study to achieve this goal.

1. Develop suitable methodology for obtaining ballpark estimates for efficient and complete waste collection in Class I and Class II towns of GRB.
2. Develop suitable framework for obtaining ballpark estimates for waste conveyance and waste treatment while promoting waste recycle/reuse.
3. Obtain ballpark estimates of capital investments for having proper infrastructure for solid waste management and annualized expenditure towards capital (capex) and sustainable operation and maintenance (opex) of such infrastructure in all Class I and Class II towns of GRB.
4. Assess financial implications of provisioning sustainable solid waste management infrastructure on individuals residing in the urban agglomerations of GRB.

5. Approach towards the goal of “Minimum Landfill” and encourage sorting of waste at source.

The scope of the study is limited to availability of secondary information in DPRs and other such reports on Strategies for Solid waste management.

4. Methodology

4.1 General

Solid Waste Management system includes (i) Waste Collection, (ii) Waste Conveyance and (iii) Waste Treatment. Estimation of capital (Capex) and operation and maintenance (Opex) costs for these three components has been worked out separately for all Class I and Class II towns in Ganga River Basin (GRB). Following sections briefly describe the methodology adopted.

4.2 Estimation of Capex and Opex of Waste Collection

This involved deciding the layout of the whole collection process, adopting an appropriate strategy which facilitates proper hygiene of the streets and open spaces besides ensuring people’s satisfaction and ease to dispose of the waste. Keeping in mind the above issues ‘door to door collection’ strategy has been proposed which involves collection of waste from the households itself by sweepers and push cart workers, transferring it from push carts into mini waste collectors which carry it to some distance and then eventually transferring the waste into Compactors.

The costs for the required components mentioned above were worked out based on Manual on Municipal Solid Waste Management - CPHEEO - Ministry of Urban Development (2000) and Detailed Project Reports (DPRs) of several cities like Ghaziabad, Kanpur, Vadodara, etc. which were made available by officials of MoEF (Ministry of Environment and Forests). Population and area of each town of GRB was taken from a recent study (Shukla, 2013).Waste generation is assumed to be 0.5 kg per capita per day.

The criterion used in estimating the quantities of various items of waste collection are given in Table 4.01.

Table 4.01: Criterion/Assumptions for Different Items in Waste Collection

S No	Item	Criterion /Assumptions
1	Number of sweepers	1 for 200 households + 15% extra
2	Push cart workers	1 for 2 sweepers
3	Push carts	1 for each worker + 25 % extra
4	Storage bins (4.5 cum)/Dumper placers	1 for 2000 persons+ 25 % extra
5	Mini Waste Collectors	1 for 7 MT/d + 25% extra
6	Manpower (Drivers, etc.)	2 for all the carriers + 25% extra

* cum – cubic meter; * MT/d – Metric Tons/day

The quantities, thus calculated, were multiplied by rates of each to calculate capex and opex of the process. To estimate the annual expenditure on waste collection 'Annualized capex' was also calculated for equipment for a loan period of 5 years at an interest rate of 12 %. This was done by multiplying the total capex of all equipment with a Capital Recovery Factor (CRF) of 0.28.

To determine the expenditure on energy, fuel demand was calculated for the vehicles. For this purpose, the town area is assumed to be a square and the distance to be travelled per day by all vehicles is related to the diagonal of this square. For the mini waste collectors, cost of fuel per day is calculated considering mileage of 8 km per liter (market research) and taking the distance travelled by each as one-tenth of the length of the diagonal.

4.3 Estimation of Capex and Opex for Waste Conveyance

Waste conveyance involves vehicles for transporting the collected waste to the sorting-cum- treatment plant and transfer station(s).

The conveyance cost is estimated by summing up the annualized capital cost and operation and maintenance cost in terms of manpower and energy expenditure on vehicles to be used in waste conveyance. The vehicles include compactors, hook lifters and dumper placer carriers. The cost also includes the cost of establishment of transfer station, which empirically has a relation with the capital expenditure and hence is taken as 10 % of the total capex and then this cost is added

to calculate the final capex. Transfer stations will serve as sites for transferring waste from compactors to hook lifters so as to further transport it to the sorting-cum-treatment site.

The criterion used in estimating the quantities of various items of waste collection is given in Table 4.02.

Table 4.02: Criterion/Assumptions for different items in Waste Conveyance

S No	Item	Criterion /Assumptions
1	Compactors	1 for 35 MT/d + 25 % extra
2	Hook lifters of 20 cum capacity	8 trips a day, each of 15 MT capacity + 25 % extra
3	Dumper placer carriers	1 for 15 containers + 25% extra
4	Bins of 20 cum capacity	1 for each lifter + 50 % extra
5	Manpower (Drivers, etc.)	2 for all the carriers + 25% extra

* cum – Cubic Meter; * MT/d – Metric Tons/day

Annualized capex was computed the same way as described in Section 4.2. Energy expenditure in this case is the sum of fuel consumption by vehicles and electricity consumption at Transfer station. The town area has been assumed as square as was done in estimating cost of collection. The details of vehicles used are given in Table 4.03.

Table 4.03: Details/Assumptions used for vehicles used in Waste Conveyance

S No	Vehicle	Mileage (kmpl)	Distance travelled per day
1	Compactors	4	Half the length of diagonal
2	Hook Lifters	4	Half the length of diagonal
3	Dumper Placer Carriers	4	Half the length of diagonal

4.4 Estimation of Capex and Opex of Solid Waste Processing Plant

Estimation of cost of solid waste treatment has been done considering that the waste is properly segregated and suitable end point solution is provided to each type of waste. Maximum recycling and minimization of landfill were the twin objectives while deciding upon the layout of the processing plan.

The total waste collected from a city is conveyed to the sorting-cum-treatment plant as described in the previous sections. This waste consists of (i) Organic or biodegradable waste (60 %), (ii) Recyclable waste (11 %), (iii) Construction waste and drain silt (29 %). While organic matter (leaves, food waste, etc.) needs treatment such as composting, recyclable waste which includes plastic, metals, glass and rubber can be sold and construction waste can be converted into other usable forms like bricks, tiles, etc. Segregation of the waste is thus an essential step and needs to be properly planned out. There are a number of segregation techniques which are being used across the world such as Induction sorting, Manual sorting, Magnetic separation, Trommel separators, etc. But in India to make it practical/feasible for all towns manual sorting, along-with few mechanized equipment, is recommended.

The complete layout of sorting station is shown in Figure 4.01.

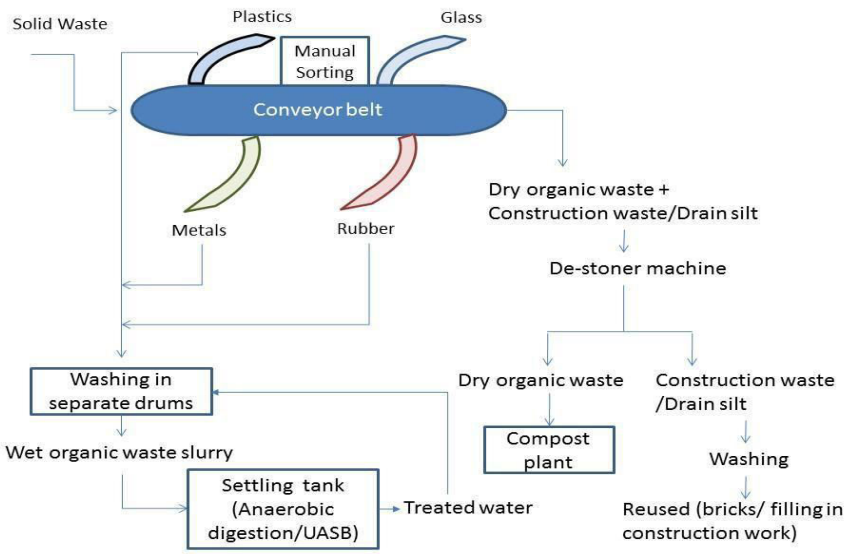


Figure 4.01: Layout Showing Unit Operations of Sorting Station

The waste coming to the sorting station is put on conveyor belt with workers standing on either side of the belt. As the waste moves on the belt workers pick up the recyclable waste which includes plastic, metal, glass and rubber. One worker collects only one type of waste. Quantity of waste that can be picked is worked out as 5 tons per person per day (White *et al*., 1995). Sorting station is assumed to be working for 24 hours a day with the total work being done in 3 shifts per day. Paper is excluded from hand-picked waste. Percentage distribution of hand- picked materials was worked out from the data available in a study by Central Pollution Control Board (CPCB, 2000) and the details are given in Table 4.04.

Table 4.04: Estimate of Recyclable (hand-picked) Waste

Item	Content, Percent
Metals	3
Glass	2
Plastics	4
Rubber/Leather	2
Total	**11**

The speed of the belt is controllable and maintained in such a way that each worker gets sufficient time to recognize and separate out the target material. The details of the conveyor belt are given in Table 4.05.

Table 4.05: Specifications of Conveyor Belt

S No	Particulars	Specification
1	Length of conveyor belt, m	30
2	Speed of conveyor belt, m/h	600

The recyclable portions of the waste are then washed separately in different drums, to remove the organic matter, after which they are recycled. The specifications of drums for washing are given in the Table 4.06. The waste from the conveyor belt contains dry organic waste, construction waste and drain silt. This waste is passed through De-stoner machines with a capacity of 4 TPH which separates out organic waste from the sand, silt and stones which are a part of construction waste.

Table 4.06: Equipment Requirement for Washing of Recyclables

Wooden Drums (5 ton capacity, 2 ton/hour)	Quantity	Running Hours per day
Metals	1	15
Glass	1	10
Plastics	1	20
Rubber	1	10

The details of manpower required at sorting station are given in Table 4.07.

Table 4.07: Manpower Requirement

Manpower	Criterion
Labour required for manual picking of recyclable waste	(1 worker/5 ton)*3 shifts/day + 25 % extra
Skilled Technicians (Device Operators, Drivers etc.,)	25 % of total labour + 25 % extra

Water consumption in washing the waste was calculated based on the assumption that 5 KL water per ton per day is required for this purpose. Waste water generated is taken as 95 % of the water consumed which will be treated up to tertiary treatment so that the treated water may be recycled and used for washing purpose again. The cost of treating wastewater containing organics is worked out as INR 17.20 per ton per day (Shukla, 2013).

The organic waste is then taken to the Compost plant where it undergoes decomposition to form compost which can then be used as fertilizer or manure for agricultural purposes. The cost of Compost plant is computed by summing up the cost of equipment, manpower, infrastructure and other miscellaneous expenses which include fuel and energy expenditure. The criteria used in estimating the cost of Compost plant are given in Table 4.08.

Table 4.08: Details/Specifications of Composting Plant

S No	Item	Criterion /Assumptions	Fuel Consumption (liters per hour)
1	Loader cum excavator	1 for 160 Mt of waste	12
2	Tipper (8 cum)	1 for 80 Mt of waste	8
3	Tractor tipper	1 for 160 Mt of waste	4
4	Water Tanker (3000 cum)	1 for 160 Mt of waste	--
5	Computerized Weigh bridge	1 for 30 Mt of waste	--
6	Plant machinery	1 Crore per ton	--
7	Infrastructure	1 Crore per ton	--
8	Manpower	22 skilled technicians + drivers, 20 workers + 25% extra	--

The construction waste and drain silt is washed in separate tanks and then it can be reused in various forms for construction work e.g. making bricks, tiles or can be used as material for filling of low lying areas.

Some amount of construction waste, if left unused, and the residue from the compost plant is sent to sanitary landfill site which is designed for 10 % of the total waste in addition to the residue from compost plant. The relevant information for cost estimation of sanitary landfill site is given in Table 4.09.

Table 4.09: Details/Specifications of Sanitary Landfill Site

S No	Item	Criterion /Assumptions	Fuel consumption (liters per hour)
1	Loader Backhoe	1 for 120 MT/d	12
2	Tipper	1 for 60 MT/d	8
3	Bulldozer	1 for 120 MT/d	60

Table continued to next page … … … …

… … … … Table continued from previous page

4	Landfill Compactor	1 for 120 MT/d	50
5	Manpower	4 skilled technicians, 15 workers +25% extra	--

Thus the total cost of treatment was calculated by adding the cost incurred on all three components of treatment i.e. Sorting station, Compost plant and Sanitary Landfill. Annualized capex was computed by multiplying CRF with the total capex. CRF values is taken to be 0.28 for equipment at an interest rate of 12 % with a loan period of 5 years and 0.134 for infrastructure at an interest rate of 12 % for a period of 20 years. Cost of electricity consumption was added in the opex. Annual expenditure was determined and thus cost of total treatment per ton per day was estimated.

5. Results and Discussion

5.1. General

An appropriate frame work is a prerequisite to provide solutions for solid waste management in urban centers. The first and foremost step towards it is to have an assessment of having the management plan in economic sense. Dumping the solid waste as landfills may appear to be a very low cost solution and may have certain advantages in low lying areas, but it has very serious effects on land, agriculture, underground water and surface water bodies as well. So having a plan for complete treatment of solid waste with an approach towards zero landfill and more recycling/reuse is the need of the hour. On the other hand achieving 100% collection efficiency and encouraging more recycling/reuse of solid waste with use of advanced treatment technologies may lead to resource recovery and also help in energy regeneration.

The present study aims at estimating the per capita expenditure on solid waste management with provision of segregation of the total solid waste generated, proper collection and conveyance of waste and subsequent recycling and treatment of different types of wastes. It is also important to note that energy consumption and footprint are also important along with expenditure incurred and hence are also estimated separately. The study also aims at estimating the financial layout for provisioning infrastructure for solid waste management in all Class I and Class II towns of the Ganga River Basin (GRB) with the objective of recycling and reuse of non-biodegradable waste and minimizing landfill sites.

Solid waste management includes (i) Waste Collection, (ii) Waste Conveyance and (iii) Waste Treatment. An attempt has been made to arrive at ballpark estimations of capital (Capex) and operation and maintenance (Opex) costs for these three components separately for all Class I and Class II towns in Ganga River Basin (GRB). Following sections describe and discuss the outcome of such an attempt based on the approach and methods described in the previous chapter.

5.2. Collection of Solid Waste

With door to door collection in our strategy to achieve the 100% collection, estimation of cost of collection of municipal solid waste calls for calculating the required amount of manpower and identifying vehicles to transport the waste collected from households to larger vehicles which convey the waste to the transfer station.

The number of sweepers, push carts, push cart workers and storage bins required were calculated after studying Detailed Project Reports (DPRs) of cities available and using the criteria described in Manual on Municipal Solid Waste Management - CPHEEO - Ministry of Urban Development (2000). In an attempt to mechanize the collection process mini waste collectors containing bins are proposed to collect waste from residential and commercial areas.

The collection costs have been estimated by identifying the number of equipment (push carts, mini waste collectors) and manpower required and multiplying it with rates of individual component. The estimated cost comes out to be INR 1224.53 per ton per day. This includes the cost of equipment, manpower, fuel and maintenance cost. The costs were calculated by thoroughly studying available DPRs of cities like Kanpur, Ghaziabad and Vadodara as well as discussions with representatives of several consulting firms.

The estimated fuel consumption in Class I towns is in the range of 0.03 to 0.05 liters/ton/day with an average of 0.04 liters/ton/day and standard deviation of 0.01 which amounts to an average cost of INR 2.05 per ton per day and for Class II towns the range is 0.001 to 0.04 liters/ton/day with an average of 0.02 liters/ton/day and standard deviation of 0.008, amounting to an average cost of INR 1.22 per ton per day. There is no other energy requirement in the collection process.

A typical pattern of distribution of estimated expenditure on waste collection adopting the methodology described in Section 4.2 is presented in Figures 5.01 to 5.03.

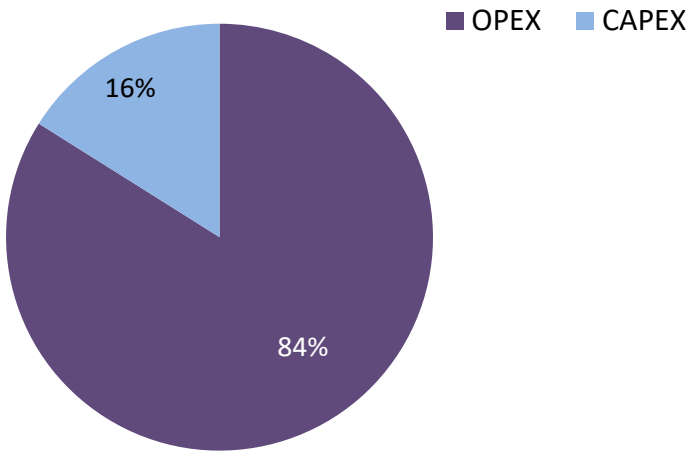


Figure 5.01: **Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Collection of Solid Waste**

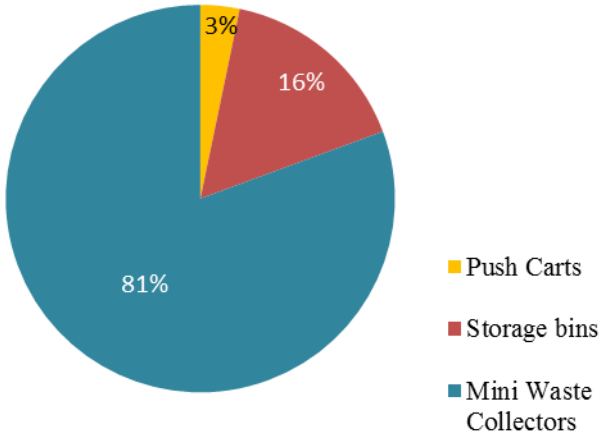


Figure 5.02: Typical Breakup of Estimated Capital Expenditure on Collection of Solid Waste

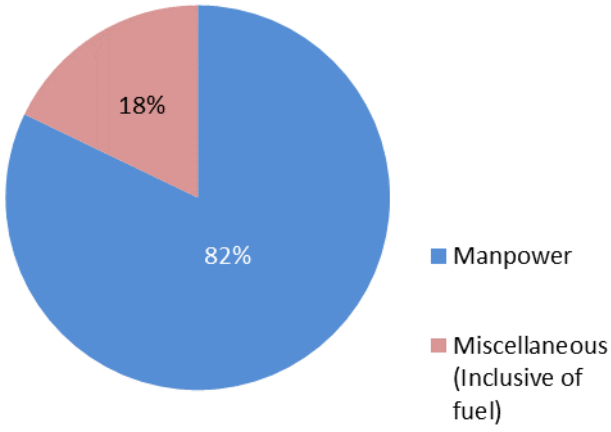


Figure 5.03: Typical Breakup of Estimated Operational Expenditure on Collection of Solid Waste

It may be noted that in waste collection the major expenditure is on Operation and maintenance (84 %) which is on account of the high cost incurred on manpower (82 % of opex).

5.3. Conveyance of solid waste

Cost estimation for waste conveyance requires identification of equipment for transfer station and vehicles for transporting waste to the sorting-cum-treatment plant. The estimated Cost for conveyance comes out to be INR 541.96 per ton per day. This includes the cost of transfer station, equipment, vehicles, manpower, fuel and maintenance cost.

The transportation of waste exerts a fuel requirement in the range of 0.28 to 0.61 liters per ton per day with an average value of 0.43 liters per ton per day and standard deviation of 0.12, which amounts to an average cost of INR 23.71 per ton per day for Class I towns. While for Class II towns the fuel requirement is in the range of 0.11 to 0.49 liters per ton per day with an average value of 0.26 liters per ton per day and standard deviation of 0.12 and subsequent average cost is INR 14.11 per ton per day. The higher values correspond to towns with low population density and the lower values correspond to high population densities.

A typical pattern of distribution of estimated expenditure on waste conveyance adopting the methodology described in Section 4.3 is presented in Figures 5.04 to 5.06.

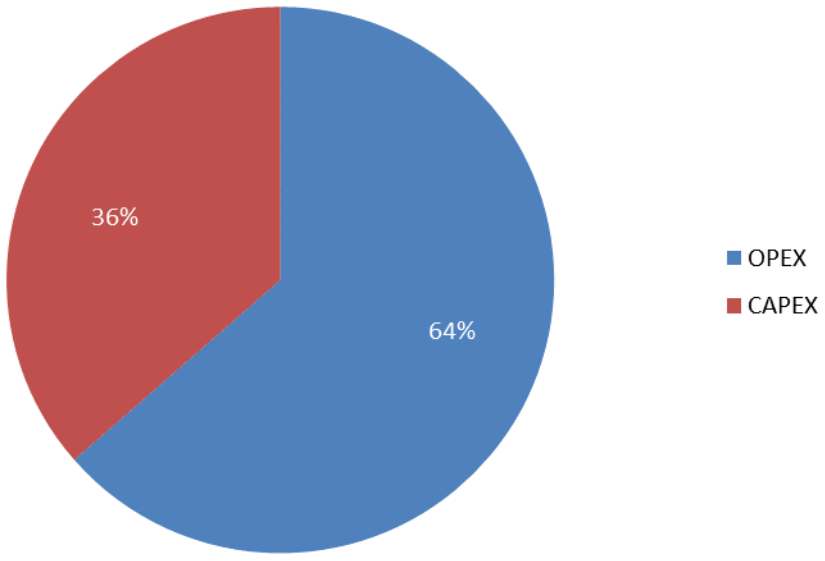


Figure 5.04: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on waste conveyance

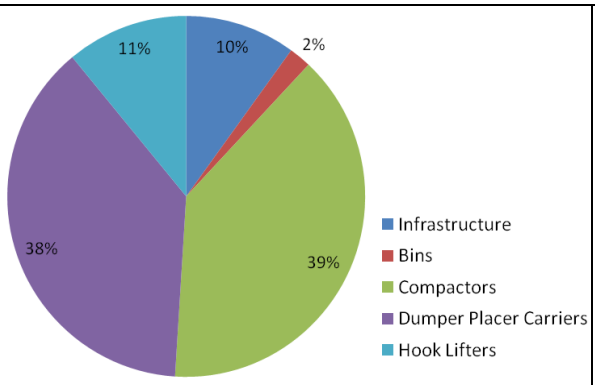


Figure 5.05: Typical Breakup of Estimated Capital Expenditure on Waste Conveyance

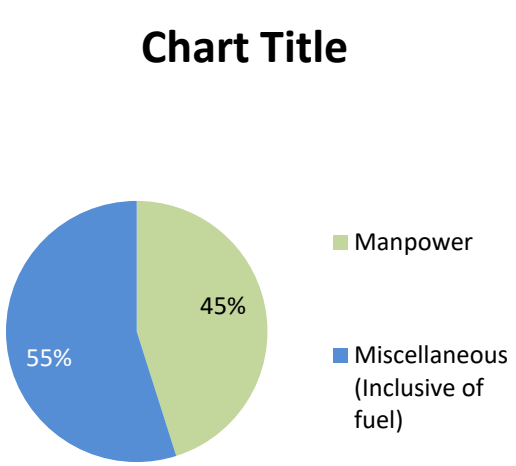


Figure 5.06: Typical Breakup of Operation and Maintenance Expenditure on Waste Conveyance

It may be noted here that in waste conveyance the opex (64 %) is very high as compared to capex (36 %). This is due to the high amount of energy expenditure in the form of fuel consumed in conveyance of the waste.

5.4. Treatment of Solid Waste

The cost of treatment of solid waste is estimated with the consideration that maximum amount of waste is recycled and reused, landfill sites are minimized and efficient treatment options are adopted.

The municipal solid waste in India mainly contains organic or biodegradable waste (60 %), recyclable waste i.e. plastics, metals, glass, rubber (11 %), drain silt and construction debris (29
%). Prior to the treatment, segregation of the total waste needs to be done so as to separate out recyclable waste from the rest and then provide different types of treatment to different types of waste. Segregation must be done at source which is not the case in India as people are not aware and unwilling to manage the waste at household level. Therefore a sorting-cum-treatment plant

is proposed. The whole treatment process can thus be divided into three components as per the municipal solid waste distribution in India (i) Segregation, (ii) Composting, (iii) Landfill.

Estimation of the costs of these three components calls for preparing the flow sheet, determining manpower requirement and equipment costs and energy expenditure.

The total cost including capital investment (Capex) and annual operation and maintenance expenditure (Opex) for such treatment has been worked out as INR 540 per ton per day. A typical breakup on expenditure made on solid waste treatment along with breakup of capex and opex on waste treatment are presented in Figures 5.07 to 5.09.

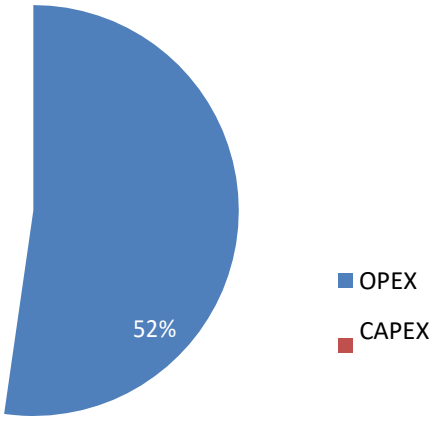


Figure 5.07: Typical Breakup of Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Waste treatment

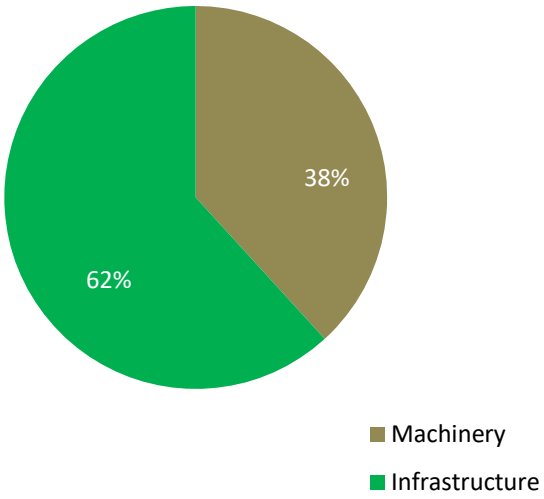


Figure 5.08: Typical Breakup of Estimated Capital Expenditure on Waste Treatment

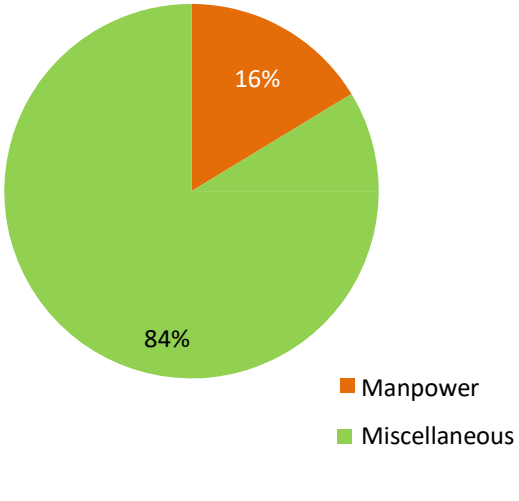


Figure 5.09: Typical Breakup of Estimated Operational Expenditure on Waste Treatment

It may be noted from the above figures that the infrastructure cost has a major share (62 %) in the total capital expenditure on waste treatment owing to the construction of stations for sorting, composting and landfill. Also, on account of the mechanization of the sorting and treatment processes less amount of manpower is required while fuel consumption is high.

The energy expenditure comes out to be INR 172.94 per ton per day of which INR 160.16 is the cost of fuel per ton per day. A breakup of electricity and fuel on energy expenditure is presented in Figure 5.10.

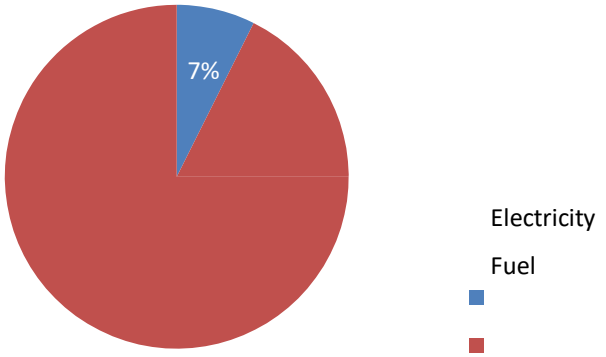


Figure 5.10: Typical Breakup of Electricity and Fuel on Energy expenditure in Waste treatment

5.5. Solid Waste Management

The entire solid waste management system costs can be arrived at by adding the cost of its three components, namely Waste Collection, Waste Conveyance and Waste Treatment. The results are presented in Figures 5.11 and 5.12.

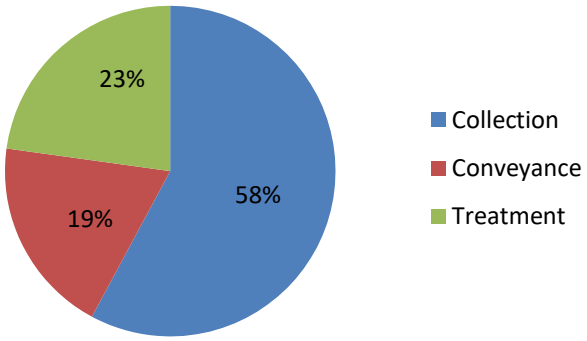


Figure 5.11: Typical Breakup of Estimated Total Annual Expenditure amongst Three Components of Solid Waste Management

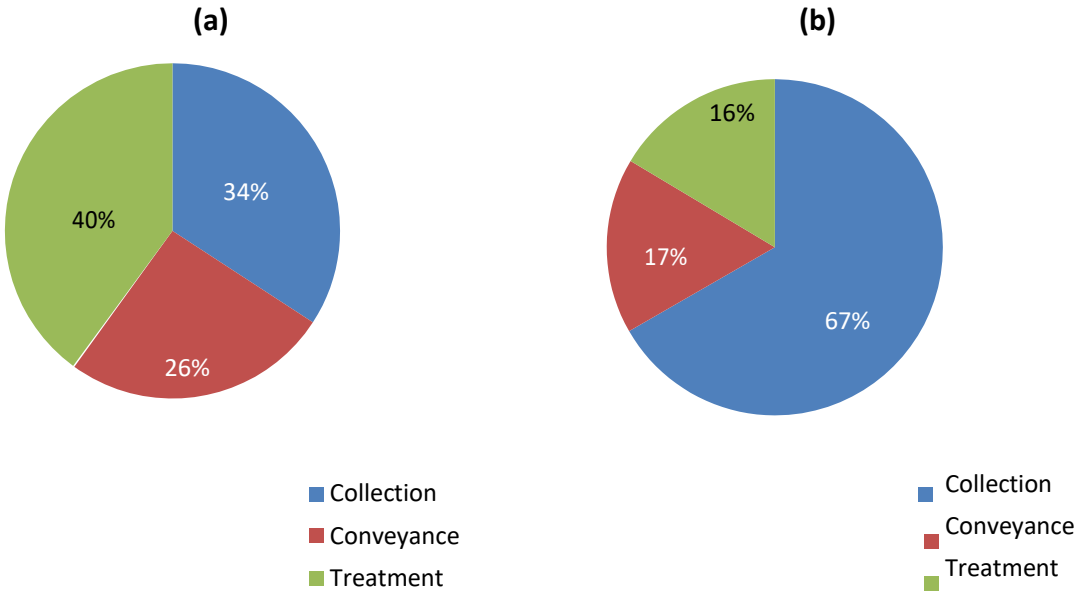


Figure 5.12: Typical Breakup of Estimated (a) Capex and (b) Opex Amongst Three Components of Solid Waste Management

It is important to note that Waste Collection has the major contribution in the total annual expenditure. This is due to high opex in waste collection which results from the heavy expenditure on manpower. Door to door collection and street sweeping demands a good number of workers. Though waste sorting at source may improve the collection efficiency and also increase the quantity of recyclable/reusable waste. Analysis of the distribution of energy expenditure, which is mainly in the form of fuel (diesel), depicts that waste treatment is the major contributor with 87 and 92 % share in Class I and Class II towns respectively. The heavy equipment and machinery such as Loader Backhoe, Tractors, Tippers, Bulldozers and Compactors used in Composting and Landfill consume high amount of fuel.

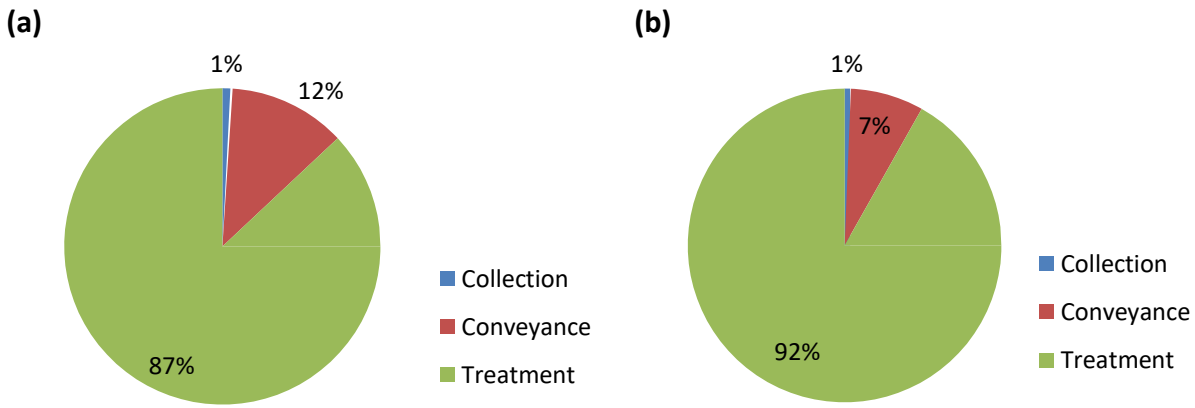


Figure 5.13: Typical Distribution of Energy Consumption in Waste Collection, Conveyance and Treatment (a) Class I and (b) Class II towns

5.6 Estimated Costs of Provisioning Solid Waste Management in Major Urban Agglomerations in Ganga River Basin

An attempt has been made to arrive at ballpark estimates for providing an appropriate and complete infrastructure for solid waste management which is based on (i) the methodology developed and results reported in the preceding sections of this chapter, and (ii) the information collated for urban agglomerations in Ganga River Basin (GRB). Significant urban agglomerations are considered as Class I and Class II towns defined on the basis of population (Class I Towns: Population ≥ 100,000; Class II Towns: Population exceeding 50,000 and less than 100,000). Tables A1.01 to A1.22 in Appendix I present (i) population as per Indian Census 2011, (ii) estimated waste generation (taken as 0.5kg per capita per day), (iii) approximate town area, (iv) capital expenditure on all three components of solid waste management system, and (vi) the total estimated capital expenditure on provisioning complete infrastructure for solid waste management for all Class I and Class II towns of GRB spread over 11 different Indian states. A summary of the total ballpark estimates of capital expenditures on provisioning solid waste management for Class I and Class II towns of each of the GRB states is presented in Tables 5.01 to 5.03 based on information given in aforementioned tables of Appendix I.

Table 5.01: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Millions) of NRGB

S No	State	Population in Millions	Estimated Waste Generation, MT/d	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
				Waste Collection	Waste Conveyance	Waste Treatment	
01	Uttarakhand	2.121	1061	158.39	315.22	579.40	1053.01
02	Uttar Pradesh	29.613	14807	2211.36	4400.87	8089.11	14701.34
03	Himachal Pradesh	**No Class I Town**					
04	Haryana	5.317	2659	397.04	790.16	1452.38	2639.58
05	Delhi	13.482	6741	1006.76	2003.57	3682.70	6693.03
06	Rajasthan	7.689	3844	574.17	1142.67	2100.30	3817.14
07	Madhya Pradesh	11.934	5967	891.14	1773.48	3259.79	5924.41
08	Bihar	6.929	3464	517.39	1029.67	1892.61	3439.67
09	Chhattisgarh	3.138	1569	234.32	466.33	857.14	1557.79
10	Jharkhand	4.801	2401	358.53	713.51	1311.48	2383.52
11	West Bengal	17.124	8562	1278.70	2544.78	4677.48	8500.96
Total		**102.148**	**51075**	**7627.80**	**15180.26**	**27902.39**	**50710.45**

Table 5.02: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of NRGB

S No	State	Population in Millions	Estimated Waste Generation, MT/d	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
				Waste Collection	Waste Conveyance	Waste Treatment	
01	Uttarakhand	0.212	106	15.86	31.57	58.02	105.45
02	Uttar Pradesh	3.109	1554	232.15	462.01	849.21	1543.37
03	Himachal Pradesh	**No Class II Town**					
04	Haryana	0.164	82	12.22	24.31	44.69	81.22
05	Delhi	0.862	431	64.35	128.07	235.41	427.83
06	Rajasthan	0.287	143	21.42	42.63	78.35	142.40
07	Madhya Pradesh	0.654	327	48.83	97.19	178.64	324.66
08	Bihar	1.462	731	109.17	217.26	399.34	725.77
09	Chhattisgarh	0.448	224	33.43	66.53	122.30	222.26
10	Jharkhand	1.236	618	92.27	183.64	337.54	613.45
11	West Bengal	1.000	500	74.68	148.62	273.18	496.48
Total		**9.433**	**4716**	**704.38**	**1401.83**	**2576.68**	**4682.89**

Table 5.03: Estimated Capital Expenditure on Solid Waste Management in Class I (Population > 0.1 Millions) and Class II (Population between 0.05 and 0.1 Million) Towns of NRGB

S No	State	Population in Millions	Estimated Waste Generation, MT/d	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
				Waste Collection	Waste Conveyance	Waste Treatment	
01	Uttarakhand	2.333	1167	174.25	346.79	637.42	1158.46
02	Uttar Pradesh	32.722	16361	2443.51	4862.88	8938.32	16244.71
03	Himachal Pradesh	**No Class I or II Towns**					
04	Haryana	5.481	2741	409.26	814.47	1497.07	2720.80
05	Delhi	14.344	7172	1071.11	2131.64	3918.11	7120.86
06	Rajasthan	7.976	3987	595.59	1185.30	2178.65	3959.54
07	Madhya Pradesh	12.588	6294	939.97	1870.67	3438.43	6249.07
08	Bihar	8.391	4195	626.56	1246.93	2291.95	4165.44
09	Chhattisgarh	3.586	1793	267.75	532.86	979.44	1780.05
10	Jharkhand	6.037	3019	450.80	897.15	1649.02	2996.97
11	West Bengal	18.124	9062	1353.38	2693.40	4950.66	8997.44
Total		**111.582**	**55791**	**8332.18**	**16582.09**	**30479.07**	**55393.34**

For each Class I and Class II towns of GRB, annual expenditure on the capital investment (Capex) for all three components of solid waste management systems has been worked out by multiplying capital expenditure with capital recovery factor (CRF). The CRF has been calculated as (i) 0.28 using 12 % interest over 5 years period for equipment and machinery, and, (ii) 0.134 using 12 % interest over 20 years period for infrastructure and construction work . Operation and Maintenance (Opex) has also been estimated for each of these towns for all three components separately using methodology presented in Chapter 4 and results described in previous section of this chapter. Results are presented in Tables A2.01 to A2.22 of Appendix II. These tables also include (i) ballpark estimates of total annual expenditure on entire solid waste management, (ii) land footprint, (iii) land required per capita, (iv) fuel demand, and (v) energy consumption. A summary of these results for each of the GRB states is presented in Tables 5.04 to 5.08 for Class I and Class II towns.

`

Table 5.04: Estimated Annual Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Millions) of NRGB

S No	State	Population in Millions	Estimated Waste Generation, MT/d	Estimated Annual Expenditure, Millions of INR						Estimated Total Expenditure, Millions of INR
				Waste Collection		Waste Conveyance		Waste Treatment		
				Capex	Opex	Capex	Opex	Capex	Opex	
01	Uttarakhand	2.121	1061	44.35	429.67	88.26	121.54	97.51	111.62	892.95
02	Uttar Pradesh	29.613	14807	619.18	5998.72	1232.24	1696.78	1361.31	1558.38	12466.61
03	Himachal Pradesh	**No Class I Town**								
04	Haryana	5.317	2659	111.17	1077.05	221.24	304.65	244.42	279.80	2238.33
05	Delhi	13.482	6741	281.89	2731.01	240.75	772.49	619.76	709.48	5355.38
06	Rajasthan	7.689	3844	160.77	1557.54	319.95	440.56	353.46	404.63	3236.91
07	Madhya Pradesh	11.934	5967	249.52	2417.39	496.58	683.78	548.59	628.00	5023.86
08	Bihar	6.929	3464	144.87	1403.52	288.31	397.00	318.51	364.61	2916.82
09	Chhattisgarh	3.138	1569	65.61	635.64	130.57	179.79	144.25	165.13	1320.99
10	Jharkhand	4.801	2401	100.39	972.57	199.78	275.10	220.71	252.66	2021.21
11	West Bengal	17.124	8562	358.04	3468.72	712.54	981.15	787.17	901.12	7208.74
Total		**102.148**	**51075**	**2135.79**	**20691.83**	**3930.22**	**5852.84**	**4695.69**	**5375.43**	**42681.8**

`

Table 5.05: Estimated Annual Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of NRGB

S No	State	Population in Millions	Estimated Waste Generation, MT/d	Estimated annual Expenditure, Millions of INR						Estimated Total Expenditure, Millions of INR
				Waste Collection		Waste Conveyance		Waste Treatment		
				Capex	Opex	Capex	Opex	Capex	Opex	
01	Uttarakhand	0.212	106	4.44	43.03	8.84	12.17	9.76	11.18	89.42
02	Uttar Pradesh	3.109	1554	65.00	629.75	129.36	178.13	142.91	163.60	1308.75
03	Himachal Pradesh	**No Class II Town**								
04	Haryana	0.164	82	3.42	33.14	6.81	9.37	7.52	8.61	68.87
05	Delhi	0.862	431	18.02	174.57	35.86	49.38	39.62	45.35	362.80
06	Rajasthan	0.287	143	6.00	58.11	11.94	16.44	13.19	15.10	120.78
07	Madhya Pradesh	0.654	327	13.67	132.47	27.21	37.47	30.06	34.41	275.29
08	Bihar	1.462	731	30.57	296.14	60.83	83.77	67.21	76.93	615.45
09	Chhattisgarh	0.448	224	9.36	90.69	18.63	25.65	20.58	23.56	188.47
10	Jharkhand	1.236	618	25.84	250.31	51.42	70.80	56.80	65.03	520.20
11	West Bengal	1.000	500	20.91	202.58	41.61	57.30	45.97	52.63	421.00
Total		**9.433**	**4716**	**197.23**	**1910.79**	**392.51**	**540.48**	**433.62**	**496.40**	**3971.03**

`

Table 5.06: Estimated Annual Expenditure on Solid Waste Management in Class I (Population > 0.1 Millions) and Class II (Population between 0.05 and 0.1 Million) Towns of NRGB

S No	State	Population in Millions	Estimated Waste Generation, MT/d	Estimated Annual Expenditure, Millions of INR							
				Waste Collection		Waste Conveyance		Waste Treatment		Total	
				Capex	Opex	Capex	Opex	Capex	Opex	Capex	Opex
01	Uttarakhand	1223.2	1167	48.79	472.70	97.10	133.71	107.27	122.80	253.16	729.21
02	Uttar Pradesh	19206.5	16361	684.18	6628.47	1361.60	1874.91	1504.22	1721.98	3550.00	10225.36
03	Himachal Pradesh	**No Class I or II Towns**									
04	Haryana	5.481	2741	114.59	1110.19	228.05	314.02	251.94	288.41	594.58	1712.62
05	Delhi	14.344	7172	299.91	2905.58	276.61	821.87	659.38	754.83	1235.90	4482.28
06	Rajasthan	7.976	3987	166.77	1615.65	331.89	457.00	366.65	419.73	865.31	2492.38
07	Madhya Pradesh	12.588	6294	263.19	2549.86	523.79	721.25	578.65	662.41	1365.63	3933.52
08	Bihar	8.391	4195	175.44	1699.66	349.14	480.77	385.72	441.54	910.30	2621.97
09	Chhattisgarh	3.586	1793	74.97	726.33	149.20	205.44	164.83	188.69	389.00	1120.46
10	Jharkhand	6.037	3019	126.23	1222.88	251.20	345.90	277.51	317.69	654.94	1886.47
11	West Bengal	18.124	9062	378.95	3671.30	754.15	1038.45	833.14	953.75	1966.24	5663.50
Total		**111.582**	**55791**	**2333.02**	**22602.62**	**4322.73**	**6393.32**	**5129.31**	**5871.83**	**11785.06**	**34867.77**

Estimated per capita footprint, daily energy consumption and daily expenditure on availing appropriate solid waste management system for each of the Class I and Class II towns in GRB are included in the tables given in Appendix II. Tables 5.07 and 5.08 present summary of such results for all Class I and Class II towns belonging to eleven different Indian states, and are part of the GRB.

It is interesting to note that footprint for waste treatment is approximately 0.7 m^2 per person. The electrical energy consumption in complete solid waste management comes out to be 0.001 KW-h per person per day while the equivalent energy in the form of fuel consumption is 0.017 KW-h per person per day for Class I towns and the corresponding value for Class II towns is 0.016 KW-h per person per day. The fuel cost in waste collection and conveyance increase with decrease in population densities. The total per capita expenditure for having complete solid waste management system is estimated to be INR 1.15 per capita per day.

4.5 Benefits of Provisioning Solid Waste Management System

Having proper solid waste management system in Indian Cities has many tangible and intangible benefits. Some of the intangible benefits include improved aesthetics of towns, lesser exposure to infectious diseases thereby substantial savings in expenditure on health, lesser suffering and higher quality time available for meaningful activities, etc. Whereas some of the tangible benefits include increased amount of recyclable/reusable waste which in turn generates revenue, helps in conserving resources and reduces the amount of waste for treatment thereby decreasing treatment cost considerably. Compost from the composting plant can be sold as manure to be used in agriculture thus generating revenue and enhancing crop yield. Further, construction debris and drain silt can be used for filling in construction work or they can be washed and made into bricks to be used for construction purposes again. Slowly progressing towards the goal of “Minimum Landfill” concept ensures good quality of agricultural land availability, no groundwater or surface water hazards.

`

Table 5.07: Estimated Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Millions) of NRGB

S No	State	Population in Millions	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
					Equivalent Energy (Fuel) Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Uttarakhand	2.121	5.6	3509.2	12808.6	828.8	892.95
02	Uttar Pradesh	29.613	43.4	54503.8	198939.0	11570.9	12466.61
03	Himachal Pradesh	**No Class I town**					
04	Haryana	5.317	11.2	9496.2	34661.0	2077.5	2238.33
05	Delhi	13.482	10.5	29001.0	105853.5	5267.9	5355.38
06	Rajasthan	7.689	13.3	15806.1	57692.1	3004.3	3236.91
07	Madhya Pradesh	11.934	18.9	22173.8	80934.5	4662.9	5023.86
08	Bihar	6.929	19.6	11750.2	42888.1	2707.3	2916.82
09	Chhattisgarh	3.138	6.3	5779.1	21093.9	1226.1	1320.99
10	Jharkhand	4.801	10.5	8456.3	30865.4	1876.0	2021.21
11	West Bengal	17.124	43.4	29710.4	108443.0	6690.8	7208.74
Total		**102.148**	**182.7**	**190186.1**	**694179.1**	**39912.5**	**42681.80**

`

Table 5.08: Estimated Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of NRGB

S No	State	Population in Millions	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
					Equivalent Energy (Fuel) Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Uttarakhand	0.212	2.8	332.1	1212.3	83.0	89.42
02	Uttar Pradesh	3.109	30.1	4888.5	17843.0	1214.7	1308.75
03	Himachal Pradesh	**No Class II town**					
04	Haryana	0.164	2.1	255.1	931.2	63.9	68.87
05	Delhi	0.862	9.8	1307.8	4773.4	336.7	362.80
06	Rajasthan	0.287	2.8	471.9	1722.3	112.1	120.76
07	Madhya Pradesh	0.654	7.0	1040.4	3797.6	255.5	275.31
08	Bihar	1.462	16.1	2316.5	8455.2	571.2	615.45
09	Chhattisgarh	0.448	4.2	779.6	2845.4	174.9	188.48
10	Jharkhand	1.236	11.9	1994.8	7281.2	482.8	520.20
11	West Bengal	1.000	10.5	1601.7	5846.4	390.8	421.01
Total		**9.433**	**97.3**	**14988.4**	**54708**	**3685.6**	**3971.05**

`

6. Conclusions and Recommendations

6.1. Conclusions

Following conclusions may be drawn based on the synthesis of the information available in the literature and the results presented in this thesis.

- Typical breakup of total annual expenditure on solid waste collection between capex and opex is 16% and 84 % respectively.
- Manpower alone contributes to about 82 % of the total opex incurred in solid waste collection.
- Typical breakup of total annual expenditure on solid waste conveyance between capex and opex is 36% and 64 % respectively.
- Approximately 10 % of total capital expenditure on solid waste conveyance is the cost incurred on transfer station.
- The total share of miscellaneous cost inclusive of fuel and maintenance cost comes out to be 55 % in case of waste conveyance which is very high as compared to 18 % as was in the case of waste collection.
- Typical breakup of total annual expenditure on waste treatment between capex and opex is 48 % and 52 % respectively.
- Infrastructure cost contributes to 62 % of the total capital expenditure in waste treatment while the cost of machinery is 38 % of the total capex.
- Approximately 84 % of the total opex is incurred on manpower while the miscellaneous cost has a share of 16 % in the total opex.
- Approximately 58, 19 and 23 % of the total annual expenditure on solid waste management is incurred on waste collection, conveyance and treatment respectively in a typical Indian town.
- About 34, 26 and 40 % of the total capital expenditure on solid waste management is towards waste collection, conveyance and treatment respectively while about 67, 17 and 16 % of the total operational expenditure is incurred in waste collection, conveyance and treatment respectively.
- Approximately 87 % of the energy bill is towards waste treatment, 12 % is due to waste conveyance while only 1 % of energy expenditure is incurred on waste collection for Class I towns.
- For Class II towns 92 % of the energy bill is towards waste treatment, 7 % is due to waste conveyance while only 1 % of energy expenditure is incurred on waste collection
- Total annual capex and opex for provisioning solid waste management in all Class I

and Class II towns of GRB is expected to be INR 11785.06 and 34867.77 million respectively. This amounts to average per capita per day expenditure of INR 1.15.

- The average per capita per day energy consumption in availing solid waste management comes out to be 20 Watt hour for Class I towns and 17 Watt hour for Class II towns.
- The expenditure on solid waste may be justified in GRB based on tangible and intangible benefits.

6.2. Recommendations

Following recommendations are made for reasonable continuation of the work described in this thesis based on the knowledge gained in conducting the present study.

- Detailed study for different categories of towns and making different plan for these classes.
- Study of reports of SWM plants of foreign countries for better understanding.
- A detailed study on waste sorting, manual as well as mechanical.

`

References

CPCB, 2000. Status of Municipal Solid waste Generation, Collection, Treatment and Disposal in Class I Cities, Series: ADSORBS/31/1999–2000

CPCB, 2000. Status of solid waste generation, collection, treatment and disposal in Metro cities, Series: CUPS/46/1999–2000.

CPHEEO 2000, Manual on Municipal solid waste management, Central public health and environmental engineering organization, Ministry of Urban Development Government of India, India (2000)

Guidance Note (2009), Municipal Solid Waste Management on a Regional Basis, Ministry of Urban Development, Government of India, 2009, Series: CUPS/46/1999–2000

Municipal Solid Wastes (Management and Handling) Rules, 2000, Management of Municipal Solid Wastes, Ministry of Environment and Forest, 2000

Shukla , S. (2013) Assessment of Some Aspects of Provisioning Sewerage Systems in Urban Agglomerations of Ganga River Basin, M Tech Thesis, Environmental Engineering and Management Programme, Department of Civil Engineering, Indian Institute of Technology, Kanpur, India.

White et al (1995). “Integrated Solid Waste management” – A Life Cycle Inventory”.

Chapman & Hall, London

`

Appendix I

Estimated Capital Expenditure on Solid Waste Management in Class I and Class II Towns of GRB

`

Table A1.01: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Dehradun	870.519	435	52.29	65.01	129.37	237.79	432.17
02	Haldwani	169.147	85	10.62	12.63	25.14	46.20	83.97
03	Hardwar	487.923	244	13.00	36.44	72.51	133.28	242.23
04	Kashipur	121.610	61	5.46	9.08	18.07	33.22	60.37
05	Nainital	110.726	55	11.06	8.27	16.46	30.25	54.98
06	Rishikesh	102.138	51	10.00	7.63	15.18	27.90	50.71
07	Roorkee	118.188	59	20.20	8.83	17.56	32.28	58.67
08	Rudrapur	140.884	70	12.43	10.52	20.94	38.48	69.94
Total		**2121.135**	**1061**	**135.06**	**158.41**	**315.23**	**579.40**	**1053.04**

Table A1.02: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	BHEL Ranipur	51.910	26	26.94	3.88	7.71	14.18	25.77
02	Manglaur	51.101	26	1.32	3.82	7.59	13.96	25.37
03	Pithoragarh	53.957	27	9.00	4.03	8.02	14.74	26.79
04	Ramnagar	55.446	28	2.42	4.14	8.24	15.15	27.53
Total		**212.414**	**106**	**39.68**	**15.87**	**31.56**	**58.03**	**105.46**

`

Table A1.03: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Uttar Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Agra	1746.467	873	141.00	130.42	259.54	477.06	867.02
02	Aligarh	909.559	455	36.70	67.92	135.17	248.45	451.54
03	Allahabad	1216.719	608	63.07	90.86	180.82	332.35	604.03
04	Amroha	197.135	99	12.00	14.72	29.30	53.85	97.87
05	Azamgarh	116.165	58	12.60	8.67	17.26	31.73	57.66
06	Badaun	159.221	80	4.39	11.89	23.66	43.49	79.04
07	Ballia	111.287	56	16.00	8.31	16.54	30.40	55.25
08	Banda	154.388	77	11.05	11.53	22.94	42.17	76.64
09	Barabanki	154.692	77	3.87	11.55	22.99	42.26	76.80
10	Baraut	101.241	51	25.00	7.56	15.05	27.65	50.26
11	Bareilly	979.933	490	106.43	73.18	145.63	267.68	486.49
12	Basti	114.651	57	19.43	8.56	17.04	31.32	56.92
13	Bijnour	115.381	58	3.65	8.62	17.15	31.52	57.29
14	Bulandsahar	222.826	111	32.50	16.64	33.11	60.87	110.62
15	Chandausi	114.254	57	8.80	8.53	16.98	31.21	56.72
16	Deoria	129.570	65	16.19	9.68	19.26	35.39	64.33
17	Etah	131.023	66	13.49	9.78	19.47	35.79	65.04
18	Etawah	256.790	128	48.00	19.18	38.16	70.14	127.48
19	Faizabad	259.160	130	16.60	19.35	38.51	70.79	128.65
20	Farrukhabad	318.540	159	16.80	23.79	47.34	87.01	158.14
21	Fatehpur	193.801	97	56.98	14.47	28.80	52.94	96.21
22	Firozabad	603.797	302	21.35	45.09	89.73	164.93	299.75
23	Gazipur	121.136	61	13.45	9.05	18.00	33.09	60.14
24	Ghaziabad	2358.525	1179	215.00	176.12	350.50	644.25	1170.87

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
25	Gonda	138.929	69	24.62	10.37	20.65	37.95	68.97
26	Gorakhpur	692.519	346	147.00	51.71	102.92	189.17	343.80
27	Greater Noida	642.381	321	27.93	47.97	95.46	175.47	318.90
28	Hapur	262.801	131	42.00	19.62	39.05	71.79	130.46
29	Hardoi	197.046	99	11.05	14.71	29.28	53.82	97.81
30	Hathras	161.289	81	8.40	12.04	23.97	44.06	80.07
31	Jaunpur	168.128	84	20.00	12.55	24.99	45.93	83.47
32	Jhansi	549.391	275	169.50	41.03	81.65	150.07	272.75
33	Kanpur	2920.067	1460	261.50	218.05	433.95	797.64	1449.64
34	Kasganj	101.241	51	7.10	7.56	15.05	27.65	50.26
35	Lakhimpur	164.925	82	10.20	12.32	24.51	45.05	81.88
36	Lalitpur	133.041	67	18.00	9.93	19.77	36.34	66.04
37	Loni	512.296	256	34.48	38.26	76.13	139.94	254.33
38	Lucknow	2901.474	1451	330.00	216.66	431.19	792.56	1440.41
39	Mainpuri	133.078	67	7.50	9.94	19.78	36.35	66.07
40	Mathura	454.937	227	32.80	33.97	67.61	124.27	225.85
41	Mau	279.060	140	39.00	20.84	41.47	76.23	138.54
42	Meerut	1424.908	712	41.94	106.40	211.76	389.22	707.38
43	Mirzapur	233.691	117	40.00	17.45	34.73	63.83	116.01
44	Modinagar	182.811	91	14.00	13.65	27.17	49.94	90.76
45	Moradabad	889.810	445	80.00	66.45	132.24	243.06	441.75
46	Mugalsarai	154.692	77	14.43	11.55	22.99	42.26	76.80
47	Muradanagar	100.080	50	12.00	7.47	14.87	27.34	49.68
48	Muzaffar Nagar	316.729	158	12.04	23.65	47.07	86.52	157.24
49	Noida	642.381	321	203.16	47.97	95.46	175.47	318.90

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
50	Orai	190.625	95	16.00	14.23	28.33	52.07	94.63
51	Pililbhit	160.146	80	9.50	11.96	23.80	43.74	79.50
52	Raibareliy	191.625	96	34.00	14.31	28.48	52.34	95.13
53	Rampur	359.062	180	20.20	26.81	53.36	98.08	178.25
54	Saharanpur	703.345	352	73.72	52.52	104.52	192.12	349.16
55	Sahaswann	178.000	89	7.50	13.29	26.45	48.62	88.36
56	Sahjahanpur	356.103	178	11.37	26.59	52.92	97.27	176.78
57	Shambhal	221.334	111	15.65	16.53	32.89	60.46	109.88
58	Sitapur	188.230	94	35.00	14.06	27.97	51.42	93.45
59	Sultanpur	116.211	58	16.00	8.68	17.27	31.74	57.69
60	Ujhani	191.000	96	6.50	14.26	28.38	52.17	94.81
61	Unnao	178.681	89	21.50	13.34	26.55	48.81	88.70
62	Varansi	1435.113	718	79.79	107.17	213.27	392.01	712.45
Total		**29613.440**	**14807**	**2869.73**	**2211.34**	**4400.86**	**8089.12**	**14701.32**

Table A1.04: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Uttar Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Auraiya	70.515	35	4.00	5.27	10.48	19.26	35.01
02	Baghpat	50.380	25	2.83	3.76	7.49	13.76	25.01

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatmen	
03	Baheri	74.869	37	15.00	5.59	11.13	20.45	37.17
04	Balrampur	90.000	45	36.28	6.72	13.37	24.58	44.67
05	Bhadohi	94.563	47	8.00	7.06	14.05	25.83	46.94
06	Bisalpur	83.347	42	4.58	6.22	12.39	22.77	41.38
07	Chandpur	83.456	42	23.40	6.23	12.40	22.80	41.43
08	Chibramau	55.296	28	11.10	4.13	8.22	15.10	27.45
09	Chitrakoot	57.452	29	7.77	4.29	8.54	15.69	28.52
10	Dadri	91.345	46	6.50	6.82	13.57	24.95	45.34
11	Deoband	97.068	49	7.90	7.25	14.43	26.51	48.19
12	Faredpur	76.422	38	9.43	5.71	11.36	20.88	37.95
13	Gangaghat	84.301	42	4.91	6.30	12.53	23.03	41.86
14	Gangoh	59.463	30	6.00	4.44	8.84	16.24	29.52
15	Gola	53.842	27	10.08	4.02	8.00	14.71	26.73
16	Hasanpur	64.536	32	5.72	4.82	9.59	17.63	32.04
17	Jahangerabad	59.873	30	14.30	4.47	8.90	16.35	29.72
18	Jalaun	56.871	28	5.00	4.25	8.45	15.53	28.23
19	Kaimur	51.469	26	7.12	3.84	7.65	14.06	25.55
20	Kairana	95.092	48	7.11	7.10	14.13	25.97	47.20
21	Kannauj	71.727	36	70.70	5.36	10.66	19.59	35.61
22	Khatauli	72.478	36	3.76	5.41	10.77	19.80	35.98
23	Kiratpur	61.801	31	4.45	4.61	9.18	16.88	30.67
24	Konch	53.426	27	2.95	3.99	7.94	14.59	26.52
25	Laharpur	61.280	31	8.00	4.58	9.11	16.74	30.43
26	Mahoba	95.454	48	12.15	7.13	14.19	26.07	47.39

Table continued to next page … … … …

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
27	Mau Ranipur	58.456	29	5.53	4.37	8.69	15.97	29.03
28	Mawana	81.126	41	7.50	6.06	12.06	22.16	40.28
29	Mubarakpur	71.365	36	9.00	5.33	10.61	19.49	35.43
30	Nagina	71.350	36	10.30	5.33	10.60	19.49	35.42
31	Nazibabad	88.638	44	5.06	6.62	13.17	24.21	44.00
32	Obra	56.116	28	4.50	4.19	8.34	15.33	27.86
33	Pilkhuwa	81.651	41	5.80	6.10	12.13	22.30	40.53
34	Pratapgarh	76.750	38	12.00	5.73	11.41	20.96	38.10
35	Ramnagar	54.800	27	3.60	4.09	8.14	14.97	27.20
36	Rath	65.092	33	6.10	4.86	9.67	17.78	32.31
37	S R Nagar*	94.563	47	8.00	7.06	14.05	25.83	46.94
38	Shahbad	80.305	40	9.70	6.00	11.93	21.94	39.87
39	Sherkot	62.148	31	6.00	4.64	9.24	16.98	30.86
40	Sikandrabad	80.309	40	1.14	6.00	11.93	21.94	39.87
41	Tanda	96.138	48	10.45	7.18	14.29	26.26	47.73
42	Tilhar	60.803	30	3.48	4.54	9.04	16.61	30.19
43	Vrindavann	62.926	31	13.49	4.70	9.35	17.19	31.24
Total		**3108.862**	**1554**	**420.69**	**232.17**	**462.02**	**849.18**	**1543.37**

* 37. S R Nagar – Sant Ravidas Nagar

`

Table A1.05: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Himanchal Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
No Class I town								

Table A1.06: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Himanchal Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
No Class I town								

`

Table A1.07: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Bhadur Garh	170.426	85	50.00	12.73	25.33	46.55	84.61
02	Bhiwani	197.662	99	47.78	14.76	29.37	53.99	98.12
03	Faridabad	1404.653	702	207.80	104.89	208.75	383.69	697.33
04	Gurgoan	901.968	451	37.10	67.35	134.04	246.38	447.77
05	Hisar	301.249	151	48.03	22.50	44.77	82.29	149.56
06	Jagadhari	124.915	62	24.80	9.33	18.56	34.12	62.01
07	Jind	166.225	83	42.00	12.41	24.70	45.41	82.52
08	Kaithal	144.633	72	45.75	10.80	21.49	39.51	71.80
09	Karnal	286.974	143	12.00	21.43	42.65	78.39	142.47
10	Kurukhetra	154.962	77	34.50	11.57	23.03	42.33	76.93
11	Narnaul	134.067	67	41.10	10.01	19.92	36.62	66.55
12	Palwal	127.931	64	8.78	9.55	19.01	34.95	63.51
13	Panipat	294.150	147	41.40	21.97	43.71	80.35	146.03
14	Rohtak	373.133	187	47.50	27.86	55.45	101.92	185.23
15	Sonipat	292.339	146	52.80	21.83	43.44	79.85	145.12
16	Yamuna Nagar	241.723	121	34.50	18.05	35.92	66.03	120.00
Total		**5317.010**	**2659**	**775.84**	**397.04**	**790.14**	**1452.38**	**2639.56**

`

Table A1.08: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatmen	
01	Hodal	50.003	25	5.39	3.73	7.43	13.66	24.82
02	Narvana	61.800	31	10.00	4.61	9.18	16.88	30.67
03	Sahadab	51.786	26	5.00	3.87	7.70	14.15	25.72
Total		**163.589**	**82**	**20.39**	**12.21**	**24.31**	**44.69**	**81.21**

Table A1.09: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	B J	197.150	99	6.70	14.72	29.30	53.85	97.87
02	Burari	145.584	73	11.19	10.87	21.64	39.77	72.28
03	Dallo Pura	154.955	77	2.29	11.57	23.03	42.33	76.93
04	Delhi Cantt.	116.352	58	42.97	8.69	17.29	31.78	57.76
05	DMC	11007.835	5504	431.09	822.00	1635.88	3006.86	5464.74
06	Deoli	169.410	85	10.12	12.65	25.18	46.28	84.11
07	Gokalpur	121.938	61	2.32	9.11	18.12	33.31	60.54
08	Hastal	177.033	89	6.75	13.22	26.31	48.36	87.89
09	Karawal Nagar	224.666	112	4.75	16.78	33.39	61.37	111.54
10	K S N	282.598	141	4.74	21.10	42.00	77.19	140.29
11	Mandoli	120.345	60	41.77	8.99	17.88	32.87	59.74
12	Mustafabad	127.012	64	1.29	9.48	18.88	34.69	63.05

Table continued to next page … … … …

`

… … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
13	Nangloi Jat	205.497	103	6.67	15.35	30.54	56.13	102.02
14	NDMC	249.998	125	42.74	18.67	37.15	68.29	124.11
15	Sultanpur Majra	181.624	91	2.86	13.56	26.99	49.61	90.16
Total		**13482.000**	**6741**	**618.25**	**1006.76**	**2003.58**	**3682.69**	**6693.03**

1. B J – Bhalswa Jahangirpur
05. DMC – Delhi Municipal Corporation
10. K S N – Kirari Suleman Nagar
14. NDMC – New Delhi Municipal Corporation

`

Table A1.10: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Babarpur	52.918	26	0.79	3.95	7.86	14.45	26.26
02	C S B	81.374	41	2.58	6.08	12.09	22.23	40.40
03	Gharoli	84.722	42	3.56	6.33	12.59	23.14	42.06
04	Jaffrabad	70.089	35	0.90	5.23	10.42	19.15	34.80
05	Khajoori Khas	55.006	28	0.94	4.11	8.17	15.03	27.31
06	Mithe Pur	49.583	25	1.81	3.70	7.37	13.54	24.61
07	Molar Band	49.439	25	4.12	3.69	7.35	13.50	24.54
08	Mundka	53.525	27	11.89	4.00	7.95	14.62	26.57
09	Pooth Kalan	61.727	31	6.97	4.61	9.17	16.86	30.64
10	Pulpehlad	64.484	32	2.16	4.82	9.58	17.61	32.01
11	S P G	52.730	26	1.05	3.94	7.84	14.40	26.18
12	Taj Pul	72.764	36	1.22	5.43	10.81	19.88	36.12
13	Tigri	54.774	27	1.05	4.09	8.14	14.96	27.19
14	Ziauddin Pur	58.661	29	1.80	4.38	8.72	16.02	29.12
Total		**861.796**	**431**	**40.84**	**64.36**	**128.06**	**235.39**	**427.81**

02. C S B – Chilla Saroda Bangar

11. S P G – Sadat Pur Gurjan

`

Table A1.11: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Rajasthan in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Ajmer	542.580	271	87.00	40.52	80.63	148.21	269.36
02	Alwar	315.310	158	49.00	23.55	46.86	86.13	156.54
03	Bahilwara	360.009	180	69.00	26.88	53.50	98.34	178.72
04	Baran	118.157	59	72.36	8.82	17.56	32.28	58.66
05	Bharatpur	252.109	126	29.00	18.83	37.47	68.87	125.17
06	Bundi	102.823	51	22.76	7.68	15.28	28.09	51.05
07	Chittaugarh	116.409	58	30.50	8.69	17.30	31.80	57.79
08	Dhaulpur	126.142	63	32.00	9.42	18.75	34.46	62.63
09	Gangapurcity	224.773	112	17.22	16.78	33.40	61.40	111.58
10	Hindauncity	105.690	53	48.00	7.89	15.71	28.87	52.47
11	Jaipur	3073.350	1537	485.00	229.50	456.73	839.51	1525.74
12	Jhunjhunun	118.966	59	50.00	8.88	17.68	32.50	59.06
13	Kishangarh	155.019	78	100.00	11.58	23.04	42.34	76.96
14	Kota	1001.365	501	527.03	74.78	148.81	273.53	497.12
15	Nagaur	100.618	50	37.81	7.51	14.95	27.48	49.94
16	Sikar	237.579	119	39.90	17.74	35.31	64.90	117.95
17	Swaimadhavpur	120.998	60	49.00	9.04	17.98	33.05	60.07
18	Tonk	165.363	83	16.00	12.35	24.57	45.17	82.09
19	Udaipur	451.735	226	56.91	33.73	67.13	123.39	224.25
Total		**7688.995**	**3844**	**1818.49**	**574.17**	**1142.66**	**2100.32**	**3817.15**

`

Table A1.12: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Rajasthan in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Jhalawara	66.500	33	12.95	4.97	9.88	18.16	33.01
02	Makrana	94.447	47	36.00	7.05	14.04	25.80	46.89
03	Nawalgarh	64.903	32	27.91	4.85	9.65	17.73	32.23
04	Nimbahera	61.000	31	12.74	4.56	9.07	16.66	30.29
Total		**286.85**	**143**	**89.6**	**21.43**	**42.64**	**78.35**	**142.42**

Table A1.13: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Madhya Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Bhind	197.332	99	17.79	14.74	29.33	53.90	97.97
02	Bopal	1883.381	942	285.00	140.64	279.89	514.46	934.99
03	Chatarpur	147.688	74	54.00	11.03	21.95	40.34	73.32
04	Damoh	147.515	74	16.00	11.02	21.92	40.29	73.23
05	Datia	100.466	50	6.85	7.50	14.93	27.44	49.87
06	Dewas	289.438	145	102.00	21.61	43.01	79.06	143.68
07	Guna	180.978	90	45.75	13.51	26.90	49.44	89.85
08	Gwalior	1101.981	551	173.88	82.29	163.77	301.01	547.07
09	Indore	2167.447	1084	131.17	161.85	322.11	592.05	1076.01
10	Jabalpur	1267.564	634	135.00	94.65	188.37	346.24	629.26
11	Katni	221.875	111	68.60	16.57	32.97	60.61	110.15

Table continued to next page … … … …

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
12	Mandsour	141.468	71	36.00	10.56	21.02	38.64	70.22
13	Morena	200.506	100	12.00	14.97	29.80	54.77	99.54
14	Neemuch	128.575	64	22.00	9.60	19.11	35.12	63.83
15	Pithampur	126.099	63	89.90	9.42	18.74	34.44	62.60
16	Ratlam	273.892	137	39.19	20.45	40.70	74.82	135.97
17	Rewa	235.422	118	102.00	17.58	34.99	64.31	116.88
18	Sagar	370.296	185	33.75	27.65	55.03	101.15	183.83
19	Satna	283.004	142	12.00	21.13	42.06	77.30	140.49
20	Sehore	1090.025	545	13.10	81.40	161.99	297.75	541.14
21	Shahdol	100.565	50	28.24	7.51	14.95	27.47	49.93
22	Shepour	105.026	53	5.00	7.84	15.61	28.69	52.14
23	Shivpuri	179.972	90	86.55	13.44	26.75	49.16	89.35
24	Singrauli	220.295	110	280.66	16.45	32.74	60.18	109.37
25	Tikamgarh	101.786	51	6.22	7.60	15.13	27.80	50.53
26	Ujjain	515.215	258	92.68	38.47	76.57	140.73	255.77
27	Vidisha	155.959	78	8.83	11.65	23.18	42.60	77.43
Total		**11933.77**	**5967**	**1904.16**	**891.13**	**1773.52**	**3259.77**	**5924.42**

`

Table A1.14: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Madhya Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatmen t	
01	Basoda	78.265	39	5.90	5.84	11.63	21.38	38.85
02	Bina	64.579	32	12.00	4.82	9.60	17.64	32.06
03	Dabra	61.260	31	12.00	4.57	9.10	16.73	30.40
04	Dhar	95.000	48	30.00	7.09	14.12	25.95	47.16
05	Jaora	65.111	33	5.54	4.86	9.68	17.79	32.33
06	Mandla	55.145	28	8.87	4.12	8.20	15.06	27.38
07	Narshimpur	59.858	30	14.71	4.47	8.90	16.35	29.72
08	Panna	50.432	25	4.50	3.77	7.49	13.78	25.04
09	Shajapur	70.000	35	11.16	5.23	10.40	19.12	34.75
10	Sidhi	54.317	27	12.31	4.06	8.07	14.84	26.97
Total		**653.967**	**327**	**116.99**	**48.83**	**97.19**	**178.64**	**324.66**

Table A1.15: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatmen t	
01	Arrah	261.099	131	30.97	19.50	38.80	71.32	129.62
02	Aurangabad	101.520	51	8.00	7.58	15.09	27.73	50.40
03	Bagaha	113.012	57	11.00	8.44	16.79	30.87	56.10
04	Begusarai	251.136	126	8.98	18.75	37.32	68.60	124.67

Table continued to next page … … … …

`

… … … … *Table continued from previous page*

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
05	Bettiah	132.896	66	11.55	9.92	19.75	36.30	65.97
06	B M C	398.138	199	30.17	29.73	59.17	108.75	197.65
07	B M C	296.889	148	22.46	22.17	44.12	81.10	147.39
08	Buxar	102.591	51	8.00	7.66	15.25	28.02	50.93
09	Chapra (NP)	201.597	101	16.96	15.05	29.96	55.07	100.08
10	Darbhanga	294.116	147	19.18	21.96	43.71	80.34	146.01
11	Dehri	137.068	69	21.32	10.24	20.37	37.44	68.05
12	D N	182.241	91	11.63	13.61	27.08	49.78	90.47
13	Gaya	463.454	232	50.17	34.61	68.87	126.60	230.08
14	Hajipur	147.126	74	19.64	10.99	21.86	40.19	73.04
15	Jamalpur	105.221	53	10.65	7.86	15.64	28.74	52.24
16	Jehanabad	102.456	51	20.23	7.65	15.23	27.99	50.87
17	Katihar	225.982	113	24.54	16.88	33.58	61.73	112.19
18	Kishanganj	107.076	54	30.12	8.00	15.91	29.25	53.16
19	M T	105.000	53	8.50	7.84	15.60	28.68	52.12
20	Motihari	125.183	63	13.52	9.35	18.60	34.19	62.14
21	Munger	213.101	107	17.50	15.91	31.67	58.21	105.79
22	Muzaffarpur	351.838	176	26.43	26.27	52.29	96.11	174.67
23	Nawada	109.141	55	5.68	8.15	16.22	29.81	54.18
24	Patna	1683.200	842	108.34	125.69	250.14	459.78	835.61
25	Purnia	280.547	140	44.52	20.95	41.69	76.63	139.27
26	Saharsa	155.175	78	21.13	11.59	23.06	42.39	77.04

Table continued to next page … … … …

`

… … … … *Table continued from previous page*

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatmen	
27	Sasaram	147.396	74	12.00	11.01	21.90	40.26	73.17
28	Siwan	134.458	67	15.68	10.04	19.98	36.73	66.75
Total		**6928.657**	**3464**	**628.87**	**517.4**	**1029.65**	**1892.61**	**3439.66**

6. B M C – Bhagalpur Municipal Corporation
7. B M C – Biharsharif Municipal Corporation
12. DN – Dinapur Nizamat
19. MT – Madhubani Town

Table A1.16: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Araria	80.000	40	4.50	5.97	11.89	21.85	39.71
02	Barahiya	50.230	25	26.54	3.75	7.46	13.72	24.93
03	Barh	61.037	31	4.50	4.56	9.07	16.67	30.30
04	Bhabua	52.611	26	7.12	3.93	7.82	14.37	26.12
05	D M	67.995	34	11.30	5.08	10.10	18.57	33.75
06	Dumraon	57.716	29	15.33	4.31	8.58	15.77	28.66
07	Forbesganj	52.289	26	4.98	3.90	7.77	14.28	25.95

Table continued to next page … … … …

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
08	Gopalganj	66.624	33	11.11	4.98	9.90	18.20	33.08
09	Kaimur	51.469	26	7.12	3.84	7.65	14.06	25.55
10	Khagaria	56.978	28	2.97	4.25	8.47	15.56	28.28
11	Khagaul	60.866	30	5.32	4.55	9.05	16.63	30.23
12	Lakhisarai	98.123	49	24.79	7.33	14.58	26.80	48.71
13	Madhepura	56.739	28	25.84	4.24	8.43	15.50	28.17
14	Masaurhi	57.012	29	9.43	4.26	8.47	15.57	28.30
15	Mokameh	71.335	36	14.18	5.33	10.60	19.49	35.42
16	Narkatiaganj	51.446	26	10.96	3.84	7.65	14.05	25.54
17	Phulwari Sharif	67.348	34	6.48	5.03	10.01	18.40	33.44
18	Raxaul Bazar	52.429	26	5.82	3.92	7.79	14.32	26.03
19	Samastipur	70.042	35	3.45	5.23	10.41	19.13	34.77
20	Shekhpura	54.322	27	15.58	4.06	8.07	14.84	26.97
21	Sitamarhi	87.279	44	8.00	6.52	12.97	23.84	43.33
22	Sultanganj	52.867	26	12.29	3.95	7.86	14.44	26.25
23	Supaul	85.200	43	22.37	6.36	12.66	23.27	42.29
Total		**1461.957**	**731**	**259.98**	**109.19**	**217.26**	**399.33**	**725.78**

05. D M – Digha-Mainpura

`

Table A2.17: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Chhatisgarh in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Ambikapur	114.575	57	9.39	8.56	17.03	31.30	56.89
02	Bhilai Nagar	625.697	313	141.30	46.72	92.99	170.91	310.62
03	Bilaspur	330.106	165	37.56	24.65	49.06	90.17	163.88
04	Durg	268.679	134	66.09	20.06	39.93	73.39	133.38
05	Jagdalpur	125.345	63	22.49	9.36	18.63	34.24	62.23
06	Korba	363.210	182	215.02	27.12	53.98	99.21	180.31
07	Raigarh	137.097	69	20.68	10.24	20.37	37.45	68.06
08	Raipur	1010.087	505	108.66	75.43	150.11	275.91	501.45
09	Rajnandgaon	163.122	82	78.09	12.18	24.24	44.56	80.98
Total		**3137.918**	**1569**	**699.28**	**234.32**	**466.34**	**857.14**	**1557.80**

Table A1.18: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Chhatisgarh in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Bhatapara	54.846	27	30.42	4.10	8.15	14.98	27.23
02	Bhilai Charoda	95.848	48	141.30	7.16	14.24	26.18	47.58
03	Chirmiri	99.934	50	64.94	7.46	14.85	27.30	49.61
04	Dalli-Rajhara	55.684	28	37.25	4.16	8.28	15.21	27.65
05	Dhamtari	89.857	45	23.40	6.71	13.35	24.55	44.61
06	Mahasamund	51.543	26	14.68	3.85	7.66	14.08	25.59
Total		**447.712**	**224**	**311.99**	**33.44**	**66.53**	**122.30**	**222.27**

`

Table A1.19: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Aditya	173.988	87	49.82	12.99	25.86	47.53	86.38
02	Bhuli	110.127	55	11.74	8.22	16.37	30.08	54.67
03	Bokaro	413.934	207	162.91	30.91	61.51	113.07	205.49
04	Chas	141.618	71	20.49	10.58	21.05	38.68	70.31
05	Deoghar	203.116	102	14.00	15.17	30.19	55.48	100.84
06	Dhanbad	1161.561	581	23.39	86.74	172.62	317.29	576.65
07	Giridih	114.447	57	9.75	8.55	17.01	31.26	56.82
08	Hazaribag	142.494	71	26.37	10.64	21.18	38.92	70.74
09	JNAC	629.659	315	59.80	47.02	93.57	172.00	312.59
10	Jharia	100.839	50	4.42	7.53	14.99	27.54	50.06
11	Jorapokhar	104.673	52	16.40	7.82	15.56	28.59	51.97
12	MNAC	224.002	112	19.45	16.73	33.29	61.19	111.21
13	Phusro	102.673	51	40.64	7.67	15.26	28.05	50.98
14	Ranchi	1073.440	537	177.19	80.16	159.52	293.22	532.90
15	Saunda	104.642	52	24.26	7.81	15.55	28.58	51.94
Total		**4801.213**	**2401**	**660.63**	**358.54**	**713.53**	**1311.48**	**2383.55**

09. JNAC – Jamshedpur Notified Area Committee

12. MNAC – Mango Notified Area Committee

`

Table A1.20: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Bagbera	82.559	41	10.70	6.17	12.27	22.55	40.99
02	Bhowrah	54.483	27	15.73	4.07	8.10	14.88	27.05
03	Bhuli	99.999	50	8.60	7.47	14.86	27.32	49.65
04	Chaibasa	78.287	39	11.11	5.85	11.63	21.38	38.86
05	Chatra	51.685	26	3.45	3.86	7.68	14.12	25.66
06	Daltonganj	87.849	44	14.00	6.56	13.06	24.00	43.62
07	Dumka	55.336	28	6.12	4.13	8.22	15.12	27.47
08	Gumia	56.024	28	26.11	4.18	8.33	15.30	27.81
09	Jhumri Tilaiya	85.489	43	51.14	6.38	12.70	23.35	42.43
10	Jugsalai	56.720	28	3.69	4.24	8.43	15.49	28.16
11	Katras	63.017	32	5.00	4.71	9.36	17.21	31.28
12	Lohardaga	56.821	28	14.57	4.24	8.44	15.52	28.20
13	Madhupur	58.211	29	18.36	4.35	8.65	15.90	28.90
14	Ramgarh Cantt.	90.324	45	34.46	6.74	13.42	24.67	44.83
15	Sahibganj	98.589	49	8.98	7.36	14.65	26.93	48.94
16	Sindri	94.398	47	46.65	7.05	14.03	25.79	46.87
17	Tisra	65.894	33	14.02	4.92	9.79	18.00	32.71
Total		**1235.685**	**618**	**292.69**	**92.28**	**183.62**	**337.53**	**613.43**

`

Table A1.21: Estimated Capital Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of West Bengal in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Alipurduar	127.342	64	9.80	9.51	18.92	34.78	63.21
02	Asansol	564.491	282	127.87	42.15	83.89	154.19	280.23
03	A-K	123.906	62	18.44	9.25	18.41	33.85	61.51
04	Baidyabati	121.081	61	7.89	9.04	17.99	33.07	60.10
05	Bally	115.715	58	11.68	8.64	17.20	31.61	57.45
06	Balurghat	151.183	76	10.46	11.29	22.47	41.30	75.06
07	Bangaon	110.668	55	24.70	8.26	16.45	30.23	54.94
08	Bankura	138.036	69	19.06	10.31	20.51	37.71	68.53
09	Bansberia	103.799	52	9.07	7.75	15.43	28.35	51.53
10	Bara Nagar	248.466	124	7.12	18.55	36.92	67.87	123.34
11	Barasat	283.443	142	34.50	21.17	42.12	77.42	140.71
12	Bardhaman	314.638	157	26.30	23.50	46.76	85.95	156.21
13	Barrackpore	154.475	77	11.65	11.54	22.96	42.20	76.70
14	Basirhat	127.135	64	22.50	9.49	18.89	34.73	63.11
15	Beharampore	195.363	98	31.43	14.59	29.03	53.36	96.98
16	Bhadreswar	101.334	51	8.28	7.57	15.06	27.68	50.31
17	Bhatpara	390.467	195	30.42	29.16	58.03	106.66	193.85
18	Bidhannagar	218.323	109	30.00	16.30	32.45	59.64	108.39
19	Chakdaha	132.855	66	15.54	9.92	19.74	36.29	65.95
20	Champadani	110.983	55	6.47	8.29	16.49	30.32	55.10
21	Chandernagore	166.949	83	22.03	12.47	24.81	45.60	82.88
22	Chinsurah	180.502	90	17.24	13.48	26.82	49.31	89.61
23	Darjiling	120.414	60	10.57	8.99	17.89	32.89	59.77
24	Dhulian	239.022	120	10.27	17.85	35.52	65.29	118.66

Table continued to next page … … … …

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
25	Durgapur	566.937	283	1.10	42.34	84.25	154.86	281.45
26	Habra	149.675	75	21.80	11.18	22.24	40.88	74.30
27	Haldia	200.762	100	104.90	14.99	29.84	54.84	99.67
28	Halisahar	126.893	63	8.28	9.48	18.86	34.66	63.00
29	H-C	177.209	89	8.29	13.23	26.34	48.41	87.98
30	Jalpaiguri	107.351	54	12.50	8.02	15.95	29.32	53.29
31	Jamuria	144.791	72	73.23	10.81	21.52	39.55	71.88
32	Jangipore	122.875	61	7.86	9.18	18.26	33.56	61.00
33	Kalyani	100.62	50	21.91	7.51	14.95	27.49	49.95
34	Kamarhati	336.579	168	20.48	25.13	50.02	91.94	167.09
35	Kanchapara	122.181	61	29.21	9.12	18.16	33.37	60.65
36	Kharagpur	206.923	103	90.65	15.45	30.75	56.52	102.72
37	Khardaha	111.13	56	10.96	8.30	16.52	30.36	55.18
38	Kolkata	4486.689	2243	185.00	335.04	666.77	1225.57	2227.38
39	Konnagar	124.585	62	9.07	9.30	18.51	34.03	61.84
40	Krishnanagar	181.182	91	6.87	13.53	26.93	49.49	89.95
41	Madhyamgram	198.964	99	21.32	14.86	29.57	54.35	98.78
42	Mahestala	449.423	225	21.50	33.56	66.79	122.76	223.11
43	Medinipur	169.127	85	14.78	12.63	25.13	46.20	83.96
44	Nabadwip	125.528	63	11.66	9.37	18.65	34.29	62.31
45	Naihati	221.762	111	11.55	16.56	32.96	60.58	110.10
46	N B	134.825	67	17.17	10.07	20.04	36.83	66.94
47	NDD	253.625	127	26.45	18.94	37.69	69.28	125.91
48	Panihati	383.522	192	6.89	28.64	57.00	104.76	190.40
49	Puruliya	121.436	61	13.90	9.07	18.05	33.17	60.29

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^{aq}	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
50	Raiganj	183.682	92	10.64	13.72	27.30	50.17	91.19
51	R G	404.991	202	28.00	30.24	60.19	110.63	201.06
52	R S	423.806	212	49.25	31.65	62.98	115.77	210.40
53	Rana Ghat	235.583	118	7.72	17.59	35.01	64.35	116.95
54	Raniganj	128.624	64	23.44	9.60	19.11	35.13	63.84
55	Rishra	124.591	62	6.48	9.30	18.52	34.03	61.85
56	Santipur	151.774	76	24.60	11.33	22.56	41.46	75.35
57	Serampore	183.339	92	14.50	13.69	27.25	50.08	91.02
58	Siliguri	509.709	255	41.90	38.06	75.75	139.23	253.04
59	S D D	410.524	205	17.39	30.66	61.01	112.14	203.81
60	Titagarh	118.426	59	3.24	8.84	17.60	32.35	58.79
61	Uluberia	221.175	111	33.72	16.52	32.87	60.42	109.81
62	Uttarpara K	162.386	81	16.34	12.13	24.13	44.36	80.62
Total		**17123.79**	**8562**	**1557.84**	**1278.71**	**2544.79**	**4677.49**	**8500.99**

03. A K – Ashokenagar-Kalyangarh
29. H C – Hooghly- Chinsurah
46. N B – New Barrackpore
47. NDD – North Dum Dum
51. R G – Rajarhat Gopalpur
52. R S – Rahjpur Sonarpur
59. S D D – South Dum Dum
62. Uttapara K – Uttapara Kotrung

`

Table A1.22: Estimated Capital Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of West Bengal in NRGB

S No	Town	Population in Thousands	Estimated Solid Waste Generation, MT/d	Town Area in Km^2	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
					Waste Collection	Waste Conveyance	Waste Treatment	
01	Arambagh	67.000	34	34.75	5.00	9.96	18.30	33.26
02	Baduria	52.500	26	22.43	3.92	7.80	14.34	26.06
03	Bankra	55.229	28	3.59	4.12	8.21	15.09	27.42
04	Baruipur	53.500	27	9.50	4.00	7.95	14.61	26.56
05	Bishnupur	70.620	35	22.01	5.27	10.49	19.29	35.05
06	Bolpur	74.890	37	10.73	5.59	11.13	20.46	37.18
07	Budge Budge	76.858	38	9.06	5.74	11.42	20.99	38.15
08	Chittaranjan	52.391	26	19.65	3.91	7.79	14.31	26.01
09	Contai	88.365	44	14.25	6.60	13.13	24.14	43.87
10	Gangarampur	61.028	31	10.29	4.56	9.07	16.67	30.30
11	Garulia	91.116	46	5.38	6.80	13.54	24.89	45.23
12	Gayeshpur	65.398	33	30.00	4.88	9.72	17.86	32.46
13	Gobardanga	57.878	29	13.50	4.32	8.60	15.81	28.73
14	J-A Ganj	51.790	26	11.66	3.87	7.70	14.15	25.72
15	Katwa	81.510	41	7.93	6.09	12.11	22.26	40.46
Total		**1000.073**	**500**	**224.73**	**74.67**	**148.62**	**273.17**	**496.46**

14. J-A Ganj – Jiyaganj-Azimganj

Appendix II

Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I and Class II Towns of GRB

`

Table A2.01: Estimated Land Footprint, Energy Consumption, and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Equivalent Energy (Fuel) Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
1	Dehradun	870.519	52.29	435	60.9	0.7	1517.2	5537.7	340.1	366.47
2	Haldwani	169.147	10.62	85	11.8	0.7	268.1	978.7	66.1	71.21
3	Hardwar	487.923	13.00	244	34.2	0.7	780.2	2847.7	190.6	205.40
4	Kashipur	121.610	5.46	61	8.5	0.7	188.3	687.4	47.5	51.20
5	Nainital	110.726	11.06	55	7.8	0.7	175.8	641.8	43.3	46.61
6	Rishikesh	102.138	10.00	51	7.1	0.7	161.5	589.6	39.9	43.00
7	Roorkee	118.188	20.20	59	8.3	0.7	193.2	705.0	46.2	49.75
8	Rudrapur	140.884	12.43	70	9.9	0.7	224.8	820.6	55.0	59.31
Total		**2121.135**	**135.06**	**1061**	**148.5**	**5.6**	**3509.2**	**12808.6**	**828.8**	**892.95**

`

Table A2.02: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	BHEL Ranipur	51.910	26.94	26	3.6	0.7	86.3	314.9	20.3	21.85
02	Manglaur	51.101	1.32	26	3.6	0.7	76.7	280.1	20.0	21.51
03	Pithoragarh	53.957	9.00	27	3.8	0.7	85.0	310.2	21.1	22.71
04	Ramnagar	55.446	2.42	28	3.9	0.7	84.2	307.2	21.7	23.34
Total		**212.414**	**39.68**	**106**	**14.9**	**2.8**	**332.1**	**1212.3**	**83.0**	**89.41**

Table A2.03: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Uttar Pradesh in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Agra	1746.467	141.00	873	122.3	0.7	3365.5	12284.2	682.4	735.22
02	Aligarh	909.559	36.70	455	63.7	0.7	1542.9	5631.6	355.4	382.90
03	Allahabad	1216.719	63.07	608	85.2	0.7	2154.9	7865.2	475.4	512.21
04	Amroha	197.135	12.00	99	13.8	0.7	314.1	1146.5	77.0	82.99

Table continued to next page … … … …

`

… … … … *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
05	Azamgarh	116.165	12.60	58	8.1	0.7	185.5	677.1	45.4	48.90
06	Badaun	159.221	4.39	80	11.1	0.7	245.1	894.5	62.2	67.03
07	Ballia	111.287	16.00	56	7.8	0.7	179.7	655.9	43.5	46.85
08	Banda	154.388	11.05	77	10.8	0.7	245.1	894.8	60.3	64.99
09	Barabanki	154.692	3.87	77	10.8	0.7	237.3	866.2	60.4	65.12
10	Baraut	101.241	25.00	51	7.1	0.7	167.5	611.3	39.6	42.62
11	Bareilly	979.933	106.43	490	68.6	0.7	1827.8	6671.5	382.9	412.53
12	Basti	114.651	19.43	57	8.0	0.7	187.0	682.5	44.8	48.27
13	Bijnour	115.381	3.65	58	8.1	0.7	176.7	645.1	45.1	48.57
14	Bulandsahar	222.826	32.50	111	15.6	0.7	374.8	1368.1	87.1	93.80
15	Chandausi	114.254	8.80	57	8.0	0.7	179.8	656.3	44.6	48.10
16	Deoria	129.570	16.19	65	9.1	0.7	209.3	764.1	50.6	54.55
17	Etah	131.023	13.49	66	9.2	0.7	209.9	766.0	51.2	55.16
18	Etawah	256.790	48.00	128	18.0	0.7	444.5	1622.3	100.3	108.10
19	Faizabad	259.160	16.60	130	18.1	0.7	419.2	1530.2	101.3	109.10
20	Farrukhabad	318.540	16.80	159	22.3	0.7	515.6	1881.9	124.5	134.10
21	Fatehpur	193.801	56.98	97	13.6	0.7	340.2	1241.8	75.7	81.59
22	Firozabad	603.797	21.35	302	42.3	0.7	989.8	3612.8	235.9	254.19
23	Gazipur	121.136	13.45	61	8.5	0.7	194.0	708.1	47.3	51.00
24	Ghaziabad	2358.525	215.00	1179	165.1	0.7	4805.9	17541.5	921.6	992.89
25	Gonda	138.929	24.62	69	9.7	0.7	229.6	838.1	54.3	58.49
26	Gorakhpur	692.519	147.00	346	48.5	0.7	1341.4	4896.1	270.6	291.54
27	Greater Noida	642.381	27.93	321	45.0	0.7	1070.0	3905.4	251.0	270.43

Table continued to next page … … … …

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita $in\ m^2$	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
28	Hapur	262.801	42.00	131	18.4	0.7	450.2	1643.2	102.7	110.63
29	Hardoi	197.046	11.05	99	13.8	0.7	312.9	1142.0	77.0	82.95
30	Hathras	161.289	8.40	81	11.3	0.7	253.4	924.8	63.0	67.90
31	Jaunpur	168.128	20.00	84	11.8	0.7	274.6	1002.4	65.7	70.78
32	Jhansi	549.391	169.50	275	38.5	0.7	1083.7	3955.3	214.7	231.28
33	Kanpur	2920.067	261.50	1460	204.4	0.7	6124.8	22355.6	1141.0	1229.28
34	Kasganj	101.241	7.10	51	7.1	0.7	158.1	577.1	39.6	42.62
35	Lakhimpur	164.925	10.20	82	11.5	0.7	261.0	952.7	64.4	69.43
36	Lalitpur	133.041	18.00	67	9.3	0.7	216.1	788.8	52.0	56.01
37	Loni	512.296	34.48	256	35.9	0.7	865.2	3158.1	200.2	215.67
38	Lucknow	2901.474	330.00	1451	203.1	0.7	6315.4	23051.4	1133.7	1221.46
39	Mainpuri	133.078	7.50	67	9.3	0.7	208.2	760.0	52.0	56.02
40	Mathura	454.937	32.80	227	31.8	0.7	765.7	2795.0	177.8	191.52
41	Mau	279.060	39.00	140	19.5	0.7	475.4	1735.4	109.0	117.48
42	Meerut	1424.908	41.94	712	99.7	0.7	2440.7	8908.7	556.8	599.86
43	Mirzapur	233.691	40.00	117	16.4	0.7	398.9	1455.9	91.3	98.38
44	Modinagar	182.811	14.00	91	12.8	0.7	293.3	1070.6	71.4	76.96
45	Moradabad	889.810	80.00	445	62.3	0.7	1611.3	5881.2	347.7	374.59
46	Mugalsarai	154.692	14.43	77	10.8	0.7	248.5	907.2	60.4	65.12
47	Muradanagar	100.080	12.00	50	7.0	0.7	159.5	582.1	39.1	42.13
48	Muzaffar Nagar	316.729	12.04	158	22.2	0.7	504.8	1842.4	123.8	133.34
49	Noida	642.381	203.16	321	45.0	0.7	1298.5	4739.6	251.0	270.43
50	Orai	190.625	16.00	95	13.3	0.7	307.8	1123.5	74.5	80.25
51	Pililbhit	160.146	9.50	80	11.2	0.7	252.8	922.6	62.6	67.42

Table continued to next page … … … …

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
52	Raibareliy	191.625	34.00	96	13.4	0.7	323.3	1180.2	74.9	80.67
53	Rampur	359.062	20.20	180	25.1	0.7	586.8	2141.9	140.3	151.16
54	Saharanpur	703.345	73.72	352	49.2	0.7	1263.6	4612.3	274.8	296.09
55	Sahaswann	178.000	7.50	89	12.5	0.7	278.5	1016.5	69.6	74.93
56	Sahjahanpur	356.103	11.37	178	24.9	0.7	566.1	2066.3	139.1	149.91
57	Shambhal	221.334	15.65	111	15.5	0.7	357.0	1303.0	86.5	93.18
58	Sitapur	188.230	35.00	94	13.2	0.7	318.2	1161.6	73.5	79.24
59	Sultanpur	116.211	16.00	58	8.1	0.7	187.6	684.9	45.4	48.92
60	Ujhani	191.000	6.50	96	13.4	0.7	297.4	1085.6	74.6	80.41
61	Unnao	178.681	21.50	89	12.5	0.7	293.0	1069.5	69.8	75.22
62	Varansi	1435.113	79.79	718	100.5	0.7	2598.1	9482.9	560.7	604.15
Total		**29613.440**	**2869.73**	**14807**	**2072.9**	**43.4**	**54503.8**	**198939.0**	**11570.9**	**12466.63**

`

Table A2.04: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Uttar Pradesh in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Auraiya	70.515	4.00	35	4.9	0.7	108.3	395.2	27.6	29.69
02	Baghpat	50.380	2.83	25	3.5	0.7	76.7	280.0	19.7	21.21
03	Baheri	74.869	15.00	37	5.2	0.7	120.5	439.9	29.3	31.52
04	Balrampur	90.000	36.28	45	6.3	0.7	152.5	556.8	35.2	37.89
05	Bhadohi	94.563	8.00	47	6.6	0.7	148.3	541.3	36.9	39.81
06	Bisalpur	83.347	4.58	42	5.8	0.7	128.4	468.8	32.6	35.09
07	Chandpur	83.456	23.40	42	5.8	0.7	137.5	502.0	32.6	35.13
08	Chibramau	55.296	11.10	28	3.9	0.7	87.8	320.5	21.6	23.28
09	Chitrakoot	57.452	7.77	29	4.0	0.7	90.0	328.5	22.4	24.19
10	Dadri	91.345	6.50	46	6.4	0.7	142.2	519.2	35.7	38.45
11	Deoband	97.068	7.90	49	6.8	0.7	152.2	555.4	37.9	40.86
12	Faredpur	76.422	9.43	38	5.3	0.7	120.6	440.1	29.9	32.17
13	Gangaghat	84.301	4.91	42	5.9	0.7	130.2	475.1	32.9	35.49
14	Gangoh	59.463	6.00	30	4.2	0.7	92.4	337.1	23.2	25.03
15	Gola	53.842	10.08	27	3.8	0.7	85.2	310.9	21.0	22.67
16	Hasanpur	64.536	5.72	32	4.5	0.7	100.1	365.3	25.2	27.17
17	Jahangerabad	59.873	14.30	30	4.2	0.7	96.2	351.0	23.4	25.21
18	Jalaun	56.871	5.00	28	4.0	0.7	87.8	320.6	22.2	23.94
19	Kaimur	51.469	7.12	26	3.6	0.7	80.4	293.4	20.1	21.67
20	Kairana	95.092	7.11	48	6.7	0.7	148.5	542.1	37.2	40.03
21	Kannauj	71.727	70.70	36	5.0	0.7	128.4	468.5	28.0	30.20

Table continued to next page … … … …

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
22	Khatauli	72.478	3.76	36	5.1	0.7	111.1	405.5	28.3	30.51
23	Kiratpur	61.801	4.45	31	4.3	0.7	95.2	347.3	24.1	26.02
24	Konch	53.426	2.95	27	3.7	0.7	81.4	297.2	20.9	22.49
25	Laharpur	61.280	8.00	31	4.3	0.7	96.1	350.8	23.9	25.80
26	Mahoba	95.454	12.15	48	6.7	0.7	152.2	555.5	37.3	40.18
27	Mau Ranipur	58.456	5.53	29	4.1	0.7	90.6	330.6	22.8	24.61
28	Mawana	81.126	7.50	41	5.7	0.7	126.9	463.3	31.7	34.15
29	Mubarakpur	71.365	9.00	36	5.0	0.7	112.4	410.3	27.9	30.04
30	Nagina	71.350	10.30	36	5.0	0.7	113.0	412.3	27.9	30.04
31	Nazibabad	88.638	5.06	44	6.2	0.7	137.0	499.9	34.6	37.31
32	Obra	56.116	4.50	28	3.9	0.7	86.4	315.5	21.9	23.62
33	Pilkhuwa	81.651	5.80	41	5.7	0.7	126.7	462.4	31.9	34.37
34	Pratapgarh	76.750	12.00	38	5.4	0.7	122.3	446.4	30.0	32.31
35	Ramnagar	54.800	3.60	27	3.8	0.7	83.9	306.3	21.4	23.07
36	Rath	65.092	6.10	33	4.6	0.7	101.2	369.2	25.4	27.40
37	S R Nagar	94.563	8.00	47	6.6	0.7	148.3	541.3	36.9	39.81
38	Shahbad	80.305	9.70	40	5.6	0.7	126.8	463.0	31.4	33.81
39	Sherkot	62.148	6.00	31	4.4	0.7	96.5	352.3	24.3	26.16
40	Sikandrabad	80.309	1.14	40	5.6	0.7	120.3	439.2	31.4	33.81
41	Tanda	96.138	10.45	48	6.7	0.7	152.3	555.9	37.6	40.47
42	Tilhar	60.803	3.48	30	4.3	0.7	93.0	339.6	23.8	25.60
43	Vrindavann	62.926	13.49	31	4.4	0.7	100.8	367.9	24.6	26.49
Total		**3108.862**	**420.69**	**1554**	**217.6**	**30.1**	**4888.5**	**17843.0**	**1214.7**	**1308.77**

37. S R Nagar – Sant Ravidas Nagar

`

Table A2.05: Estimated Footprint,Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Himanchal Pradesh in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual			Estimated Per Capita Per Day	
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR	Energy Consumption in KWH (Unit of Electricity)	Expenditure in INR
	No Class I town											

Table A2.06: Estimated Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Himanchal Pradesh in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual			Estimated Per Capita Per Day	
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR	Energy Consumption in KWH (Unit of Electricity)	Expenditure in INR
	No Class II town											

`

Table A2.07: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Bahadur Garh	170.426	50.00	85	11.9	0.7	295.9	1080.2	66.6	71.75
02	Bhiwani	197.662	47.78	99	13.8	0.7	342.0	1248.2	77.2	83.21
03	Faridabad	1404.653	207.80	702	98.3	0.7	2848.4	10396.7	548.8	591.33
04	Gurgoan	901.968	37.10	451	63.1	0.7	1531.2	5588.9	352.4	379.71
05	Hisar	301.249	48.03	151	21.1	0.7	521.4	1903.3	117.7	126.82
06	Jagadhari	124.915	24.80	62	8.7	0.7	206.6	753.9	48.8	52.59
07	Jind	166.225	42.00	83	11.6	0.7	284.8	1039.4	64.9	69.98
08	Kaithal	144.633	45.75	72	10.1	0.7	249.4	910.3	56.5	60.89
09	Karnal	286.974	12.00	143	20.1	0.7	457.3	1669.0	112.1	120.81
10	Kurukshetra	154.962	34.50	77	10.8	0.7	261.7	955.3	60.5	65.24
11	Narnaul	134.067	41.10	67	9.4	0.7	229.3	836.9	52.4	56.44
12	Palwal	127.931	8.78	64	9.0	0.7	201.3	734.8	50.0	53.86
13	Panipat	294.15	41.40	147	20.6	0.7	503.4	1837.3	114.9	123.83
14	Rohtak	373.133	47.50	187	26.1	0.7	645.3	2355.3	145.8	157.08
15	Sonipat	292.339	52.80	146	20.5	0.7	509.9	1861.2	114.2	123.07
16	Yamuna Nagar	241.723	34.50	121	16.9	0.7	408.3	1490.2	94.4	101.76
Total		**5317.010**	**775.84**	**2659**	**372.2**	**11.2**	**9496.2**	**34661.0**	**2077.5**	**2238.37**

`

Table A2.08: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Hodal	50.003	5.39	25	3.5	0.7	77.4	282.5	19.5	21.05
02	Narvana	61.800	10.00	31	4.3	0.7	97.7	356.7	24.1	26.02
03	Sahadab	51.786	5.00	26	3.6	0.7	80.0	292.0	20.2	21.80
Total		**163.589**	**20.39**	**82**	**11.5**	**2.1**	**255.1**	**931.2**	**63.9**	**68.87**

Table A2.09: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	B J	197.150	6.70	99	13.8	0.7	307.3	1121.6	77.0	83.00
02	Burari	145.584	11.19	73	10.2	0.7	231.3	844.2	56.9	61.29
03	Dallo Pura	154.955	2.29	77	10.8	0.7	234.9	857.4	60.5	65.23
04	Delhi Cantt.	116.352	42.97	58	8.1	0.7	199.7	728.8	45.5	48.98
05	DMC	11007.835	431.09	5504	770.5	0.7	25094.0	91593.0	4301.1	4634.06

Table continued to next page … … … …

`

… … … … Table continued from previous page

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
06	Deoli	169.410	10.12	85	11.9	0.7	268.0	978.3	66.2	71.32
07	Gokalpur	121.938	2.32	61	8.5	0.7	184.9	674.9	47.6	51.33
08	Hastal	177.033	6.75	89	12.4	0.7	276.0	1007.4	69.2	74.53
09	Karawal Nagar	224.666	4.75	112	15.7	0.7	346.5	1264.9	87.8	94.58
10	K S N	282.598	4.74	141	19.8	0.7	435.9	1590.9	110.4	118.97
11	Mandoli	120.345	41.77	60	8.4	0.7	206.1	752.2	47.0	50.66
12	Mustafabad	127.012	1.29	64	8.9	0.7	190.7	695.9	49.6	53.47
13	Nangloi Jat	205.497	6.67	103	14.4	0.7	320.3	1168.9	80.3	86.51
14	NDMC	249.998	42.74	125	17.5	0.7	428.8	1565.2	97.7	105.24
15	Sultanpur Majra	181.624	2.86	91	12.7	0.7	276.6	1009.7	71.0	76.46
Total		**13482.000**	**618.25**	**6741**	**943.7**	**10.5**	**29001.0**	**105853.5**	**5267.9**	**5675.63**

1. B J- Bhalswa Jahangirpur
05. DMC (U) – Delhi Municipal Corporation
10. K S N – Kirari Suleman Nagar
14. NDMC – New Delhi Municipal Corporation

`

Table A2.10: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Babarpur	52.918	0.79	26	3.7	0.7	78.9	288.0	20.7	22.28
02	C S B	81.374	2.58	41	5.7	0.7	123.7	451.4	31.8	34.26
03	Gharoli	84.722	3.56	42	5.9	0.7	129.7	473.4	33.1	35.67
04	Jaffrabad	70.089	0.90	35	4.9	0.7	104.7	382.1	27.4	29.51
05	Khajoori Khas	55.006	0.94	28	3.9	0.7	82.2	300.0	21.5	23.16
06	Mithe Pur	49.583	1.81	25	3.5	0.7	74.8	273.2	19.4	20.87
07	Molar Band	49.439	4.12	25	3.5	0.7	76.0	277.3	19.3	20.81
08	Mundka	53.525	11.89	27	3.7	0.7	85.3	311.2	20.9	22.53
09	Pooth Kalan	61.727	6.97	31	4.3	0.7	96.3	351.6	24.1	25.99
10	Pulpehlad	64.484	2.16	32	4.5	0.7	97.6	356.4	25.2	27.15
11	S P G	52.730	1.05	26	3.7	0.7	78.9	288.0	20.6	22.20
12	Taj Pul	72.764	1.22	36	5.1	0.7	109.1	398.3	28.4	30.63
13	Tigri	54.774	1.05	27	3.8	0.7	82.0	299.2	21.4	23.06
14	Ziauddin Pur	58.661	1.80	29	4.1	0.7	88.5	323.1	22.9	24.70
Total		**861.796**	**40.84**	**431**	**60.3**	**9.8**	**1307.8**	**4773.4**	**336.7**	**362.82**

2. C S B – Chilla Saroda Bangar
11. S P G – Sadat Pur Gurjan

`

Table A2.11: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Rajasthan in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Ajmer	542.580	87.00	271	38.0	0.7	990.8	3616.3	212.0	228.41
02	Alwar	315.310	49.00	158	22.1	0.7	546.6	1995.3	123.2	132.74
03	Bahilwara	360.009	69.00	180	25.2	0.7	642.8	2346.2	140.7	151.56
04	Baran	118.157	72.36	59	8.3	0.7	211.9	773.5	46.2	49.74
05	Bharatpur	252.109	29.00	126	17.6	0.7	420.9	1536.4	98.5	106.13
06	Bundi	102.823	22.76	51	7.2	0.7	169.2	617.5	40.2	43.29
07	Chittaugarh	116.409	30.50	58	8.1	0.7	195.0	711.7	45.5	49.01
08	Dhaulpur	126.142	32.00	63	8.8	0.7	212.0	773.7	49.3	53.10
09	Gangapurcity	224.773	17.22	112	15.7	0.7	364.3	1329.6	87.8	94.62
10	Hindauncity	105.690	48.00	53	7.4	0.7	182.9	667.7	41.3	44.49
11	Jaipur	3073.350	485.00	1537	215.1	0.7	7159.8	26133.2	1200.9	1293.81
12	Jhunjhunun	118.966	50.00	59	8.3	0.7	206.6	754.0	46.5	50.08
13	Kishangarh	155.019	100.00	78	10.9	0.7	287.2	1048.3	60.6	65.26
14	Kota	1001.365	527.03	501	70.1	0.7	2369.9	8650.2	391.3	421.55
15	Nagaur	100.618	37.81	50	7.0	0.7	171.0	624.3	39.3	42.36
16	Sikar	237.579	39.90	119	16.6	0.7	405.4	1479.9	92.8	100.02
17	Swaimadhavpur	120.998	49.00	60	8.5	0.7	209.8	765.7	47.3	50.94
18	Tonk	165.363	16.00	83	11.6	0.7	267.0	974.6	64.6	69.61
19	Udaipur	451.735	56.91	226	31.6	0.7	792.9	2894.1	176.5	190.17
Total		**7688.995**	**1818.49**	**3844**	**538.2**	**13.3**	**15806.1**	**57692.1**	**3004.3**	**3236.89**

`

Table A2.12: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Rajasthan in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Jhalawara	66.500	12.95	33	4.7	0.7	106.3	388.1	26.0	28.00
02	Makrana	94.447	36.00	47	6.6	0.7	160.0	584.0	36.9	39.76
03	Nawalgarh	64.903	27.91	32	4.5	0.7	108.1	394.6	25.4	27.32
04	Nimbahera	61.000	12.74	31	4.3	0.7	97.5	355.7	23.8	25.68
Total		**286.850**	**89.60**	**143**	**20.1**	**2.8**	**471.9**	**1722.3**	**112.1**	**120.76**

Table A2.13: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Madhya Pradesh in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Bhind	197.332	17.79	99	13.8	0.7	320.3	1169.2	77.1	83.07
02	Bopal	1883.381	285.00	942	131.8	0.7	4003.5	14612.8	735.9	792.86

Table continued to next page … … … …

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
03	Chatarpur	147.688	54.00	74	10.3	0.7	258.1	942.0	57.7	62.17
04	Damoh	147.515	16.00	74	10.3	0.7	238.2	869.4	57.6	62.10
05	Datia	100.466	6.85	50	7.0	0.7	156.7	572.0	39.3	42.29
06	Dewas	289.438	102.00	145	20.3	0.7	537.4	1961.4	113.1	121.85
07	Guna	180.978	45.75	90	12.7	0.7	312.1	1139.0	70.7	76.19
08	Gwalior	1101.981	173.88	551	77.1	0.7	2180.9	7960.4	430.6	463.91
09	Indore	2167.447	131.17	1084	151.7	0.7	4140.5	15113.0	846.9	912.45
10	Jabalpur	1267.564	135.00	634	88.7	0.7	2429.8	8868.8	495.3	533.62
11	Katni	221.875	68.60	111	15.5	0.7	395.9	1445.2	86.7	93.40
12	Mandsour	141.468	36.00	71	9.9	0.7	239.6	874.7	55.3	59.55
13	Morena	200.506	12.00	100	14.0	0.7	319.5	1166.1	78.3	84.41
14	Neemuch	128.575	22.00	64	9.0	0.7	211.1	770.6	50.2	54.13
15	Pithampur	126.099	89.90	63	8.8	0.7	231.0	843.3	49.3	53.08
16	Ratlam	273.892	39.19	137	19.2	0.7	466.8	1703.8	107.0	115.30
17	Rewa	235.422	102.00	118	16.5	0.7	437.1	1595.4	92.0	99.11
18	Sagar	370.296	33.75	185	25.9	0.7	624.5	2279.4	144.7	155.89
19	Satna	283.004	12.00	142	19.8	0.7	450.9	1645.9	110.6	119.14
20	Sehore	1090.025	13.10	545	76.3	0.7	1743.6	6364.1	425.9	458.88
21	Shahdol	100.565	28.24	50	7.0	0.7	167.6	611.8	39.3	42.34
22	Shepour	105.026	5.00	53	7.4	0.7	162.2	592.2	41.0	44.21
23	Shivpuri	179.972	86.55	90	12.6	0.7	328.5	1198.9	70.3	75.76
24	Singrauli	220.295	280.66	110	15.4	0.7	467.2	1705.1	86.1	92.74

Table continued to next page ... ...

`

… … … Table continued from previous page

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
25	Tikamgarh	101.786	6.22	51	7.1	0.7	158.3	577.7	39.8	42.85
26	Ujjain	515.215	92.68	258	36.1	0.7	946.9	3456.2	201.3	216.89
27	Vidisha	155.959	8.83	78	10.9	0.7	245.5	895.9	60.9	65.66
	Total	**11933.770**	**1904.16**	**5967**	**835.4**	**18.9**	**22173.8**	**80934.5**	**4662.9**	**5023.85**

Table A2.14: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Madhya Pradesh in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Basoda	78.265	5.90	39	5.5	0.7	121.5	443.5	30.6	32.95
02	Bina	64.579	12.00	32	4.5	0.7	102.9	375.6	25.2	27.19
03	Dabra	61.260	12.00	31	4.3	0.7	97.6	356.3	23.9	25.79
04	Dhar	95.000	30.00	48	6.7	0.7	159.0	580.2	37.1	39.99
05	Jaora	65.111	5.54	33	4.6	0.7	100.9	368.2	25.4	27.41

Table continued to next page … … … …

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
06	Mandla	55.145	8.87	28	3.9	0.7	86.8	316.8	21.5	23.21
07	Narshimpur	59.858	14.71	30	4.2	0.7	96.3	351.4	23.4	25.20
08	Panna	50.432	4.50	25	3.5	0.7	77.7	283.5	19.7	21.23
09	Shajapur	70.000	11.16	35	4.9	0.7	111.2	405.9	27.4	29.47
10	Sidhi	54.317	12.31	27	3.8	0.7	86.6	316.3	21.2	22.87
	Total	**653.967**	**116.99**	**327**	**45.8**	**7.0**	**1040.4**	**3797.6**	**255.5**	**275.31**

Table A2.15: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Arrah	261.099	30.97	131	18.3	0.7	437.8	1598.0	102.0	109.92
02	Aurangabad	101.520	8.00	51	7.1	0.7	159.2	581.1	39.7	42.74
03	Bagaha	113.012	11.00	57	7.9	0.7	179.4	654.9	44.2	47.58

Table continued to next page ... ...

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
04	Begusarai	251.136	8.98	126	17.6	0.7	395.5	1443.6	98.1	105.72
05	Bettiah	132.896	11.55	66	9.3	0.7	211.4	771.7	51.9	55.95
06	B M C	398.138	30.17	199	27.9	0.7	666.4	2432.5	155.6	167.61
07	B M C	296.889	22.46	148	20.8	0.7	488.1	1781.5	116.0	124.98
08	Buxar	102.591	8.00	51	7.2	0.7	160.9	587.2	40.1	43.19
09	Chapra (NP)	201.597	16.96	101	14.1	0.7	326.5	1191.6	78.8	84.87
10	Darbhanga	294.116	19.18	147	20.6	0.7	479.3	1749.6	114.9	123.82
11	Dehri	137.068	21.32	69	9.6	0.7	224.7	820.1	53.6	57.70
12	D N	182.241	11.63	91	12.8	0.7	290.0	1058.5	71.2	76.72
13	Gaya	463.454	50.17	232	32.4	0.7	805.0	2938.3	181.1	195.10
14	Hajipur	147.126	19.64	74	10.3	0.7	240.1	876.3	57.5	61.94
15	Jamalpur	105.221	10.65	53	7.4	0.7	166.8	608.9	41.1	44.30
16	Jehanabad	102.456	20.23	51	7.2	0.7	167.5	611.2	40.0	43.13
17	Katihar	225.982	24.54	113	15.8	0.7	373.4	1363.1	88.3	95.13
18	Kishanganj	107.076	30.12	54	7.5	0.7	179.2	654.1	41.8	45.08
19	M T	105.000	8.50	53	7.4	0.7	165.0	602.3	41.0	44.20
20	Motihari	125.183	13.52	63	8.8	0.7	200.5	731.9	48.9	52.70
21	Munger	213.101	17.50	107	14.9	0.7	345.6	1261.6	83.3	89.71
22	Muzaffarpur	351.838	26.43	176	24.6	0.7	584.0	2131.7	137.5	148.12
23	Nawada	109.141	5.68	55	7.6	0.7	169.2	617.7	42.6	45.95
24	Patna	1683.200	108.34	842	117.8	0.7	3145.7	11482.0	657.7	708.59

Table continued to next page ... ...

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Liters	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
25	Purnia	280.547	44.52	140	19.6	0.7	482.7	1762.0	109.6	118.10
26	Saharsa	155.175	21.13	78	10.9	0.7	254.2	927.9	60.6	65.33
27	Sasaram	147.396	12.00	74	10.3	0.7	234.9	857.3	57.6	62.05
28	Siwan	134.458	15.68	67	9.4	0.7	216.9	791.7	52.5	56.60
Total		**6928.657**	**628.87**	**3464**	**485.0**	**19.6**	**11750.2**	**42888.1**	**2707.3**	**2916.83**

06. B M C – Bhagalpur Municipal Corporation
07. B M C – Biharsharif Municipal Corporation
12. DN – Dinapur Nizamat
19. MT – Madhubani Town

Table A2.16: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Araria	80.000	4.50	40	5.6	0.7	123.2	449.7	31.3	33.68
02	Barahiya	50.230	26.54	25	3.5	0.7	83.4	304.4	19.6	21.15

Table continued to next page ... ...

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
03	Barh	61.037	4.50	31	4.3	0.7	94.0	343.1	23.8	25.70
04	Bhabua	52.611	7.12	26	3.7	0.7	82.2	299.9	20.6	22.15
05	D M	67.995	11.30	34	4.8	0.7	108.1	394.4	26.6	28.62
06	Dumraon	57.716	15.33	29	4.0	0.7	93.0	339.4	22.6	24.30
07	Forbesganj	52.289	4.98	26	3.7	0.7	80.8	294.8	20.4	22.01
08	Gopalganj	66.624	11.11	33	4.7	0.7	105.8	386.2	26.0	28.05
09	Kaimur	51.469	7.12	26	3.6	0.7	80.4	293.4	20.1	21.67
10	Khagaria	56.978	2.97	28	4.0	0.7	86.9	317.0	22.3	23.99
11	Khagaul	60.866	5.32	30	4.3	0.7	94.2	343.8	23.8	25.62
12	Lakhisarai	98.123	24.79	49	6.9	0.7	162.2	592.2	38.3	41.31
13	Madhepura	56.739	25.84	28	4.0	0.7	94.1	343.3	22.2	23.89
14	Masaurhi	57.012	9.43	29	4.0	0.7	90.0	328.3	22.3	24.00
15	Mokameh	71.335	14.18	36	5.0	0.7	114.5	418.0	27.9	30.03
16	Narkatiaganj	51.446	10.96	26	3.6	0.7	81.7	298.1	20.1	21.66
17	Phulwari Sharif	67.348	6.48	34	4.7	0.7	104.9	382.7	26.3	28.35
18	Raxaul Bazar	52.429	5.82	26	3.7	0.7	81.4	296.9	20.5	22.07
19	Samastipur	70.042	3.45	35	4.9	0.7	107.1	391.1	27.4	29.49
20	Shekhpura	54.322	15.58	27	3.8	0.7	87.6	319.7	21.2	22.87
21	Sitamarhi	87.279	8.00	44	6.1	0.7	136.9	499.6	34.1	36.74
22	Sultanganj	52.867	12.29	26	3.7	0.7	84.3	307.8	20.7	22.26
23	Supaul	85.200	22.37	43	6.0	0.7	140.0	511.1	33.3	35.87
Total/Range		**1461.957**	**259.98**	**731**	**102.3**	**16.1**	**2316.5**	**8455.2**	**571.2**	**615.48**

05. D M – Digha-Mainpura

`

Table A2.17: Estimated LandFootprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Chhatisgarh in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Ambikapur	114.575	9.39	57	8.0	0.7	180.7	659.7	44.8	48.23
02	Bhilai Nagar	625.697	141.30	313	43.8	0.7	1206.1	4402.1	244.5	263.40
03	Bilaspur	330.106	37.56	165	23.1	0.7	560.9	2047.2	129.0	138.97
04	Durg	268.679	66.09	134	18.8	0.7	477.8	1744.1	105.0	113.11
05	Jagdalpur	125.345	22.49	63	8.8	0.7	206.1	752.2	49.0	52.77
06	Korba	363.210	215.02	182	25.4	0.7	740.1	2701.4	141.9	152.90
07	Raigarh	137.097	20.68	69	9.6	0.7	224.3	818.9	53.6	57.71
08	Raipur	1010.087	108.66	505	70.7	0.7	1888.4	6892.6	394.7	425.22
09	Rajnandgaon	163.122	78.09	82	11.4	0.7	294.7	1075.6	63.7	68.67
Total/Range		**3137.918**	**699.28**	**1569**	**219.7**	**6.3**	**5779.1**	**21093.9**	**1226.1**	**1320.98**

Table A2.18 Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Chhatisgarh in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Bhatapara	54.846	30.42	27	3.8	0.7	91.9	335.3	21.4	23.09
02	Bhilai Charoda	95.848	141.30	48	6.7	0.7	184.8	674.3	37.5	40.35
03	Chirmiri	99.934	64.94	50	7.0	0.7	177.5	647.7	39.0	42.07
04	Dalli-Rajhara	55.684	37.25	28	3.9	0.7	94.6	345.1	21.8	23.44
05	Dhamtari	89.857	23.40	45	6.3	0.7	148.1	540.5	35.1	37.83
06	Mahasamund	51.543	14.68	26	3.6	0.7	82.9	302.5	20.1	21.70
Total/Range		**447.712**	**311.99**	**224**	**31.3**	**4.2**	**779.6**	**2845.4**	**174.9**	**188.48**

Table A2.19: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Aditya	173.988	49.82	87	12.2	0.7	302.0	1102.5	68.0	73.25
02	Bhuli	110.127	11.74	55	7.7	0.7	175.3	639.9	43.0	46.36
03	Bokaro	413.934	162.91	207	29.0	0.7	812.3	2964.8	161.7	174.26

Table continued to next page … … … …

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
04	Chas	141.618	20.49	71	9.9	0.7	231.6	845.4	55.3	59.62
05	Deoghar	203.116	14.00	102	14.2	0.7	325.9	1189.5	79.4	85.51
06	Dhanbad	1161.561	23.39	581	81.3	0.7	1914.1	6986.4	453.9	488.99
07	Giridih	114.447	9.75	57	8.0	0.7	180.8	660.0	44.7	48.18
08	Hazaribag	142.494	26.37	71	10.0	0.7	236.5	863.2	55.7	59.99
09	JNAC	629.659	59.80	315	44.1	0.7	1109.9	4051.3	246.0	265.07
10	Jharia	100.839	4.42	50	7.1	0.7	155.2	566.6	39.4	42.45
11	Jorapokhar	104.673	16.40	52	7.3	0.7	169.2	617.7	40.9	44.07
12	MNAC	224.002	19.45	112	15.7	0.7	365.3	1333.5	87.5	94.30
13	Phusro	102.673	40.64	51	7.2	0.7	175.5	640.4	40.1	43.22
14	Ranchi	1073.440	177.19	537	75.1	0.7	2129.8	7773.6	419.4	451.89
15	Saunda	104.642	24.26	52	7.3	0.7	172.8	630.7	40.9	44.05
Total/Range		**4801.213**	**660.63**	**2401**	**336.1**	**10.5**	**8456.3**	**30865.4**	**1876.0**	**2021.21**

09. JNAC – Jamshedpur Notified Area Committee
12. MNAC – Mango Notified Area Committee

`

Table A2.20: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Bagbera	82.559	10.70	41	5.8	0.7	130.9	477.9	32.3	34.76
02	Bhowrah	54.483	15.73	27	3.8	0.7	87.9	320.8	21.3	22.94
03	Bhuli	99.990	8.60	50	7.0	0.7	157.2	573.9	39.1	42.10
04	Chaibasa	78.287	11.11	39	5.5	0.7	124.3	453.8	30.6	32.96
05	Chatra	51.685	3.45	26	3.6	0.7	79.1	288.6	20.2	21.76
06	Daltonganj	87.849	14.00	44	6.1	0.7	140.9	514.5	34.3	36.98
07	Dumka	55.336	6.12	28	3.9	0.7	86.0	313.9	21.6	23.30
08	Gumia	56.024	26.11	28	3.9	0.7	92.9	339.2	21.9	23.58
09	Jhumri Tilaiya	85.489	51.14	43	6.0	0.7	148.7	542.8	33.4	35.99
10	Jugsalai	56.720	3.69	28	4.0	0.7	86.9	317.2	22.2	23.88
11	Katras	63.017	5.00	32	4.4	0.7	97.3	355.3	24.6	26.53
12	Lohardaga	56.821	14.57	28	4.0	0.7	91.3	333.4	22.2	23.92
13	Madhupur	58.211	18.36	29	4.1	0.7	94.6	345.5	22.7	24.51
14	Ramgarh Cantt.	90.324	34.46	45	6.3	0.7	152.5	556.8	35.3	38.02
15	Sahibganj	98.589	8.98	49	6.9	0.7	155.3	566.7	38.5	41.50
16	Sindri	94.398	46.65	47	6.6	0.7	163.0	595.0	36.9	39.74
17	Tisra	65.894	14.02	33	4.6	0.7	105.7	385.9	25.7	27.74
Total/Range		**1235.676**	**292.69**	**618**	**86.5**	**11.9**	**1994.8**	**7281.2**	**482.8**	**520.21**

`

Table A2.21: Estimated LandFootprint, Energy Consumption and Expenditure on Solid Waste Management in Class I Towns (Population > 0.1 Million) of West Bengal in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Alipurduar	127.342	9.80	64	8.9	0.7	201.2	734.5	49.8	53.61
02	Asansol	564.491	127.87	282	39.5	0.7	1075.1	3924.2	220.6	237.64
03	A-K	123.906	18.44	62	8.7	0.7	201.5	735.5	48.4	52.16
04	Baidyabati	121.081	7.89	61	8.5	0.7	189.8	692.7	47.3	50.97
05	Bally	115.715	11.68	58	8.1	0.7	184.2	672.2	45.2	48.71
06	Balurghat	151.183	10.46	76	10.6	0.7	239.5	874.2	59.1	63.64
07	Bangaon	110.668	24.70	55	7.7	0.7	183.0	667.8	43.2	46.59
08	Bankura	138.036	19.06	69	9.7	0.7	224.9	820.8	53.9	58.11
09	Bansberia	103.799	9.07	52	7.3	0.7	163.5	596.9	40.6	43.70
10	Bara Nagar	248.466	7.12	124	17.4	0.7	388.1	1416.4	97.1	104.60
11	Barasat	283.443	34.50	142	19.8	0.7	478.7	1747.4	110.8	119.32
12	Bardhaman	314.638	26.30	157	22.0	0.7	522.1	1905.7	122.9	132.46
13	Barrackpore	154.475	11.65	77	10.8	0.7	245.8	897.3	60.4	65.03
14	Basirhat	127.135	22.50	64	8.9	0.7	209.0	763.0	49.7	53.52
15	Beharampore	195.363	31.43	98	13.7	0.7	327.9	1196.8	76.3	82.24
16	Bhadreswar	101.334	8.28	51	7.1	0.7	159.1	580.7	39.6	42.66
17	Bhatpara	390.467	30.42	195	27.3	0.7	654.0	2386.9	152.6	164.38
18	Bidhannagar	218.323	30.00	109	15.3	0.7	365.3	1333.4	85.3	91.91
19	Chakdaha	132.855	15.54	66	9.3	0.7	214.2	781.9	51.9	55.93

Table continued to next page … … … …

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
20	Champadani	110.983	6.47	55	7.8	0.7	172.8	630.7	43.4	46.72
21	Chandernagore	166.949	22.03	83	11.7	0.7	274.2	1000.7	65.2	70.28
22	Chinsurah	180.502	17.24	90	12.6	0.7	292.5	1067.8	70.5	75.99
23	Darjiling	120.414	10.57	60	8.4	0.7	190.9	696.6	47.0	50.69
24	Dhulian	239.022	10.27	120	16.7	0.7	378.4	1381.2	93.4	100.62
25	Durgapur	566.937	1.10	283	39.7	0.7	849.0	3099.0	221.5	238.67
26	Habra	149.675	21.80	75	10.5	0.7	245.6	896.6	58.5	63.01
27	Haldia	200.762	104.90	100	14.1	0.7	373.9	1364.7	78.4	84.52
28	Halisahar	126.893	8.28	63	8.9	0.7	199.2	727.2	49.6	53.42
29	H-C	177.209	8.29	89	12.4	0.7	278.3	1015.6	69.2	74.60
30	Jalpaiguri	107.351	12.50	54	7.5	0.7	171.4	625.5	41.9	45.19
31	Jamuria	144.791	73.23	72	10.1	0.7	260.0	948.9	56.6	60.95
32	Jangipore	122.875	7.86	61	8.6	0.7	192.6	702.9	48.0	51.73
33	Kalyani	100.62	21.91	50	7.0	0.7	165.2	602.9	39.3	42.36
34	Kamarhati	336.579	20.48	168	23.6	0.7	550.5	2009.3	131.5	141.69
35	Kanchapara	122.181	29.21	61	8.6	0.7	204.1	744.9	47.7	51.44
36	Kharagpur	206.923	90.65	103	14.5	0.7	379.4	1384.9	80.9	87.11
37	Khardaha	111.13	10.96	56	7.8	0.7	176.4	643.9	43.4	46.78
38	Kolkata	4486.689	185.00	2243	314.1	0.7	8953.5	32680.2	1753.1	1888.80
39	Konnagar	124.585	9.07	62	8.7	0.7	196.3	716.4	48.7	52.45
40	Krishnanagar	181.182	6.87	91	12.7	0.7	282.6	1031.6	70.8	76.27

Table continued to next page ... ...

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
41	Madhyamgram	198.964	21.32	99	13.9	0.7	326.1	1190.4	77.7	83.76
42	Mahestala	449.423	21.50	225	31.5	0.7	737.0	2690.1	175.6	189.20
43	Medinipur	169.127	14.78	85	11.8	0.7	272.0	993.0	66.1	71.20
44	Nabadwip	125.528	11.66	63	8.8	0.7	199.8	729.2	49.0	52.84
45	Naihati	221.762	11.55	111	15.5	0.7	352.8	1287.7	86.6	93.36
46	N B	134.825	17.17	67	9.4	0.7	218.5	797.4	52.7	56.76
47	NDD	253.625	26.45	127	17.8	0.7	421.0	1536.7	99.1	106.77
48	Panihati	383.522	6.89	192	26.8	0.7	598.3	2184.0	149.9	161.45
49	Puruliya	121.436	13.90	61	8.5	0.7	194.8	710.9	47.4	51.12
50	Raiganj	183.682	10.64	92	12.9	0.7	291.2	1062.9	71.8	77.33
51	R G	404.991	28.00	202	28.3	0.7	674.7	2462.6	158.2	170.49
52	R S	423.806	49.25	212	29.7	0.7	735.0	2682.9	165.6	178.41
53	Rana Ghat	235.583	7.72	118	16.5	0.7	369.0	1346.8	92.0	99.18
54	Raniganj	128.624	23.44	64	9.0	0.7	212.0	773.7	50.3	54.15
55	Rishra	124.591	6.48	62	8.7	0.7	194.0	708.0	48.7	52.45
56	Santipur	151.774	24.60	76	10.6	0.7	250.8	915.6	59.3	63.89
57	Serampore	183.339	14.50	92	12.8	0.7	294.6	1075.4	71.6	77.18
58	Siliguri	509.709	41.90	255	35.7	0.7	873.0	3186.5	199.2	214.58
59	S D D	410.524	17.39	205	28.7	0.7	665.6	2429.6	160.4	172.82
60	Titagarh	118.426	3.24	59	8.3	0.7	180.9	660.2	46.3	49.85

Table continued to next page ... ...

`

... ... *Table continued from previous page*

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
61	Uluberia	221.175	33.72	111	15.5	0.7	373.0	1361.4	86.4	93.11
62	Uttarpara K	162.386	16.34	81	11.4	0.7	262.5	958.0	63.4	68.36
Total/Range		**17123.790**	**1557.84**	**8561.9**	**1198.7**	**43.4**	**29710.4**	**108443.0**	**6690.8**	**7208.73**

03. A K – Ashokenagar-Kalyangarh
29. H C – Hooghly- Chinsurah
46. N B – New Barrackpore
47. NDD – North Dum Dum
51. R G – Rajarhat Gopalpur
52. R S – Rahjpur Sonarpur
59. S D D – South Dum Dum
62. Uttapara K – Uttapara Kotrung

`

Table A2.22: Estimated Land Footprint, Energy Consumption and Expenditure on Solid Waste Management in Class II Towns (Population between 0.05 and 0.1 Million) of West Bengal in NRGB

S No	Town	Population in Thousands	Town Area in Km^2	Estimated Waste Generation in MT/d	Estimated Land Footprint in Ha	Estimated Land Required Per Capita in m^2	Estimated Daily Fuel Demand in Litres	Estimated Annual		
								Fuel Consumption in MWH	Energy Consumption in MWH	Expenditure on Solid Waste Management in Millions of INR
01	Arambagh	67.000	34.75	34	4.7	0.7	113.2	413.3	26.2	28.21
02	Baduria	52.500	22.43	26	3.7	0.7	86.3	315.0	20.5	22.10
03	Bankra	55.229	3.59	28	3.9	0.7	84.6	308.7	21.6	23.25
04	Baruipur	53.500	9.50	27	3.7	0.7	84.4	308.2	20.9	22.52
05	Bishnupur	70.620	22.01	35	4.9	0.7	116.0	423.3	27.6	29.73
06	Bolpur	74.890	10.73	37	5.2	0.7	118.8	433.5	29.3	31.53
07	Budge Budge	76.858	9.06	38	5.4	0.7	121.1	442.0	30.0	32.36
08	Chittaranjan	52.391	19.65	26	3.7	0.7	85.5	312.1	20.5	22.06
09	Contai	88.365	14.25	44	6.2	0.7	141.9	517.9	34.5	37.20
10	Gangarampur	61.028	10.29	31	4.3	0.7	96.6	352.7	23.8	25.69
11	Garulia	91.116	5.38	46	6.4	0.7	141.0	514.8	35.6	38.36
12	Gayeshpur	65.398	30.00	33	4.6	0.7	109.4	399.4	25.6	27.53
13	Gobardanga	57.878	13.50	29	4.1	0.7	92.7	338.4	22.6	24.37
14	J-A Ganj	51.790	11.66	26	3.6	0.7	82.4	300.8	20.2	21.80
15	Katwa	81.510	7.93	41	5.7	0.7	127.8	466.4	31.8	34.31
Total/Range		**1000.073**	**224.73**	**500**	**70.0**	**10.5**	**1601.7**	**5846.4**	**390.8**	**421.02**

14. J-A Ganj – Jiyaganj-Azimganj

Assessment of Domestic Pollution Load from Urban Agglomeration in Yamuna Sub-Basin (Ganga Basin)

GRBMP: Ganga River BasinManagement Plan

by

Consortium of 7 "Indian Institute ofTechnology" s (IITs)

IIT Bombay | IIT Delhi | IIT Guwahati | IIT Kanpur | IIT Kharagpur | IIT Madras | IIT Roorkee

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 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 (GRBMP). 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 GRBMP. 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. A list of persons who have contributed directly and names of those who have taken lead in preparing this report is given on the reverse side.

Dr Vinod Tare
Professor and Coordinator
Development of GRBMP
IIT Kanpur

The Team

1. A AKazmi, IIT Roorkee *kazmifce@iitr.ernet.in*
2. A K Gupta, IIT Kharagpur *akgupta18@rediffmail.com,akgupta@iitkgp.ac.in*
3. A K Mittal, IIT Delhi *akmittal@civil.iitd.ernet.in*
4. A K Nema, IIT Delhi *aknema@gmail.com*
5. Ajay Kalmhad, IIT Guwahati *kajay@iitg.ernet.in*
6. Anirban Gupta, BESU Shibpur *guptaanirban@hotmail.com*
7. Arun Kumar, IIT Delhi *arunku@civil.iitd.ac.in*
8. G J Chakrapani, IIT Roorkkee *gjcurfes@iitr.ernet.in*
9. GazalaHabib, IIT Delhi *gazalahabib@gmail.com*
10. Himanshu Joshi, IIT Roorkee *himanshujoshi58@gmail.com*
11. InduMehrotra, IIT Roorkee *indumfce@iitr.ernet.in*
12. I M Mishra, IIT Roorkee *imishfch@iitr.ernet.in*
13. Ligy Philip, IIT Madras *ligy@iitm.ac.in*
14. M MGhangrekar, IIT Kharagpur *ghangrekar@civil.iitkgp.ernet.in*
15. MukeshDoble, IIT Bombay *mukeshd@iitm.ac.in*
16. P K Singh, IT BHU *dr_pksingh1@rediffmail.com*
17. Purnendu Bose, IIT Kanpur *pbose@iitk.ac.in*
18. R Ravi Krishna, IIT Madras *rrk@iitm.ac.in*
19. Rakesh Kumar, NEERI Nagpur *r_kumar@neeri.res.in*
20. S M Shivnagendra, IIT Madras *snagendra@iitm.ac.in*
21. SaumyenGuha, IIT Kanpur *sguha@iitk.ac.in*
22. Shyam R Asolekar, IIT Bombay *asolekar@iitb.ac.in*
23. SudhaGoel, IIT Kharagpur *sudhagoel@civil.iitkgp.ernet.in*
24. Suparna Mukherjee, IIT Bombay *mitras@iitb.ac.in*
25. T R Sreekrishanan, IIT Delhi *sree@dbeb.iitd.ac.in*
26. Vinod Tare, IIT Kanpur *vinod@iitk.ac.in*
27. Vivek Kumar, IIT Roorkee *vivekfpt@iitr.ernet.in*

Lead Authors

1. Vinod Tare, IIT Kanpur
2. Purnendu Bose, IIT Kanpur
3. Vishal Kapoor, IIT Kanpur
4. Suresh Kr Gurjar, IIT Kanpur
5. Abhishek Gaur, IIT Kanpur

Contents

1. Introduction

River Yamuna, the largest tributary (1,376 km) of river Ganga, originates from Yamunotri glacierat Bandar Punch in the region of Mussourie range at 6,387 m above mean sea-level (msl), in the lower Himalayas. After flowing through the Sivaliks, river Yamuna emerges on the plains near Tajewala at 370 m (msl). The river then flows south-west to southwards for 224 km to enter the National Capital Territory of Delhi at 215 m (msl). After meandering through Delhi for about 22 km to Okhla, the river continues southwards for 272 km to Agra (146 m msl) and then turns south-east until its confluence with the River Ganga at Allahabad (100 m msl). All along its 1,170 km flow through the Gangetic plain, the average slope of the river bed decreases from about 0.56 m/km between Tajewala and Delhi to less than 20 cm/km between Delhi and Agra before becoming less than 5 cm/km thereafter, merging with the Ganges at Allahabad (Gopal and Sah, 1993).It has a total catchment area of 366,223 km^2.The total catchment basin of the river Yamuna is 42.5% of the Ganga basin and 11% of the total geographical landmass of the country (Gopal and Sah, 1993). Yamuna flows through the states of Delhi, Haryana and Uttar Pradesh. The total catchment area of the river Yamuna liesin the states of Uttarakhand, Uttar Pradesh, Himachal Pradesh, Haryana, Rajasthan, Madhya Pradesh and Delhi. The statewise percent categorization of the Yamuna basinarea are represented in Table 1. Major sub-basins in Yamuna basin is illustrated in Figure 1 while state-wise contribution in the basin is presented in Figure 2.

Table 1:State-wise Distribution of the Yamuna River Basin Area

State/ Union Territory	Total Geographical Area (sq. km)	Yamuna Catchment Area in the State (sq. km)
Uttarakhand	53,483	3,771
Uttar Pradesh	240,928	70,437
Himachal Pradesh	55,673	5,799
Haryana	44,212	21,265
Rajasthan	342,239	102,883
Madhya Pradesh	308,252	140,208
Delhi	1,484	1,484

*Misra and Mishra, 2014

Based on the hydrological and geo-morphological information river Yamuna can be sub-divided into 5 sub stretches (CPCB, 2006):

a) Himalayan stretch from origin to Tajewala barrage (172 kms.) (YR1)
b) Upper stretch Tajewala barrage to Wazirabad barrage (224 kms.) (YR2)
c) Delhi stretch Wazirabad barrage to Okhla barrage (22 kms.) (YR3)
d) Eutrophic stretch Okhla barrage to Chambal confluence (490 kms.) (YR4)
e) Diluted stretch Chambal confluence to Ganga confluence (468 kms.) (YR5)

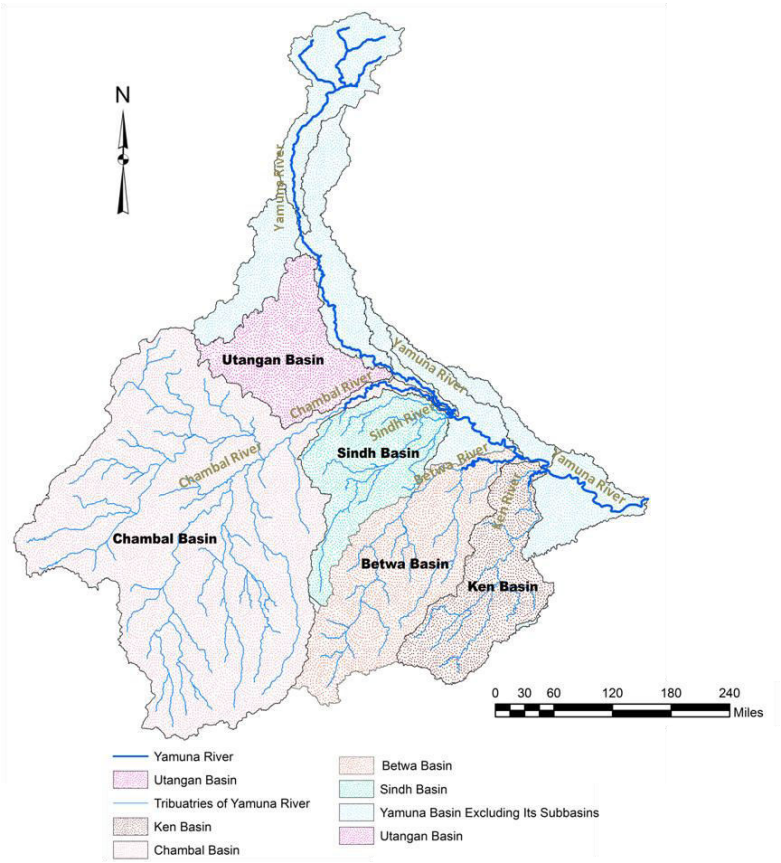


Figure 1: Major Sub-Basins inYamuna River Basin

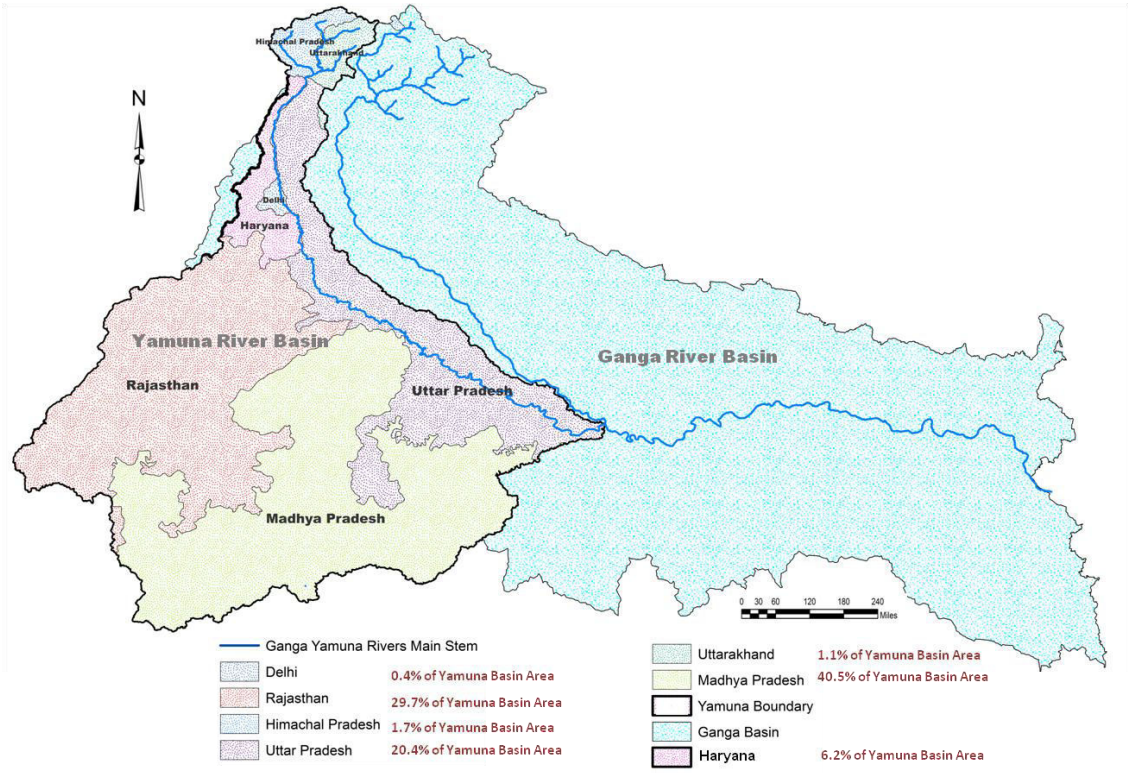


Figure 2: Major States ContributinginYamuna River Basin

1.1. Salient Features of River Yamuna and its Tributaries

Several tributaries join river Yamuna along its path, transforming it into a fourth-order river. Several major tributaries join river Yamuna in the Gangetic plain. Its major tributaries and sub-tributaries of the Himalayan region are Tons, Asan, Giri and Pabbar while at plains it receives waters from Hindon, Betwa, Chambal, Ken, Senger and Sind River. The tributaries cater to a major portion (70.9%) of the catchment area, the balance (i.e., 29.1%) area is directly drained into Yamuna or is drained by smaller streams. The salient features of all the major tributaries of river Yamuna are described in Table 2. River Chambal, well known for its deep ravines, is the largest of these tributaries, with a catchment area of about 40% of the Yamuna river basin.

1.2. Physical Conditions of the River Yamuna

The Himalayan part of the basin experiences very low winter temperatures and high rainfall (1,200 to > l,600 mm). In the plains, peak temperature rise above 45°C during summer (late May-June), but during winter the temperature (average 2-9°C December-January) rarely drops below the freezing-point (Gopal, 2003). The soils of the Yamuna basin vary considerably, as they have developed under different lithological, climatic, and pedogenetic, conditions (Raychaudhury et al., 1963). River bed of the upper Yamuna is primarily sandy in texture having sand in the range of 70.52-74.76%, silt in the range of 17.74-18.56% and clay in the range of 7.35-11.55%. Due to large variation in climate and soils, the natural vegetation is also highly variable in the Yamuna river basin (Mathur and Kapoor, 2013).

Table 2: Tributaries of River Yamuna

	Tributaries at the Mountainous stretches				
Characteristics	**Tons**	**Asan**	**Giri**	**Pabbar**	**Paisuni**
Position	Right bank tributary	Left bank tributary	Right bank tributary	Right bank tributary of Tons River	Right bank tributary
Region of origin	Banderpunchh Mountain	Chandrabani Village at the base of Siwalik	Kharapathar, Jubbal Tehsil of District Shimla	Gangadari Dhar (Chander Nahan) ranges of Himalaya	Kaimur hills of Vindhyan range
Mouth	Asan	Yamuna	Yamuna	Tons	Yamuna
Total catchment area (sq km)	16,860	654.47	2,600	1,200	-
Length (km)	150	42	155*	87*	100
River bed	Stones, Sand	Gravels, Course fractions, Boulders, Sand	-	-	Stones, Sand, Mud

	Tributaries at the Plains				
Characteristics	**Hindon**	**Chambal**	**Sind**	**Betwa**	**Ken**
Position	Left bank tributary	Right bank tributary	Right bank tributary	Right bank tributary	Right bank tributary
Region of origin	Sivalik hills	North wards slope of the Vindhyan mountains in native state of Indore (M.P.)	North wards slope of the Vindhyan mountains originates at Hatoli (District Vidisha)	North wards slope of the Vindhyan mountains	North Western slope of the Vindhyan mountains in native state of Bhopal
Mouth	Yamuna	Yamuna	Yamuna	Yamuna	Yamuna
Total catchment area (sq km)	7,083	143,219	27,940	46,580	28,224
Length (km)	400	960	415	590	360
River bed	Sand	Stony rapid, sand banks and gravel bars, alkaline and saline soils	-	Stones, Sand, Riffle and Pools; Pebbles and Cobble	Rocks, Stones, Sand

Gopal and Sah (1993); Dwivedi (2006); Chauhan et al. (2014): Garg et al. (2012): * approx measured length of the river

2.Major Obstruction and Abstraction Projects Executed in the Yamuna basin

In the Himalayan segment from the source (Yamunotri Glacier) to Indo-Gangetic plains at Dak Patthar in Uttaranchal the river water quality is good and it meets most of the water quality standards. The major water quality problems arise afterwards due to the flow regulation of river through dams and barrages and the stretches downstream to the dams are devoid of water or having very less water. The water of river Yamuna is abstracted at different locations for multiple uses. The flows are dissected at 5 barrages during its course *i.e.,* at Dakpathar; Hathnikund; Wazirabad;Okhla; and at Mathura (Gokul barrage).The river water is regulated for irrigation and power generationwithin the segment in Hathnikund/Tajewala in Yamuna Nagar district of Haryana state, and almost all water is diverted into Eastern Yamuna Canal (EYC) and Western Yamuna Canal (WYC). The stretch is devoid of water during summer and winters downstream of Hathnikund barrage. The statistical interpretation revealed that decadal average flow in the river downstream of Hathnikund barrage at Yamuna Nagar reducing to around 3,000 cumecs in 2000-08 from over 15,000 cumecs in 1961-70 (Panwar, 2009).

Downstream of Hathnikund the river regains water from ground water accrual and contributions of feeding canals and small tributaries etc. From Hathnikund the river sluggishly meanders and reaches Delhi at Palla after travelling a distance of about 224 km. At Wazirabad the river is trapped again through a barrage for drinking water supply to urban agglomeration at Delhi. From Wazirabad barrage no river water is allowed to flow

down particularly during summer, as the available water in the river is not adequate to fulfill the water supply demand of Delhi. The water flowing in the Yamuna River downstream of Wazirabad is the treated, partiallytreated or untreated domestic & industrial wastewater contributed by various drains joining river Yamuna and canal water. After 22 km downstream from Wazirabad barrage the Yamuna water is again blocked and diverted into Agra Canal for irrigation through another barrage at Okhla. Similar to what happens downstream of Wazirabad, downstream of Okhla barrage the water flows in the river is the drain water of domestic & industrial origin contributed mainly by Shahdara drain. After travelling a distance of around 166 km, the river reaches Mathura from where again a major part of water is diverted for drinking water supply through Gokul barrage. The Yamuna from Gokul barrage, after receiving water through other important tributaries and city drains, joins river Ganga at Allahabad after traversing about 790 km via cities of Agra, Bateshwar, Etawah, Hamirpur and Pratapgarh (CPCB, 2006).The points of abstraction and addition in water of Yamuna River are shown in Figure 3. A list of the dams and barrages construted under the Yamuna basin are presented in Table 3.

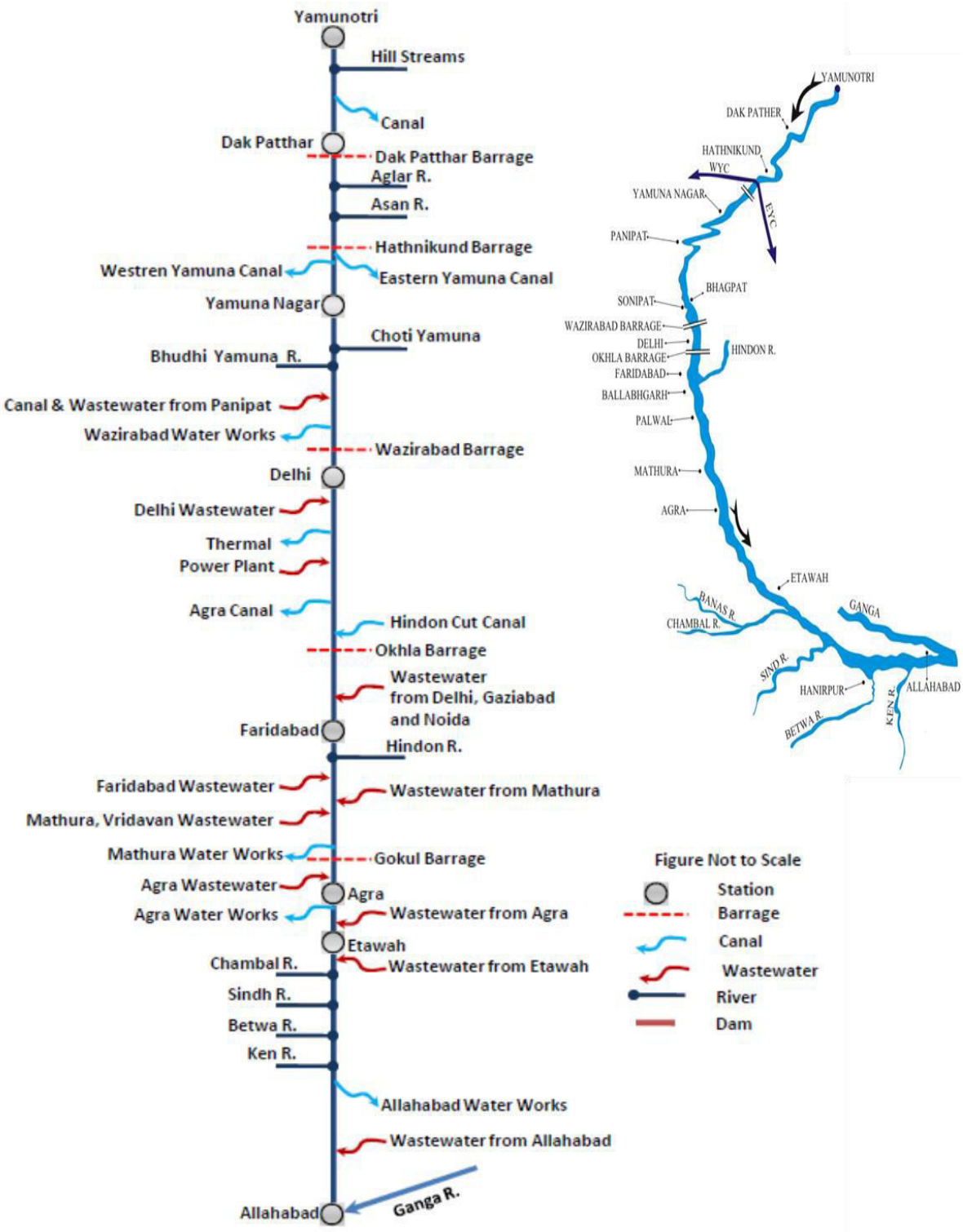


Figure 3: Line-digram Depicting Points of Water Abstraction and Additions from/in Yamuna River

Table 3: Details of Major Dams/ Barrages/ Weirs on River Yamuna and its Tributaries

Projects	River	State	Year of Completion	Status	Remark
Lakhwar Dam	Yamuna	Uttarakhand	-	U/C	Hydroelectric, Irrigation
Dakpathar Barrage	Yamuna	Uttarakhand	1965	On	Hydroelectric
Tajewala barrage	Yamuna	Haryana	1873	On	Irrigation
Asan Barrage	Asan	Uttarakhand-Himachal Pradesh border region	1975	On	Hydroelectric
Khara Dam	Ahsan	Uttar Pradesh	1992	On	Hydroelectric
Hathni Kund Barrage	Yamuna	Haryana	1999	On	Irrigation
Gunta Dam	Gunta Nala (Yamuna)	Uttar Pradesh	2003	On	Irrigation
Gandhi Sagar Dam	Chambal	Madhya Pradesh	1960	On	Hydroelectric, Irrigation
Rana Pratap Sagar Dam	Chambal	Rajasthan	1970	On	Hydroelectric
Jawahar Sagar Dam	Chambal	Rajasthan	1972	On	Hydroelectric
Kota Barrage	Chambal	Rajasthan	1960	On	Irrigation
Gangau Weir	Ken	Madhya Pradesh	1915	On	Irrigation
Rangwan Dam	Ken	Madhya Pradesh	1957	On	Irrigation
Bariyarpur Weir	Ken	Madhya Pradesh	1905	On	Irrigation
Kishau Dam	Tons	Uttarakhand-Himachal Pradesh border region	-	U/C	Hydroelectric, Irrigation
Ichari Dam	Tons	Uttarakhand	1972	On	Hydroelectric
Rohini Dam	Rohini	Uttar Pradesh	1984	On	Irrigation
Parichha Dam	Betwa	Uttar Pradesh	1885	On	Irrigation
Dhukwan Dam	Betwa	Uttar Pradesh	1909	On	Irrigation
Matatila Dam	Betwa	Uttar Pradesh	1964	On	Hydroelectric, Irrigation
Rajghat Dam	Betwa	Madhya Pradesh-Uttar Pradesh border region	2006	On	Hydroelectric, Irrigation
Betwa Barrage	Betwa	Madhya Pradesh	-	On	Irrigation
Jamini Dam	Jamini	Uttar Pradesh	1973	On	Irrigation
Bhaunrat Dam	Jamini	Uttar Pradesh	-	On	Irrigation
Giri Dam	Giri	Himachal Pradesh	-	On	Hydroelectric, Irrigation
Renuka Ji Dam	Giri	Himachal Pradesh	2014	On	Hydroelectric, Irrigation
Sawra Kuddu Dam	Pabbar	Himachal Pradesh	2010	-	Hydroelectric
Dhamwari Sunda Barrage	Pabbar	Himachal Pradesh	-	-	Hydroelectric
Sainj Barrage	Sainj	Himachal Pradesh	-	-	Hydroelectric
Madikheda Dam	Sind	Madhya Pradesh	2008	On	Hydroelectric, Irrigation

India-WRIS (2015); U/C: Under construction

3. Demographic Profile of Yamuna Basin

As per estimation based on Census 2011 the Yamuna basin accommodates 84 Class I cities, 69 Class II towns and 229 Class III towns.These cities/ towns belong to of the states ofUttaranchal, Uttar Pradesh, Himachal Pradesh, Haryana, Rajasthan, Madhya Pradesh and Delhi.The total population of the basin is estimated to be 127 million (according to Census 2001). Population-wise the major contributing state is Uttar Pradesh, which contributes 32.95% of the basin population followed by Madhya Pradesh, Rajasthan, Haryana, Delhi, Uttarakhand and Himachal Pradesh (Rai et al., 2012).The total population of the Class I cities, Class II towns and Class III towns in the basin according to the Census 2011 is 54.5 million. Among the Class I Cities DMC (Delhi Municipal Corporation), Faridabad, Agra, Allahabad, Ghaziabad, Bhopal, Gwalior, Indore, Kota and Jaipur are the most populated cities having more than 1 million people, according to the Population Census 2011.

In the basin, 39.24% and 2.95% of the population lying in the Class I cities and Class II towns are situated along the main stem of river Yamuna. The overall share of Class III population in the basin is 12.45%. The population residing under major sub-basins lying in the state has also been estimated for Class I and Class II cities/ towns. The largest population is harboured inChambal Basin (Class I: 17.63%) and least in Ken Basin (Class I: 1.22%). The Betwa, Sindh and Utangan basins accommodate 5.26, 3.18 and 4.33% respectively, of the total Class I population of the Yamuna basin. The least population of Class II towns also belong to Sindh basin (0.22%) and maximum to Chambal basin (1.79%). The other sub-basins – Betwa (1.09), Ken (0.28%) and Utangan (0.51%) – contain the remaining Class II population of the Yamuna basin. The total population residing outside the selected sub-basins for Class I cities and Class II towns in the state is 9.84%. Figure 4 shows the population distribution of Class I cities and Class II and III towns in the major sub-basins of river Yamuna and along the main stem of the river Yamuna. Figures5 and 6 show the distribution of Class I cities and Class II towns in the state under YamunaRiver Basin.

The details of the area, population and the major river systems of all the Class I, II and III cities are presented in Tables4-6, respectively. The average population of class I town in the state is 0.5 million approximately, which isseven times and seventeen times higher than the average population of class II and class III towns, respectively. DMC is the most populated class I city having the population of the order of 11 million while Nagda is the least populated (0.1 million) class I city. Sadat Pur Gujran and Hodal are the cities having maximum and minimum population under class II towns, containing 0.09 and 0.05 million, respectively. In class III towns where the population is less than 0.05 million, the maximum population is in the Kotputli town (0.049 million) while the minimum is in the Maksi (0.02 million).

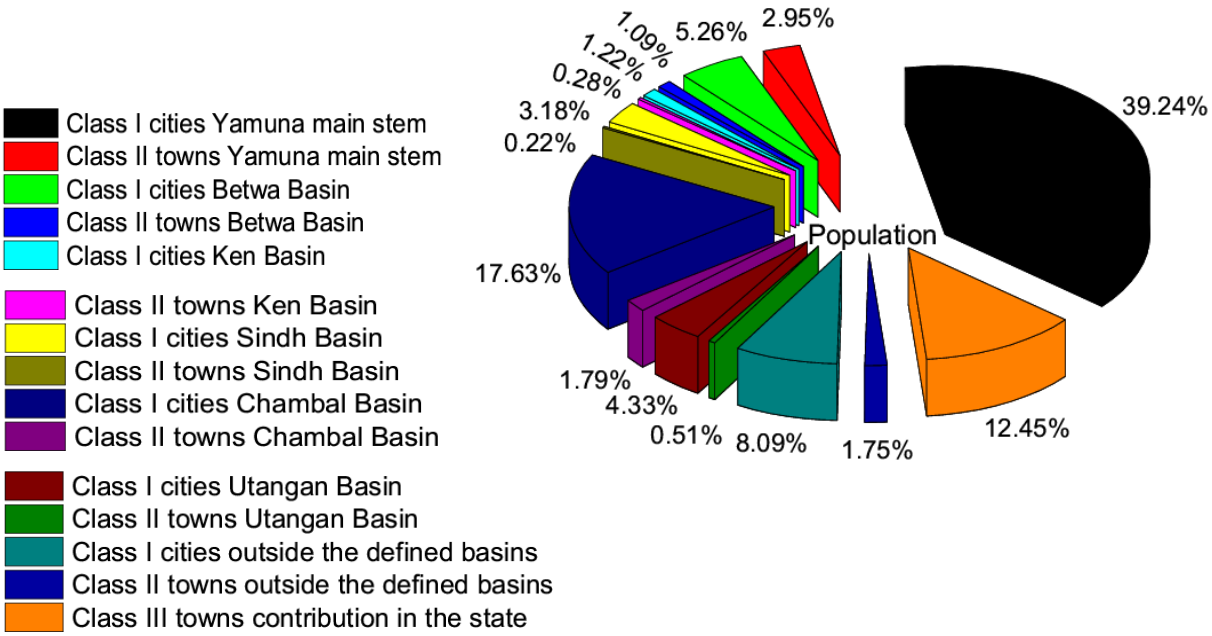


Figure 4: **Population Distribution of Class I Cities and Class II, Class III Towns in the Major Basins of Yamuna Basin and Along the Main Stem of the River Yamuna**

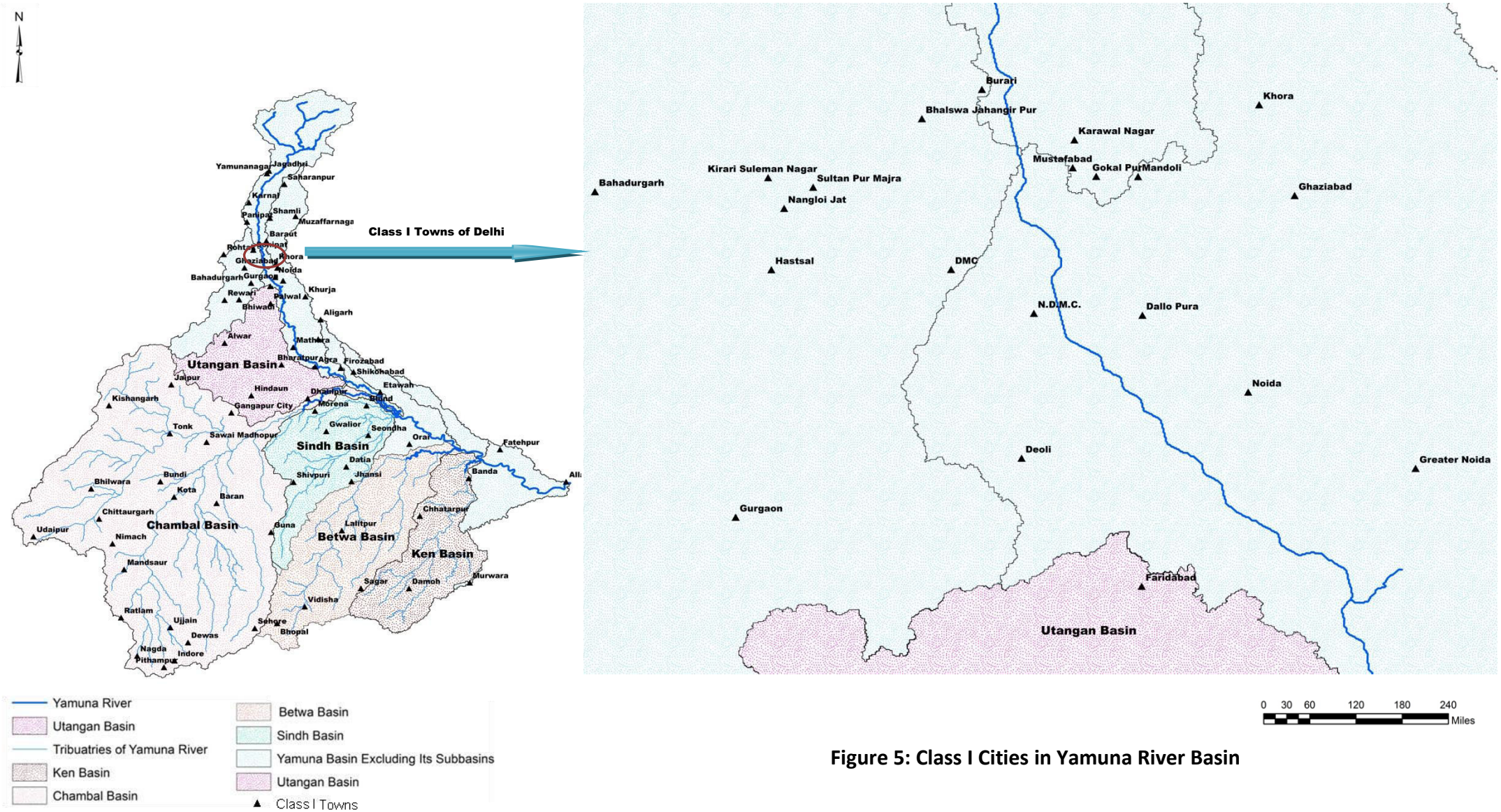


Figure 5: Class I Cities in Yamuna River Basin

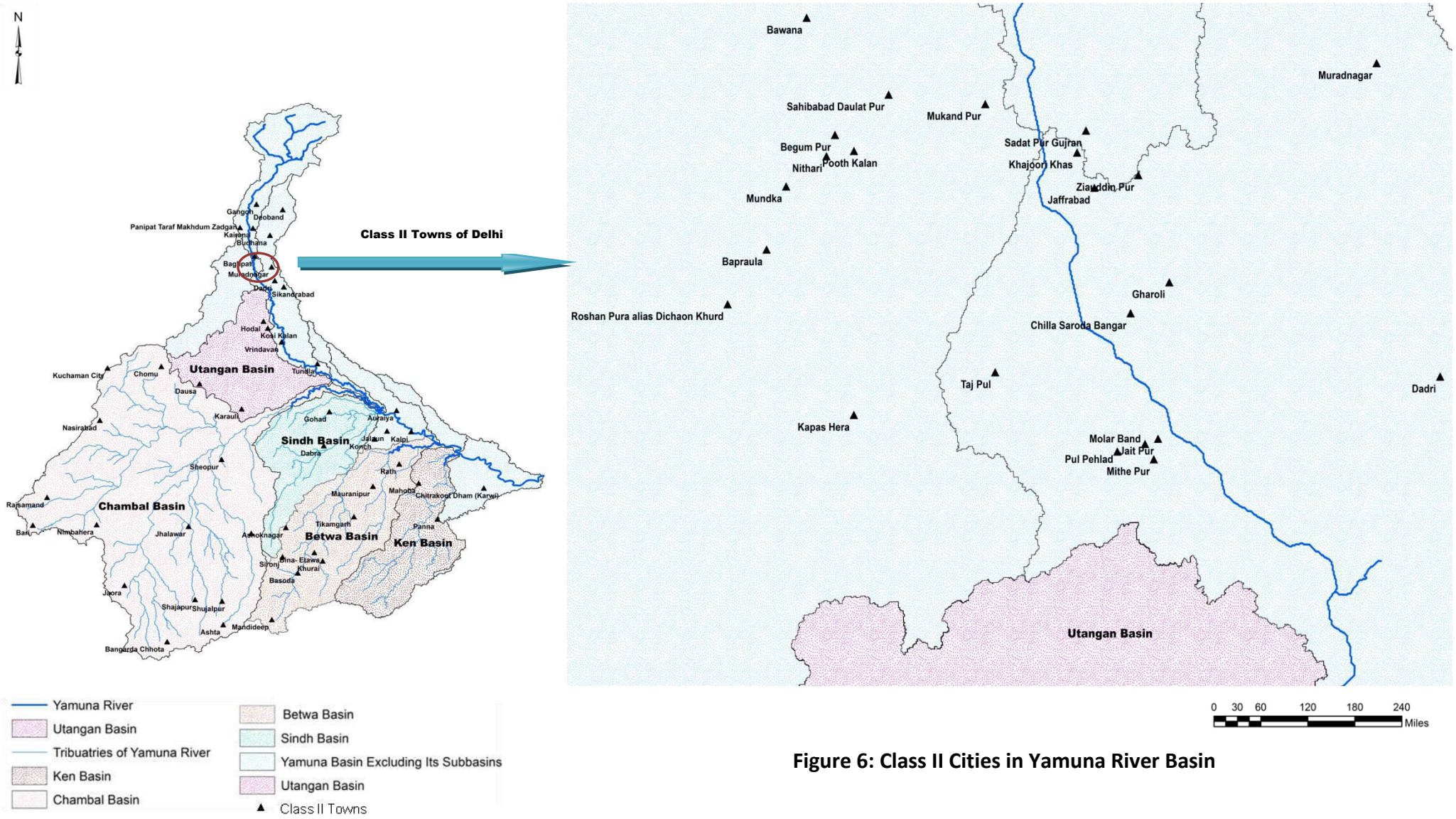


Figure 6: Class II Cities in Yamuna River Basin

Table 4: Demography of Major Class I Citiesin YamunaRiver Basin

S. No.	City/ Town	State	River System	Area (Sq. Km.)	Population (Census 2011)
1	DMC	NCT OF DELHI	Yamuna, Hindan River	561.3	11,034,555
2	N.D.M.C.		Yamuna, Hindan River	42.7	257,803
3	Kirari Suleman Nagar		Yamuna,Hindan River	4.7	283,211
4	Sultan Pur Majra		Yamuna, Hindan River	2.8	181,554
5	Bhalswa Jahangir Pur		Yamuna,Hindan River	6.7	197,148
6	Burari		Yamuna, Hindan River	11.2	146,190
7	Karawal Nagar		Yamuna, Hindan River	4.8	224,281
8	Mustafabad		Yamuna,Hindan River	1.3	127,167
9	Gokal Pur		Yamuna, Hindan River	2.3	121,870
10	Mandoli		Yamuna, Hindan River	5.9	120,417
11	Dallo Pura		Yamuna,Hindan River	2.3	154,791
12	Hastsal		Yamuna, Hindan River	6.8	176,877
13	Nangloi Jat		Yamuna, Hindan River	6.7	205,596
14	Deoli		Yamuna,Hindan River	10.1	169,122
15	Bahadurgarh	Haryana	Yamuna River	29.5	170,767
16	Faridabad		Yamuna, Hindan River	204	1,414,050
17	Gurgaon		Yamuna, Hindan River	184.59	886,519
18	Jagadhri		Yamuna, Hindan River	24.8	124,894
19	Karnal		Yamuna, Hindan River	29.46	302,140
20	Palwal		Yamuna, Hindan River	8.42	131,926
21	Panipat		Yamuna, Hindan River	21.86	295,970
22	Rohatak		Yamuna,Hindan River	72.18	374,292
23	Rewari		Yamuna River 79 km	22.5	143,021
24	Sonipat		Yamuna,Hindan River	42.61	289,333
25	Yamunanagar		Yamuna River	16.48	217,071

S. No.	City/ Town	State	River System	Area (Sq. Km.)	Population (Census 2011)
26	Morena	Madhya Pradesh	Asan River	12.00	200,482
27	Bhind		Kunwari River	17.18	197,585
28	Bhopal		Betwa River	285.88	1,798,218
29	Chhatarpur		Dhasan River	15.56	142,128
30	Damoh		Ken River	33.23	139,561
31	Datia		Pahuj River	6.64	100,284
32	Dewas		Shipra River	100.22	289,550
33	Guna		Sindh River	45.75	180,935
34	Gwalior		SonRekha River	173.68	1054,420
35	Murwara		Katni River	68.57	221,883
36	Sehore		Parbati River	15.11	109,118
37	Shivpuri		Sindh River	81.11	179,977
38	Ujjain		Kshipra River	92.68	515,215
39	Vidisha		Betwa River	5.83	155,951
40	Mandsaur		Shivna River	36.36	141,667
41	Nagda		Chambal River	23.83	100,039
42	Neemach		Ratem River	22.00	128,575
43	Pithampur		Narmada 47 km	89.90	126,099
44	Ratlam		Mahi River	39.19	273,892
45	Sagar		Dhasan River	33.75	370,296
46	Indore		Saraswati River	172.39	1,994,397
47	Bundi	Rajasthan	Mez,Chambal River	27.79	104,919
48	Kishangarh		Luni River 46 Km	45.49	154,886
49	Alwar		Yamuna River 98 km	48.4	322,568
50	Bharatpur		Yamuna River	57.77	252,838
51	Bhilwara		Kothari,Banas River	118.49	359,483
52	Bhiwadi		Sahibi River	44.06	104,921
53	Chittaurgarh		Banas, Gambhiri River	41.76	116,406
54	Dhaulpur		Chambal,Utangan River	32.03	133,075
55	Gangapur		Kothari,Banas River	52.31	119,090
56	Hindaun		Utangan River	48	105,452
57	Jaipur		Banas River 60 Km	484.64	3,046,163
58	Tonk		Banas River	60.5	165,294
59	Udaipur		Sabarmati, Ayad River	56.92	451,100
60	Kota		Chambal,Kali Sindh,Parvan,Mez River	527.03	1,001,694
61	Sawai Madhopur		Parbati, Banas River	59	121,106
62	Baran		Parbati, Kali Sindh,Parvan River	72.36	117,992

S. No.	City/ Town	State	River System	Area (Sq. Km.)	Population (Census 2011)
63	Agra	Uttar Pradesh	Yamuna,Chambal River	120.57	1,585,704
64	Aligarh		Yamuna River	40.43	874,408
65	Allahabad		Ganga,Yamuna River	70.05	1,168,385
66	Banda		Ken,Yamuna River	16.00	160,473
67	Baraut		Yamuna River	10.36	103,764
68	Etawah		Sengar,Chambal, Yamuna River	28.94	256,838
69	Fatehpur		Ken,Ganga,Yamuna River	56.98	193,193
70	Firozabad		Chambal,Utangan,Yamuna River	21.35	604,214
71	Ghaziabad		Hindon,Yamuna River	220.00	1,648,643
72	Greater Noida		Hindon,Yamuna River		
73	Hathras		Yamuna River	6.76	143,020
74	Jhansi		Pahuj,Betwa River	150.00	505,693
75	Khora		Hindon,Yamuna River	4.26	190,005
76	Khurja		Yamuna River 36 km	16.70	121,207
77	Lalitpur		Shahzad,Sajnam,Jamani,Betwa River	17.35	133,305
78	Mathura		Yamuna River	28.05	349,909
79	Muzaffarnagar		Kali nadi,Ganga River	12.04	392,768
80	Orai		Yamuna,Betwa,Dhasan River	23.20	190,575
81	Saharanpur		Hindon,Yamuna, River	46.74	705,478
82	Shamli		Yamuna River	26.23	107,266
83	Shikohabad		Yamuna,Chambal,Utangan River	8.48	107,404
84	Noida		Yamuna,Hindon River	92.10	637,272

Table 5: Demography of Major Class II Cities in YamunaRiver Basin

S. No.	City/ Town	State	River System	Area (Sq. Km.)	Population (Census 2011)
1	Sahibabad Daulat Pur	NCT of Delhi	Yamuna,Hindon River	5.7	54,773
2	Bawana		Yamuna,Hindon River	17.0	73,680
3	Nithari		Yamuna,Hindon River	2.3	50,464
4	Begum Pur		Yamuna,Hindon River	1.9	53,682
5	Pooth Kalan		Yamuna,Hindon River	7.0	96,002
6	Mukand Pur		Yamuna,Hindon River	2.5	57,135
7	Sadat Pur Gujran		Yamuna,HIndon River	1.1	97,641
8	Khajoori Khas		Yamuna,HIndon River	0.9	76,640
9	Ziauddin Pur		Yamuna,Hindon River	1.8	68,993
10	Jaffrabad		Yamuna,Hindon River	0.9	54,601
11	Gharoli		Yamuna,Hindon River	3.6	92,540
12	Chilla Saroda Bangar		Yamuna,Hindon River	2.6	83,217
13	Bapraula		Yamuna River	5.6	52,744
14	Mundka		Yamuna River	11.9	54,541
15	Roshan Pura		Yamuna River	2.8	57,217
16	Kapas Hera		Yamuna River	3.4	74,073
17	Pul Pehlad		Yamuna,Hindon River	2.2	69,657
18	Taj Pul		Yamuna,Hindon River	1.2	68,796
19	Mithe Pur		Yamuna, Hindon River	1.8	69,837
20	Molar Band		Yamuna,Hindon River	4.1	91,402
21	Jait Pur		Yamuna,Hindon River	3.8	59,330
22	Hodal	Haryana	Yamuna River	5.39	50,143
23	Panipat Taraf Makhdum Zadgan		Yamuna River	6.54	67,998
24	Ashta	Madhya Pradesh	Prabati river	15.78	53,184
25	Bangarda Chhota		Betwa River	11.19	64,213
26	Basoda		Betwa River	16.55	78,289
27	Sheopur		Parbati River	6.29	71,951
28	Shujalpur		Newaj River	7.74	51,225
29	Ashoknagar		Aur River	4.43	81,828
30	Bina		Bina River	12.00	64,529
31	Gohad		Chambal River	14.91	58,939
32	Jaora		Maleni River	14.54	74,907
33	Khurai		Bina River	11.03	51,108
34	Mandideep		Kaliasot River	12.78	59,654
35	Panna		Kilkila River	10.00	59,091
36	Raghogarh -Vijaypur		Parbati,Chopan,Sindh River	73.79	62,163
37	Sironj		Betwa River	9.99	52,460
38	Tikamgarh		Jamani River	6.22	79,106
39	Shajapur		Chiler River	17.19	69,263
40	Dabra		Sindh River	3.79	61,277
41	Dhar		Narmada River	30.00	95,000

S. No.	City/ Town	State	River System	Area (Sq. Km.)	Population (Census 2011)
42	Jhalawar	Rajasthan	Kali Sindh,Ahu River	12.95	66,919
43	Nimbahera		Banas River	12.74	61,949
44	Bari		Sabarmati, Ayad River	22.27	62,721
45	Chomun		-	22.53	64,417
46	Dausa		Utanganga,Banganga River	16	85,960
47	Karauli		Chambal,Utanganga River	35	82,960
48	Kuchaman		Luni River	12.5	61,969
49	Nasirabad		Luni,Khari River	22.93	50,804
50	Rajsamand		Banas,Gomati, Rajpura River	55	67,798
51	Auraiya	Uttar Pradesh	Sengar,Yamuna,Sindh,Pahuj, Kunwari RIver	9.00	87,736
52	Baghpat		Yamuna,Hindon River	2.83	50,310
53	Budhana		Kali nadi,Yamuna River	7.61	53,722
54	Chitrakoot Dham (Karwi)		Paisuni,Yamuna River	7.77	57,402
55	Dadri		Yamuna,Hindon River	6.50	91,189
56	Deoband		Hindon River	7.90	97,037
57	Gangoh		Yamuna River	6.00	59,279
58	Jalaun		Yamuna,Betwa,Pahuj River	6.34	56,909
59	Kairana		Yamuna River	7.11	89,000
60	Kalpi		Yamuna,Betwa,Virma River	9.73	51,670
61	Kosi		Yamuna River	4.50	60,074
62	Konch		Dhasan,Betwa,Pahuj River	2.95	53,412
63	Mahoba		Urmil,KaliRiver	12.15	95,216
64	Mauranipur		Sukhnai Nadi,Dhasan River	5.53	61,449
65	Muradnagar		Yamuna,HIndon River	12.00	95,208
66	Rath		Virna,Dhasan,Betwa River	8.12	65,056
67	Sikandarabad		Yamuna, Hindon River	1.14	81,028
68	Tundla		Yamuna,Utangan River	8.25	50,423
69	Vrindavan		Yamuna River	13.50	63,005

Table6: Demography of Major Class II Cities in YamunaRiver Basin

S. No.	City/ Town	State	River System	Area (Sq. Km.)	Population (Census 2011)
1	Ali Pur	NCT OF DELHI	Yamuna,Hindon River	8.6	20,332
2	Libas Pur		Yamuna,Hindon River	2.3	44,,375
3	Siras Pur		Yamuna,Hindon River	4.3	30,445
4	Pehlad Pur Bangar		Yamuna,Hindon River	4.7	22,968
5	Karala		Yamuna,Hindon River	8.8	35,730
6	Kamal Pur Majra Burari		Yamuna,Hindon River	1.3	43,086
7	Jharoda Majra Burari		Yamuna,Hindon River	2.6	22,878
8	Dayal Pur		Yamuna,Hindon River	-	20,589
9	Jiwan Pur alias Johri Pur		Yamuna,Hindon River	1.0	43,054
10	Babar Pur		Yamuna,Hindon River	0.8	37,058
11	Gharonda Neemka Bangar alias Patpar Ganj		Yamuna,Hindon River	1.5	37,876
12	Kondli		Yamuna,Hindon River	1.9	38,207
13	Shafi Pur Ranhola		Yamuna River	4.3	31,944
14	Nilothi		Yamuna,Hindon River	3.9	43,371
15	Quammruddin Nagar		Yamuna,Hindon River	2.4	25,126
16	Dindar Pur		Yamuna River	3.9	35,856
17	Nangli Sakrawati		Yamuna River	3.1	37,706
18	Moradabad Pahari		Yamuna,Hindon River	1.2	21,502
19	Malik Pur Kohi Alias Rang Puri		-	7.5	23,726
20	Aya Nagar		Yamuna,Hindon River	8.2	33,123
21	Chattar Pur		Yamuna,Hindon River	7.4	46,776
22	Tigri		Yamuna,Hindon River	1.1	46,974
23	Aali		Yamuna,Hindon River	4.0	27,169
24	Dharuhera	Haryana	Sahibi River	11.49	30,344
25	Firozpur Jhirka		Yamuna River	8.86	24,750
26	Ganaur		Yamuna River	9.06	35,603
27	Gharaunda		Yamuna River	12.98	37,816
28	Hailey Mandi		Yamuna River	16.27	20,906
29	Jhajjar		Yamuna River	36	48,424
30	Kharkhoda		Yamuna River	1.63	25,051
31	Kundli		Yamuna,Hindon River	7.9	21,633
32	Manesar		Yamuna River	14.7	23,448
33	Palwal (Rural)		Yamuna River	20.1	23,072
34	Panipat Taraf Ansar		Yamuna River	7.88	42,877
35	Pataudi		Yamuna River	13.51	20,418
36	Punahana		Yamuna River	10.12	24,734
37	Samalkha		Yamuna River	4.66	39,710
38	Sampla		Yamuna River	17.83	20,563
39	Sasauli		Yamuna,Markanda River	2.88	22,479
40	Sohna		Yamuna River	9.7	36,552
41	Taoru		Yamuna River	4.52	22,599

42	Tilpat	Haryana	Yamuna,Hindon River	9.92	20,514
43	Ugra Kheri		Yamuna River	4.6	24,440
44	Paonta Sahib	Himachal Pradesh	Yamuna,Giri,Tons River	6.2	25,183
45	Solan		Giri River	6.18	39,256
46	Mussoorie	Uttaranchal	Bhagirathi,Yamuna River	64.75	30,118
47	Agar	Madhya Pradesh	Kali Sindh River	3.52	37,917
48	Alot		Kshipra River	2.78	24,115
49	Amla		Bel Nadi	6.39	30,215
50	Aron		Sindh River	20.01	28,010
51	Banda		Dhasan River	10.02	30,923
52	Badnagar		Chamla River	7.02	36,438
53	Begamganj		Bina River	18.46	34,031
54	Berasia		Baanh River	13.99	30,951
55	Bhander		Pahuj River	1.68	25,204
56	Bhanpura		Ahu River	8.00	21,013
57	Biaora		Parbati River	6.96	49,093
58	Garhakota		Sunar River	2.98	32,726
59	Khachrod		Chambal River	10.40	34,191
60	Maksi		Choti Kali Sindh River	19.19	20,088
61	Manasa		Ratem River	3.61	26,551
62	Pachor		Lakhundar River	25.79	27,396
63	Rahatgarh		Bina River	6.54	31,537
64	Rajgarh		Parbati River	9.36	20,668
65	Rehli		Sunar River	27.86	30,329
66	Tarana		Choti Kali Sindh River	1.45	24,908
67	Ambah		Chambal River	3.85	47,177
68	Bijawar		Dhasan River	25.72	20,513
69	Chanderi		Betwa River	14.87	33,081
70	Karera		Mahuar River	12.00	28,705
71	Lahar		Kwari River	19.04	35,674
72	Maharajpur		Narmada River	14.50	23,328
73	Mungaoli		Betwa River	17.98	26,192
74	Sabalgarh		Chambel River	8.57	40,333
75	Seondha		Sindh River	2.93	23,140
76	Sarangpur		Kali Sindh River	5.68	37,435
77	Badnawar		Mahi River	3.01	20,917
78	Mau		Parbati River	58.69	20,147
79	Bamor Kalan		Betwa River	3.43	32,838
80	Chitrakoot		Yamuna River	83.00	23,316
81	Deori		Narmada River	5.00	25,632
82	Gormi		Kunwari,ChambalRiver	17.00	20,841
83	Indergarh		Pahuj,Sindh River	18.05	23,045
84	Jaura Khurd		Asan,Chambal River	10.42	32,087
85	Jirapur		Kali Sindh River	9.25	21,724
86	Joura		Maleni,Chambal River	4.00	42,153

87	Kailaras		Chambal River	1.72	25,920
88	Laundi		Urmil,Ken River	25.04	22,002
89	Maihar		Mahanadi River	10.36	40,192
90	Mauganj		Sone River	36.91	26,420
91	Mehgaon		Sindh,Kunwari River	4.00	21,335
92	Mhowgaon		Narmada River	13.00	30,012
93	Niwari		Betwa River	14.91	23,724
94	Nowgong		Dhasan River	20.86	40,580
95	Obedullaganj		Tawa,Narmada River	29.86	22,845
96	Porsa		Kwari,Chambal,YamunaRiver	12.17	39,669
97	Prithvipur		Betwa Jamni River	0.55	26,883
98	Rajakhedi		Dhasan River	3.54	24,232
99	Rau		Narmada River	14.74	36,055
100	Shamgarh		Ahu,Chambal River	3.02	24,637
101	Pathari		Bina,Betwa River	19.24	21,026
102	Khajuraho		Khudar,Ken River	59.80	24,481
103	Hatta		Ken,Sunar River	6.29	32,465
104	Narsinghgarh		Parbati River	12.95	32,329
105	Raisen		Betwa River	19.08	44,162
106	Binaganj		Parbati River	11.65	21,860
107	Aklera	Rajasthan	Choti Nadi,Chapi River	5.00	26,240
108	Bagru		-	10.00	26,091
109	Bhawani Mandi		Piplaad,Ahu River	40.00	42,283
110	Chaksu		Banas River	13.25	33,432
111	Chhabra		Parbati River	9.00	32,285
112	Deoli		Banas,Khari River	3.75	22,065
113	Jahazpur		Banas,Khari River	5.00	20,586
114	Jhalrapatan		Kali Sindh,Ahu River	20.17	37,506
115	Kekri		Banas,Khari River	7.00	41,890
116	Keshoraipatan		Chambal,Mez River	25.9	24,627
117	Kotputli		-	36.00	49,202
118	Lakheri		Mez,Parbati,Chambal River	25.00	29,572
119	Lalsot		Banas River	9.42	34,363
120	Malpura		Banas River	45.35	36,028
121	Mangrol		Parbati,KaliSindh River	27.45	25,073
122	Nagar		Banganga River	3.61	25,572
123	Niwai		Banas River	48	37,765
124	Bandikui		Banganga River	5	44,664
125	Bassi		Banganga River	20.4	26,029
126	Behror		-	15.12	29,531
127	Borawar		Khari RIver	24	24,975
128	Fatehnagar		Banas River	15	22,812

129	Kaithoon	Rajasthan	Chandrelohi,Chambal, Kali Sindh,Parvan River	17.23	24,260
130	Kaprain		Chambal,Mez,Kali Sindh River	64	20,748
131	Khairthal		-	21.09	38,298
132	Manoharpur		-	12.11	20,287
133	Nandri		Banganga,Utangan River	6.9	20,827
134	Nawa		-	24	22,088
135	Ramganj Mandi		Ahu,Kali Sindh RIver	10.82	41,328
136	Rawatbhata		Chambal River	21.53	37,699
137	Sarwar		Khari River	5	20,372
138	Suket		Ahu,Kali Sindh River	9.52	22,319
139	Todabhim		Banganga,Utangan River	5	22,977
140	Phulera		-	10	26,091
141	Kishangarh Renwal		-	25.94	29,201
142	Reengus		-	30	26,139
143	Sangod		Sangod, Kali Sindh,Parvan River	14.89	21,846
144	Shahpura (Bhilwara)		Banas,Khari,Maansi, Kothari River	56.52	30,320
145	Shahpura (Jaipur)		-	64	33,895
146	Todaraisingh		Banas,Khari River	54.14	23,559
147	Bayana		Utangan River	5.68	38,502
148	Deeg		Yamuna River	3.29	44,999
149	Kaman		Yamuna River	6	38,040
150	Kumher		Yamuna River	19.62	23,540
151	Nadbai		Utangan River	14.91	26,411
152	Rajakhera		Utangan,Chambal River	10	33,666
153	Ramgarh		-	2.57	33,024
154	Sambhar		-	12.5	22,327
155	Shri Madhopur		-	16	31,366
156	Tijara		-	21	24,747
157	Mahwa	Rajasthan	Banganga,Utangan River	3.06	24,846
158	Gulabpura		Khari River	12	27,215
159	Nathdwara		Banas River	24	42,016
160	Antah		Parvan,Kali Sindh,Parbati River	23.48	32,377
161	Begun		Brahmini River	6.62	20,705
162	Karanpur		Banas River	4.85	21,297
163	Rajgarh		Banganga Rivver	25	26,631
164	Kapasan		Banas,Berach River	26.75	20,869
165	Achhnera	Uttar Pradesh	Yamuna, Utangan River	8.0	22,781
166	Babarpur Ajitmal		Yamuna River	5.0	29,284
167	Banat		Eastern Yamuna	2.9	20,728
168	Banki		Betwa River	4.3	21,317
169	Bidhuna		Rind River	10.0	32,252
170	Dasna		Yamuna,Hindon River	3.3	34,914
171	Dibiyapur		Rind,Sengar,Yamuna RIver	10.0	27,237

172	Fatehpur		Ganga,Yamuna,Virma, Betwa River	8.0	35,582
173	Hindalco Industries Ltd. (Renukoot)		Renu River	5.0	41,792
174	Jhinjhak		Rind,Sengar,Yamuna RIver	5.4	24,027
175	Kanth		Ramganga,Gangan River	0.8	26,381
176	Khekada		Yamuna,Hindon River	8.0	48,676
177	Kheragarh		Utangan,Yamuna River	3.0	21,470
178	Khurja Rural	Uttar Pradesh	Yamuna River	9.7	21,383
179	Kiraoali		Utangan,Yamuna River	5.0	23,788
180	Kora Jahanabad		Rind,Yamuna,Betwa, Ganga River	3.1	26,359
181	Kul Pahar		Dhasan,Urmil River	2.8	20,096
182	Nakur		Yamuna River	6.3	22,712
183	Nanauta		Yamuna,Hindon River	4.0	22,551
184	Pukhrayan		Yamuna,Sengar River	15.0	24,258
185	Purquazi		Kali Nadi,Hindon,Ganga RIver	4.9	29,041
186	Rampur Maniharan		Hindon,Yamuna River	2.0	27,979
187	Sarwat		Kali Nadi,Ganga, Malini River	6.9	24,846
188	Sewalkhas		Hindon,Yamuna River	4.0	24,882
189	Shahbudinpur		Kali Nadi	4.7	25,157
190	Shahpur		Kali Nadi	2.6	20,154
191	Shamsabad		Utangan,Yamuna, Chambal River	6.0	33,144
192	Sumerpur		Ganga,Sai River	7.5	39,132
193	Villimar Kundi		-	30.7	21,082
194	Ghatampur		Yamuna,Betwa River	4.00	40,623
195	Etmadpur		Yamuna River	4.00	21,897
196	Jewar		Yamuna River	18.17	32,269
197	Kabrai		Ken River	4.00	28,564
198	Khaga		Ganga,Yamuna River	16.00	35,637
199	Raya		Yamuna River	7.00	21,344
200	Sirsaganj		Yamuna River	2.14	32,098
201	Atarra		Ken,Kali RIver	10.00	47,419
202	Barua Sagar		Betwa River	5.89	25,028
203	Bharthana		Sengar,Rind,Yamuna, Kunwari,Chambal River	6.00	44,120
204	Bindki		Ganga,Yamuna,Ken River	3.90	36,926
205	Charkhari		Virna River	5.00	27,760
206	Charthawal		Kali Nadi,Hindon River	8.75	20,653
207	Chhata		Yamuna River	14.00	23,537
208	Fatehabad		Yamuna,Utangan, Chambal River	6.00	23,278
209	Fatehpur Sikri	Uttar Pradesh	Yamuna,Utangan River	8.00	32,905
210	Govardhan		Yamuna River	8.00	22,756
211	Gursarai		Dhasan,Betwa River	2.24	26,869
212	Hamirpur		Ganga,SaiRiver	3.94	35,475

213	Jalalabad		Ganga,Ramganga River	9.00	38,202
214	Jalalabad		Kali River	4.10	27,921
215	Jalesar		Yamuna River	3.67	38,130
216	Jaswantnagar		Sengar,Chambal, Yamuna River	5.76	28,164
217	Kandhla		Yamuna River	5.96	46,796
218	Karhal		Chambal,Yamuna River	9.58	27,701
219	Khair		Karban Nadi,Yamuna River	15.54	35,751
220	Maudaha		Ken,Betwa,Yamuna, Virna River	6.07	40,003
221	Sadabad		Karwan, Yamuna River	3.97	40,926
222	Samthar		Betwa, Pahuj River	4.00	22,455
223	Thana Bhawan		Hindon,Yamuna River	1.11	36,669
224	Behat		Yamuna River	4.00	20,474
225	Rasulabad		Rind RIver	8.00	22,196
226	Akbarpur		Sengar,Yamuna River	5.00	20,445
227	Jalalpur		Choti Saryu, Tons River	0.34	31,972
228	Bewar		Virna,Betwa River	9.00	23,729
229	Shamsabad		Ganga River	4.00	28,454

4. Religious Places and Their Importance

Yamuna basinis comprising of parts of six states (Uttarakhand, Himachal Pradesh, Haryana, Uttar Pradesh, Madhya Pradesh and Rajasthan) and one Union territory (National Capital Territory of Delhi).The basin has cultural, religious and traditional richness, marked with the presence of sages, seers, devotees and mystics. Allahabad, Mathura, Vrindavan, Ujjain, Orchha, Maihar, Chitrakoot, Jaipur, Udaipur, Bharatpur, Jhalawarand Karauli are major holy cities for Hindus. Hordes of pilgrims and devotees visit these places of pilgrimage every year and participate in festivals.

Allahabad/Prayaga is an ancient pilgrim sitelocated at the confluence of River Ganga, Yamuna and the mythical Saraswati and plays a central role in Hindu scriptures. Sangam, rivers convergence point, is venue of many sacred fairs and rituals since ancient times which attracts thousands of pilgrims to take a holy dip throughout the year.Among the various festivals and fairs, the Kumbh Melais one of the greatest Indian cultural and religious fair. Magh Mela is another fair that is held annually in the month of Magh (Mid January to Mid February).

Mathura and Vrindavan arethe most important places of pilgrimage for devotees of Lord Krishna.These ancient towns witness numerous mesmerizing temples of various ages, and stretch of the sacred Yamuna River which flows past here is lined with 25 ghats. Govardhan, Barsana, Gokul, Nandgaon, Mahavan, Baldeo and Chhatikara are some of the popular places.Mathura was earlier a Buddhist center before Hinduism rose to prominence.

Ujjain is an ideal destination for the spiritual souls, dedicated mostly to the Shaivite, Vaishnavite and followers of Shakta. It is one of the seven sacred cities (Sapta Puri) of the

Hindus located on the eastern bank of the Kshipra River. The place has several old age temples of 10th and 11th centuries and ancient caves which are believed to be in existence since Mahabharata era.Ujjain is one out of four pilgrimage sites in India where the largest Hindu fair (Kumbh Mela) is celebrated in every 12 years.There are about 15 Ghats along river Kshipra.

Orchha is one of the ancient towns situated on the bank of river Betwa and famous for its architectural heritage and its pilgrimage stature.It has many temples but is most famous for the Ram Raja mandir where devotees visit regularly. Orchha receives a huge number of devotees on certain important Hindu festivals like the Ram navami, Makar Sankranti, Vivaha Panchami, Basant Panchami, Shivratri and Kartik Purnima.

Bhojpur is a small town near to Bhopal having historical and religious importance. The place is located on river Betwa, famous for an ancient incomplete Bhojeshwar Temple dedicated to Lord Shivaand an unfinished Jain temple. Bhojeshwar Temple is also known as Somnath of the east. During Maha Shivratri, a big fair is organized every year.

Maihar is one of the 52 Shakti Peethas (shrines) located in the district of Satna, associated with the Goddess Shakti, also known as Sharda Devi.Millions of pilgrims throng the temple all round the year. Chitrakoot, 'the hill of many wonders', lies on the borders of Madhya Pradesh–Uttar Pradesh.The town hasspiritual,cultural and historical significance, known for a number of ancient temples as well as bathing ghats along the Mandakini River. The place is renowned as Lord Rama Pilgrimage, and devotees believed that Lord Rama along with his brother Lakshman and goddess Sita spent 11 and half years of their 14 years exile in forests around Chitrakoot.This holy town is crowded with pilgrims visiting throughout the year.Some major religious events and their features have been illustrated in Table 7.

Table 7: Major Religious Events on River Banks in Yamuna and Its Major Tributaries in Yamuna Basin

S No	Religious Events	Place	River Bank	Duration	Period
1	Kumbha Mela	Allahabad	Ganga, Yamuna	January–February	Every twelfth year
2	Kumbha Mela (Simhastha)	Ujjain	Kshipra	When Jupiter ascends into sun sign Leo's quarter or the Simha constellation of zodiac	Every twelfth year
3	Ardh Kumbha Mela	Allahabad	Ganga, Yamuna River	January–February	Every twelfth year
4	Magh Mela	Allahabad	Ganga, Yamuna	January–February	Annual
5	Kartik Poornima	Orchha	Betwa	November	Annual
6	Ganga Dusshera	Allahabad, Garhmukteshwar	Ganga	June	Annual

7	Garh Ganga Mela	Garhmuketeshwar	Ganga	November	Annual
8	Bateshwar Fair	Agra	Yamuna	October–November	Annual
9	Ramayan Mela	Chitrakoot	Mandakini	February, March	Annual
10	Ram Navmi	Orchha	Betwa River	April	Annual
11	Makar Sankranti	Orchha	Betwa River	January 14	Annual
12	Vivaha panchami	Orchha	Betwa River	November–December	Annual
13	Basant Panchami	Orchha	Betwa River	February	Annual
14	Shivratri	Orchha	Betwa River	March	Annual
15	Banganag Fair	Jaipur	Banganga River	April–May	Annual
16	Brij Festival	Bharatpur	Banganga River	March	Annual
17	Chandrabahga Fair	Jhalawar	Chadrabhaga River	November	Annual
18	Kaila Devi Fair	Karauli	Kalisil River	March–April	Annual

5. Pollution Load

The major pollution load in the area of basin under the state is due to point and nonpoint sources. Discharges of untreated/partially treated sewage from urban centres, discharges from open drains carrying sewage, discharges from the tributaries and discharges of untreated/partially treated wastewater from industrial units are the major point sources that contribute to the pollution load in the state. The major nonpoint sources *i.e.,*agriculturalactivities, sediment remobilization or entrainment, groundwater intrusion or a combinationof these sourcesare also significantly contributed in the pollution. The major towns along the river Yamuna are Kota, Gwalior, Indore, Nagda, Khetri, Yamuna Nagar, Panipat, Sonepat, Delhi, Baghpat, Ghaziabad, Gautam BudhaNagar, Agra, Faridabad and Mathura.

According to Upadhyay and Rai (2013), 8,444 MLD of wastewater is generated in the basin, out of which about 4,458 MLD is discharged directly into the Yamuna river and about 1,200 MLD is discharged into its tributaries. The remaining 2,786 MLD is either disposed of on land or used for irrigation.The large number of pulp and paper, sugar, distillery, leather, textile, chemical, thermal power, and food processing industries situated in Class I and Class II cities (Kota, Gwalior, Indore, Yamuna Nagar, Panipat, Sonepat, Delhi, Baghpat, Ghaziabad, Gautam Buddha Nagar, Faridabad, Mathura, Vrindavan, Agra and others) on the banks of the river Yamuna and its tributaries, directly or indirectly influencing the water quality of river by discharging their treated and untreated effluents into the nearby riverine systems. The estimation of the amount of pollution load generated by the industries and its

contribution in the river Yamuna is a strenuous task. According to Rai et al. (2012), the state-wise maximum industrial effluent generation in Yamuna basin is by Uttar Pradesh (55%), followed by Delhi (18%), Madhya Pradesh (14%), Haryana (7%), Rajasthan (4%) and Himachal Pradesh (2%).

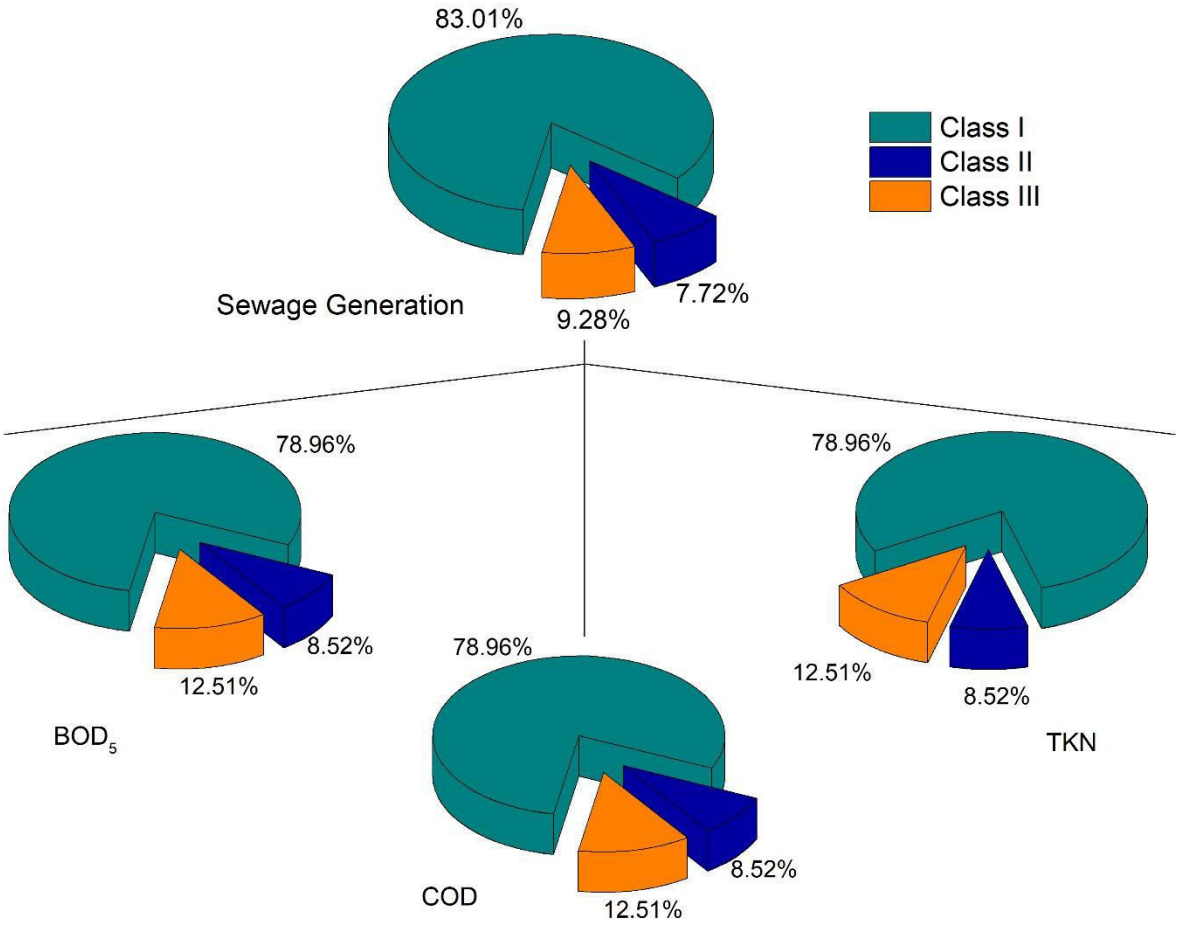


Figure 7: Distribution of Pollution Load of Class I Cities and Class II, Class III Towns in Yamuna Basin

The pollution load for Class I cities, Class II and III towns have been estimated by the data received through rigorous field survey of almost all the major cities and towns in the state (Figure 7). The maximum sewage generation is in the Class I cities (83.01%) followed by Class III (9.28%) and Class II towns (7.72%). The BOD, COD and TKN load for Class I cities, Class II and Class III towns are in the order of 78.96, 8.52 and 12.51%, respectively. The BOD, COD and TKN load of all the Class I cities, Class II and Class III towns are estimated on the per capita basis by using standard values.The domestic water demand is estimated from the population data. The standard water use of 135 lpcd in urban centres is considered for the domestic water requirement and also as per standard 80% of the water is generated as sewage water. The assessment of the total water supply and total sewage generation of class I cities in the state revealed that the maximum sewage generation is in DMC(U).which is 1191.73MLD. In case of the class II towns the sewage generation in Sikandrabad is maximum at 48.79 MLD, approx 800% of its total water supply. The total BOD and COD

loads in tons/day has been estimated for Class I towns and their averagesare approximately 13.8 and 23.4 tons/day, respectively. The average BOD and COD loads from the Class II towns are 1.80 and 3.07 tons/day, respectively whereas Class III towns contribute approximately 0.8 tons/day and 1.36 tons/day of BOD and COD, respectively. The maximum BOD, COD and TKN contributing city in Class I towns are DMC(U)while minimum BOD, COD and TKN contribution are made by Nagda. In Class II and Class III towns, maximum BOD, COD and TKN load are from Sadat Pur Gujran and Kotputli, respectively, while minimum is contribution are from Hodal and Maksi, respectively.

The estimates of total water supply, total sewage generated, BOD, COD and TKN loads are summarized and illustrated in Figures 8a(Part i)to10b(Part ii) for class I cities and class II towns. All the plots from Figures8 to 10are in two parts (Parts i and ii) for proper understanding of the observations. The comparative account of towns of all the classes (I, II and III) for their population, sewage generation, water supply and BOD, COD and TKN load are presented in Figure 11.

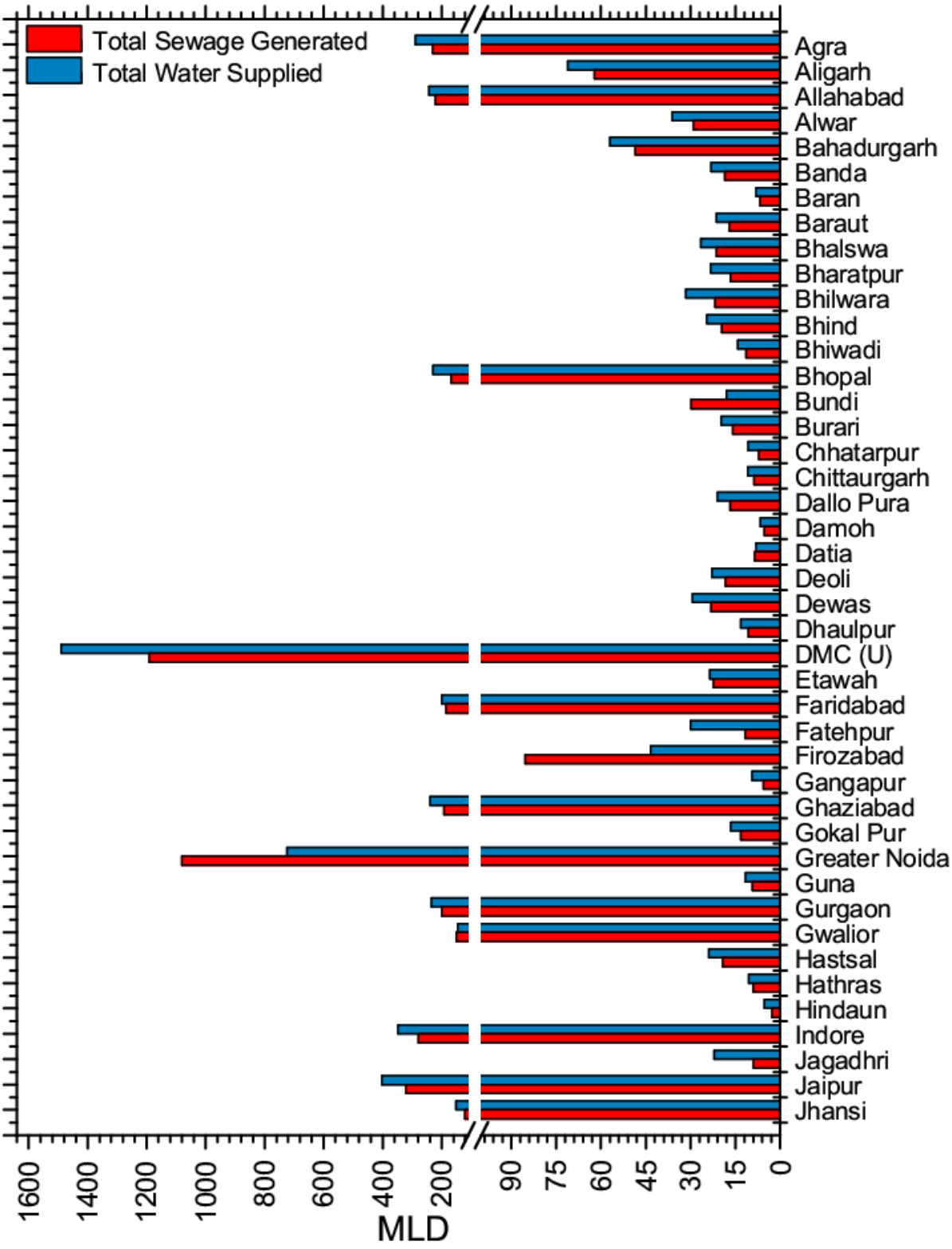


Figure 8a (Part i): Assessment of Water Supply and Sewage Generation (MLD) in Class I Towns in Yamuna River Basin

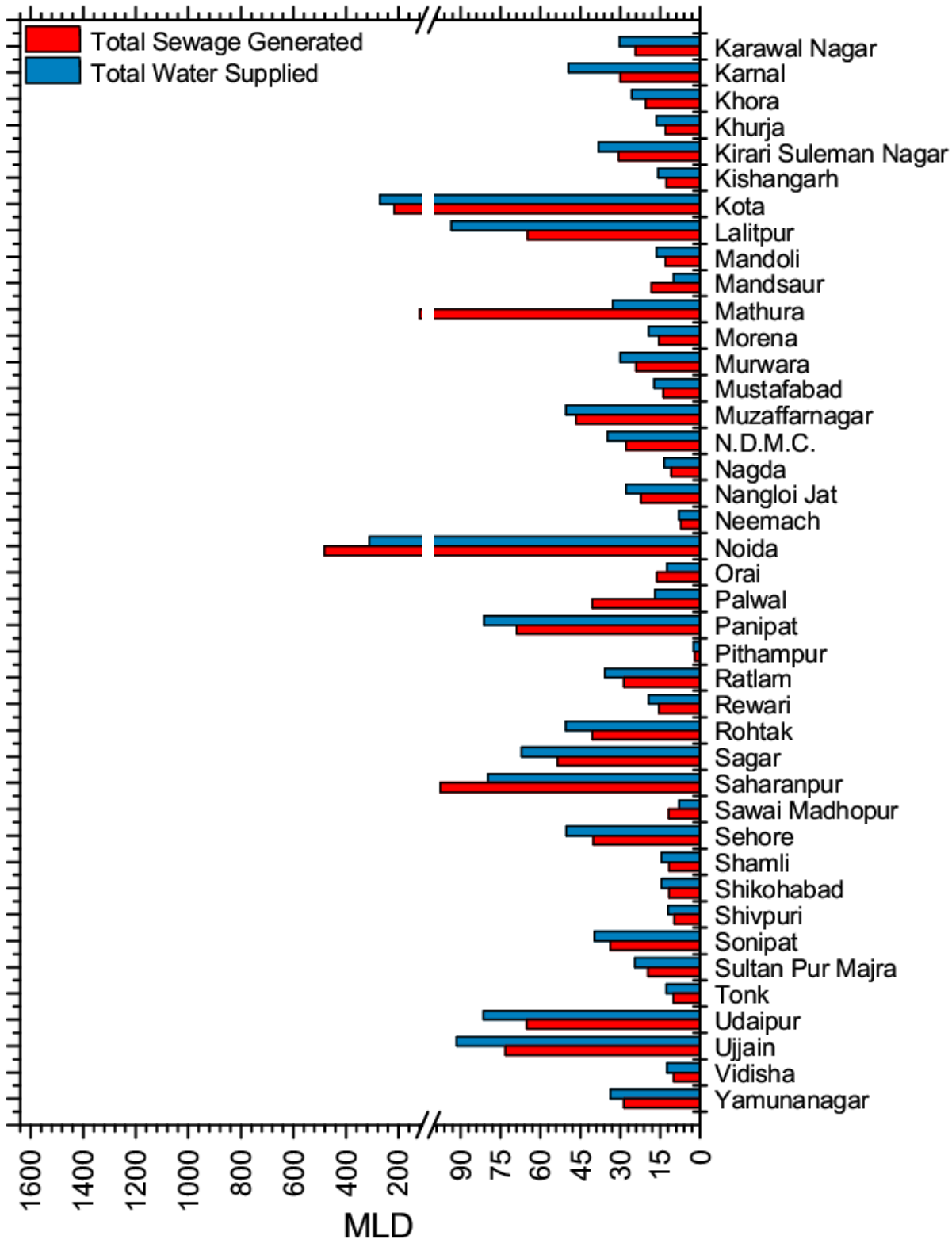


Figure 8a (Part ii): Assessment of Water Supply and Sewage Generation (MLD) in Class I Towns in Yamuna River Basin

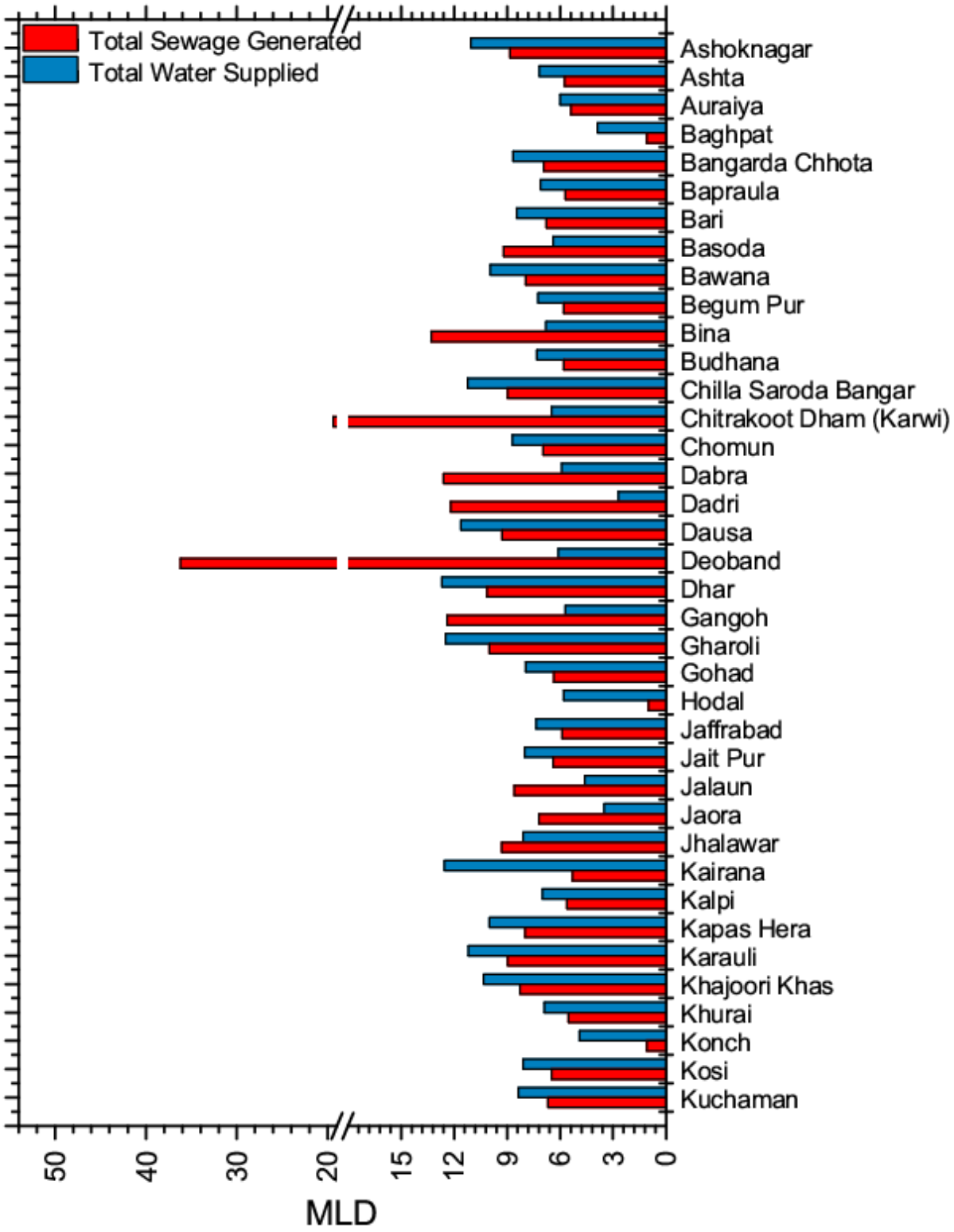


Figure 8b (Part i): Assessment of Water Supply and Sewage Generation (MLD) in Class II Towns in Yamuna River Basin

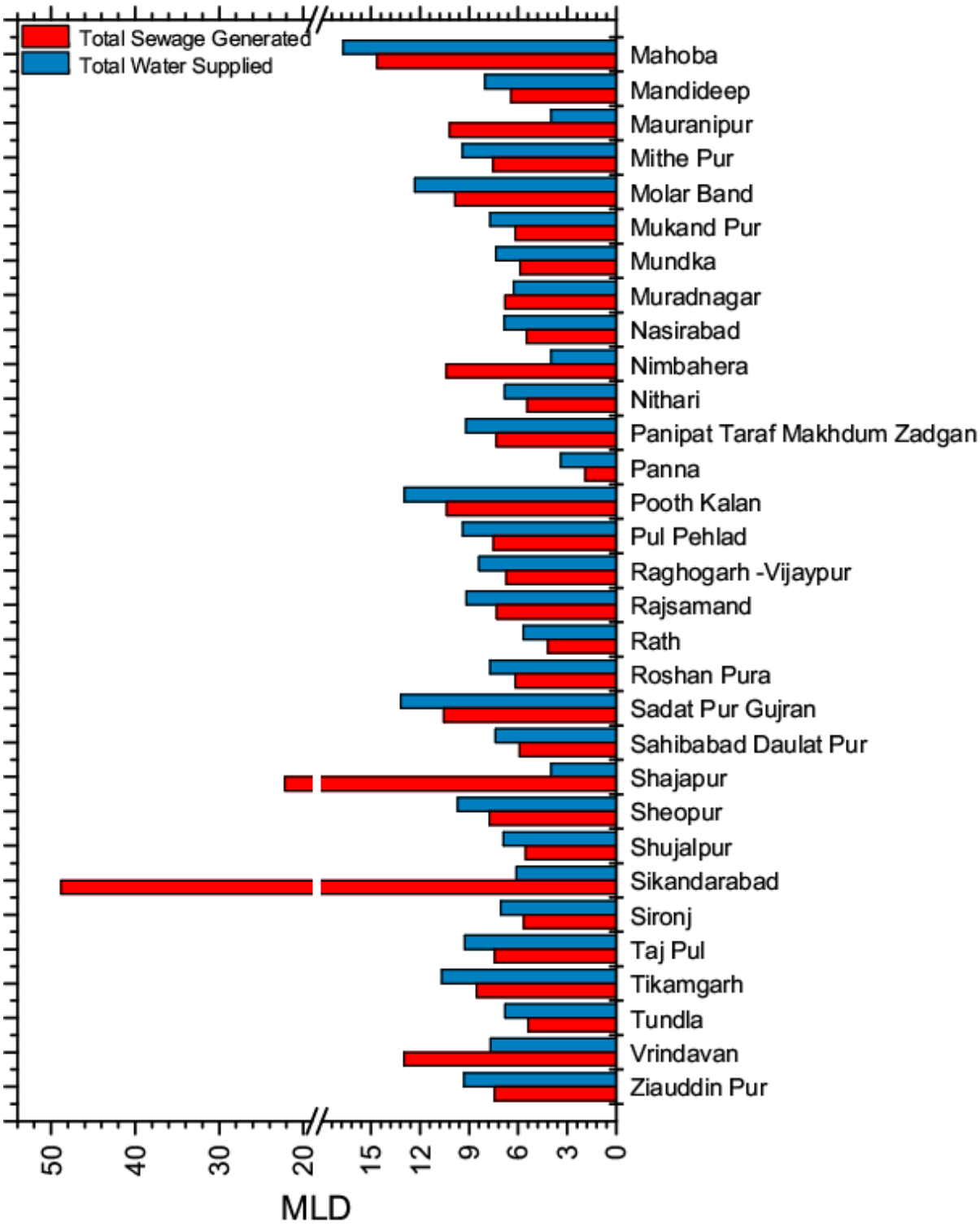


Figure 8b (Part ii): Assessment of Water Supply and Sewage Generation (MLD) in Class II Towns in Yamuna River Basin

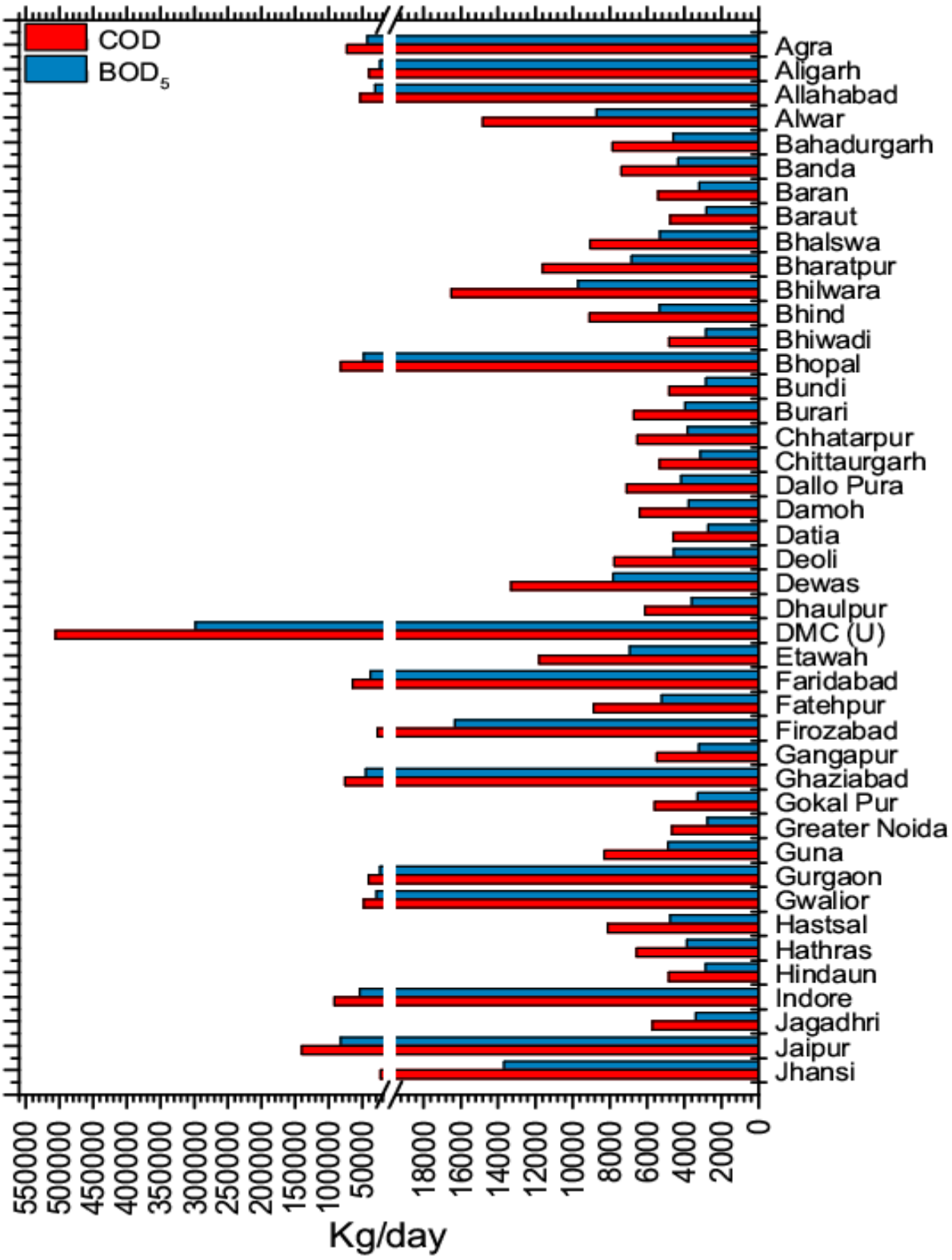


Figure 9a (Part i): Assessment of Water Organic Pollution Load (kg/day) from Class I Towns in Yamuna River Basin

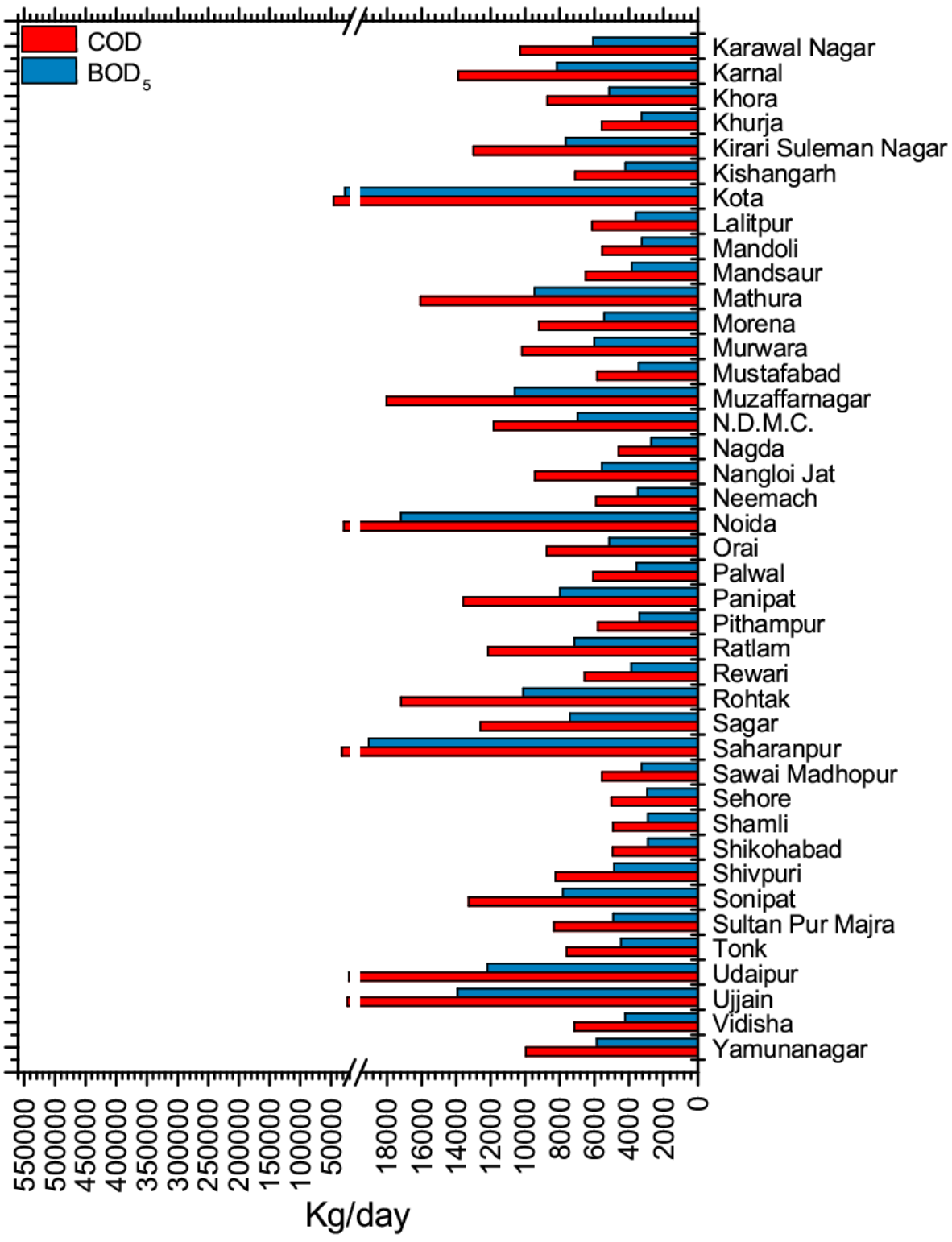


Figure 9a (Part ii): Assessment of Organic Pollution Load (kg/day) from Class I Towns in Yamuna River Basin

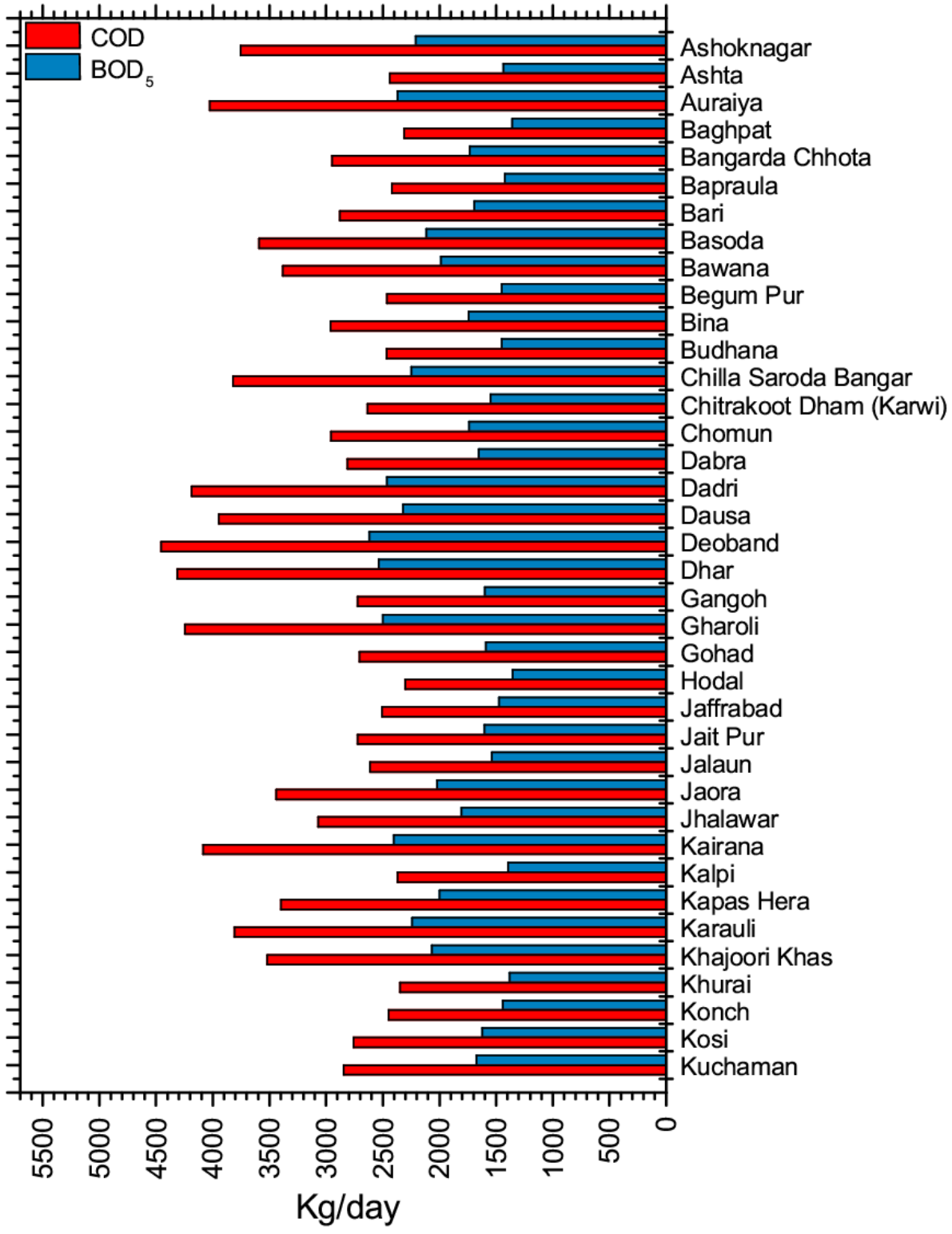


Figure 9b (Part i): **Assessment of Water Organic Pollution Load (kg/day) from Class II Towns in Yamuna River Basin**

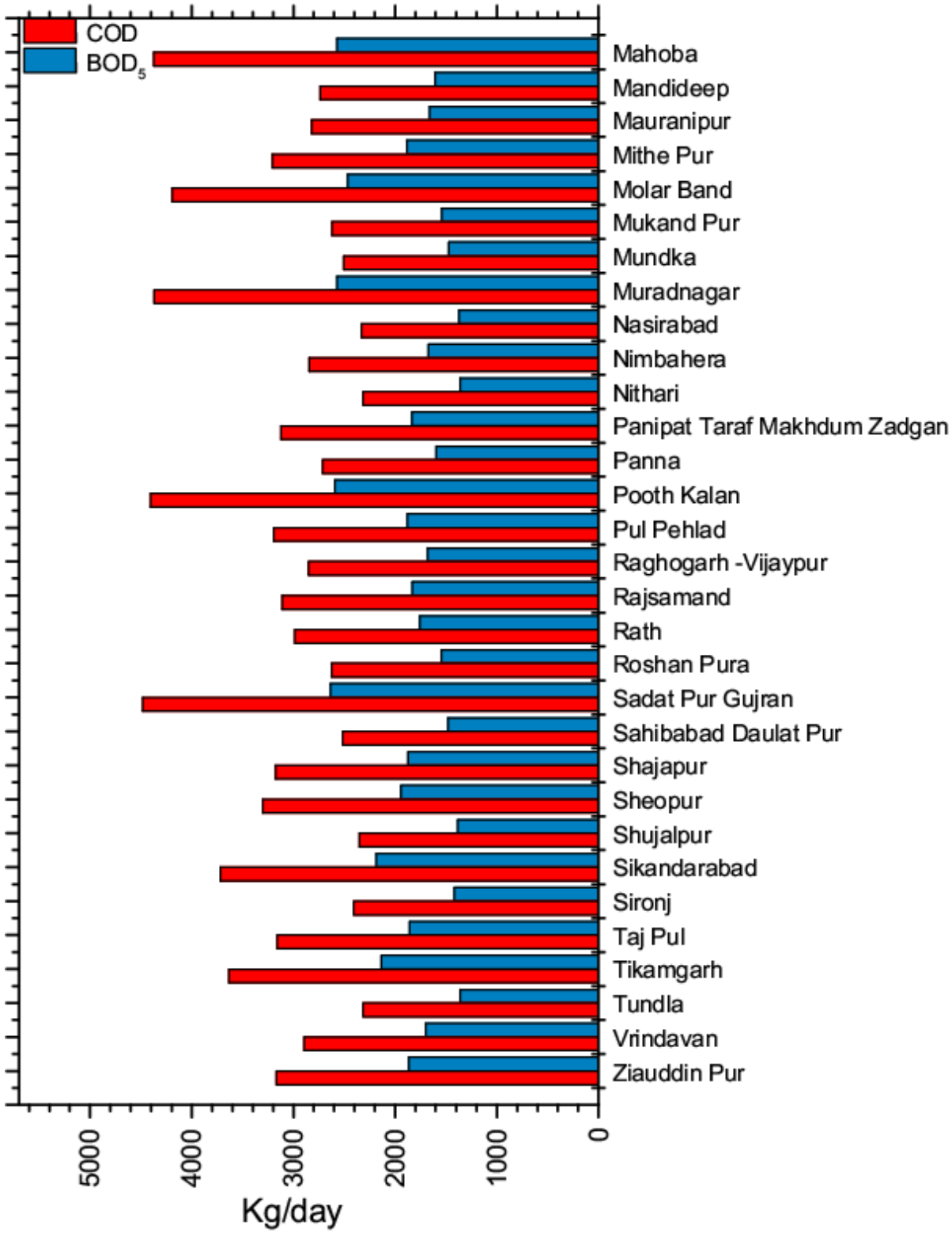


Figure 9b (Part ii): Assessment of Water Organic Pollution Load (kg/day) from Class II Towns in Yamuna River Basin

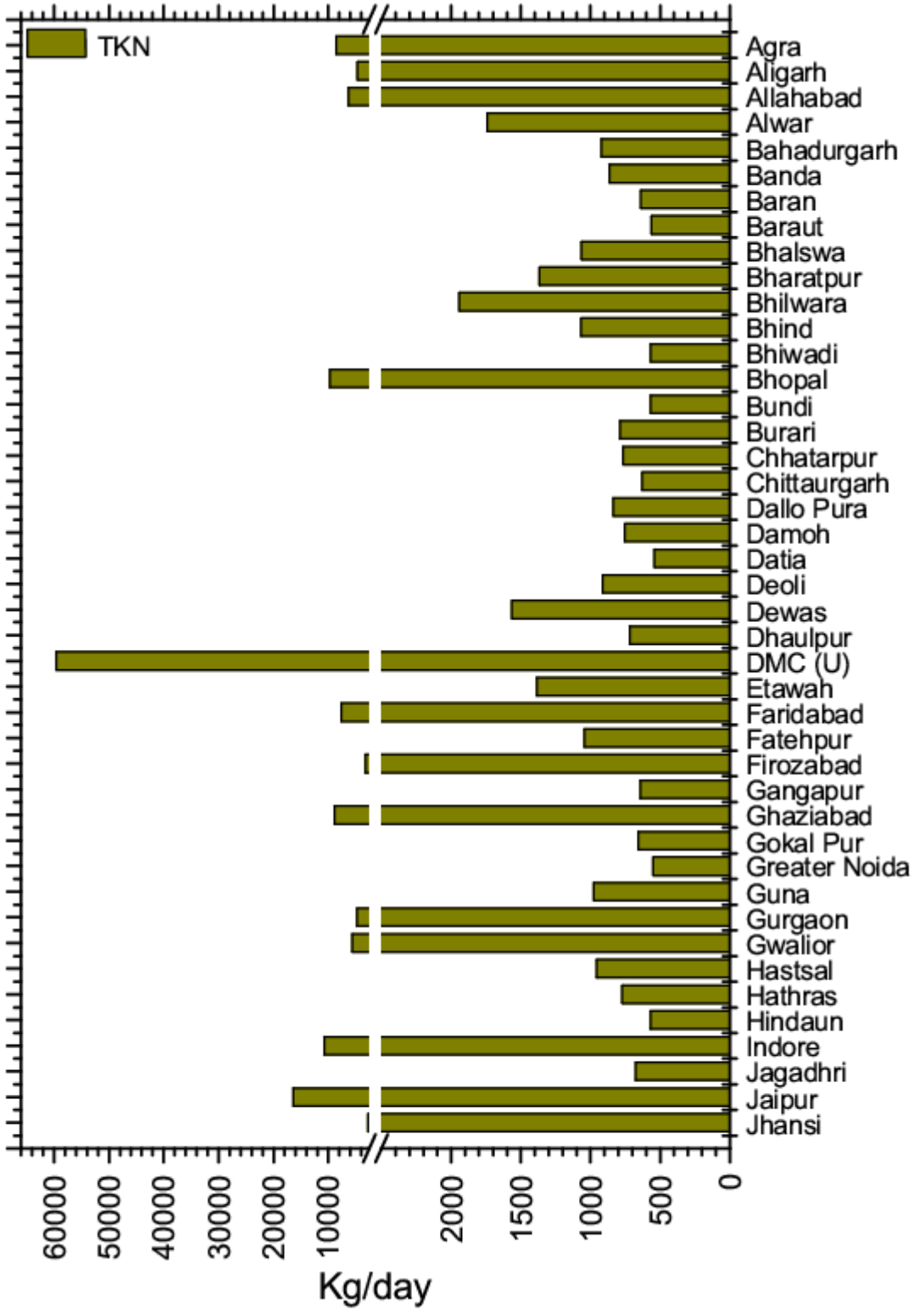


Figure 10a (Part i): Assessment of Water TKN Load (kg/day) from Class I Towns in Yamuna River Basin

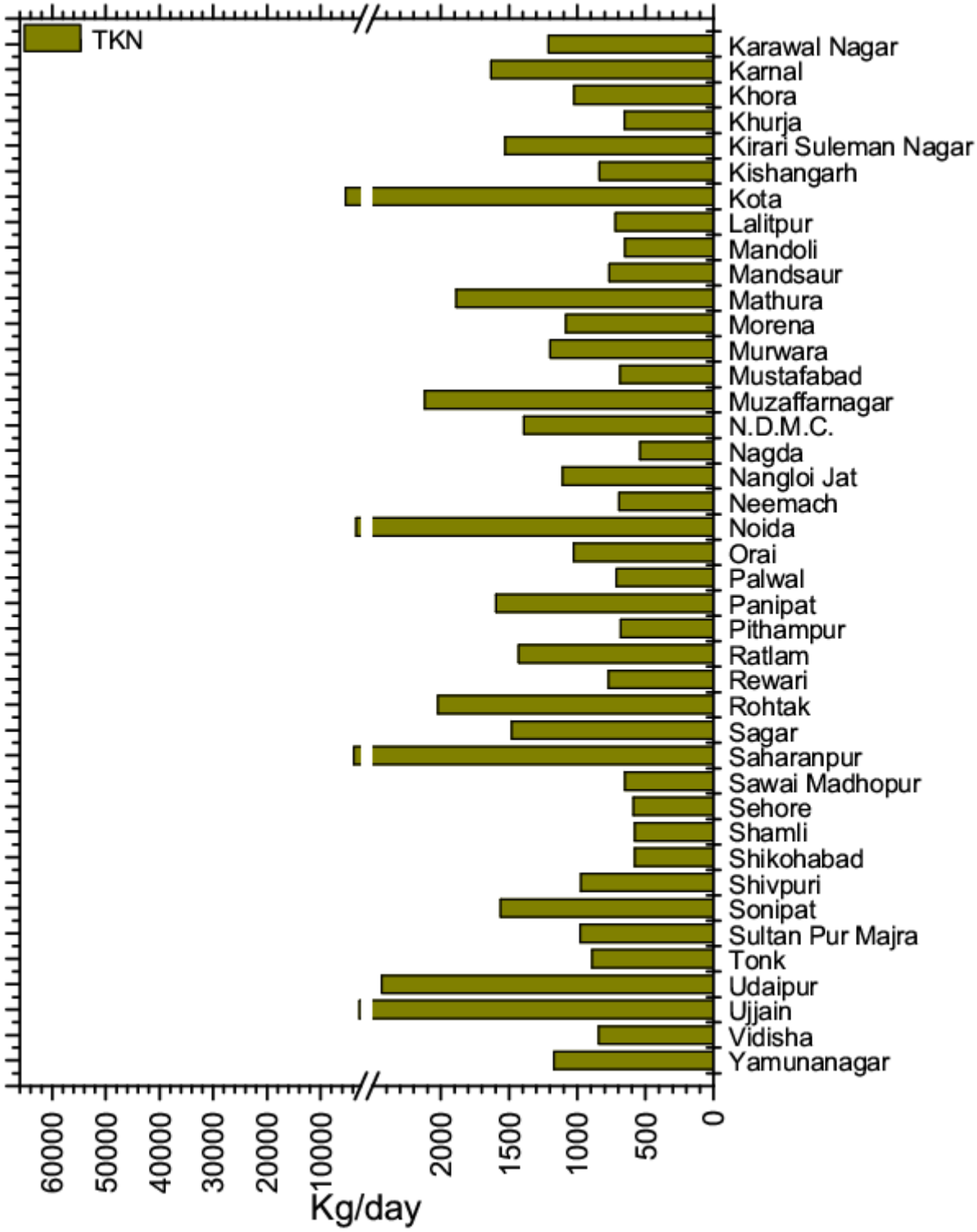


Figure 10a (Part ii): Assessment of Water TKN Load (kg/day) from Class I Towns in Yamuna River Basin

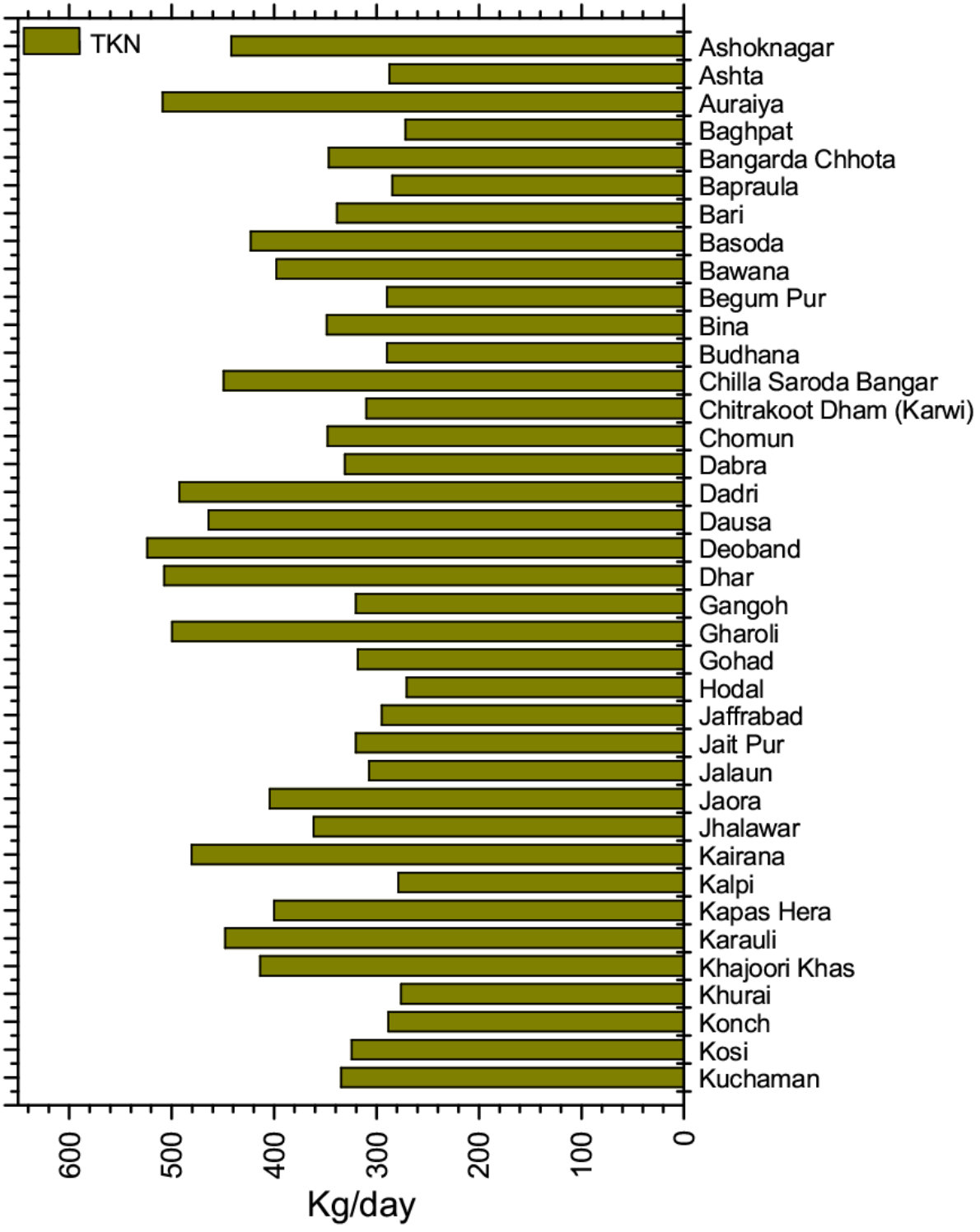


Figure 10b (Part i): Assessment of Water TKN Load (kg/day) from Class II Towns in Yamuna River Basin

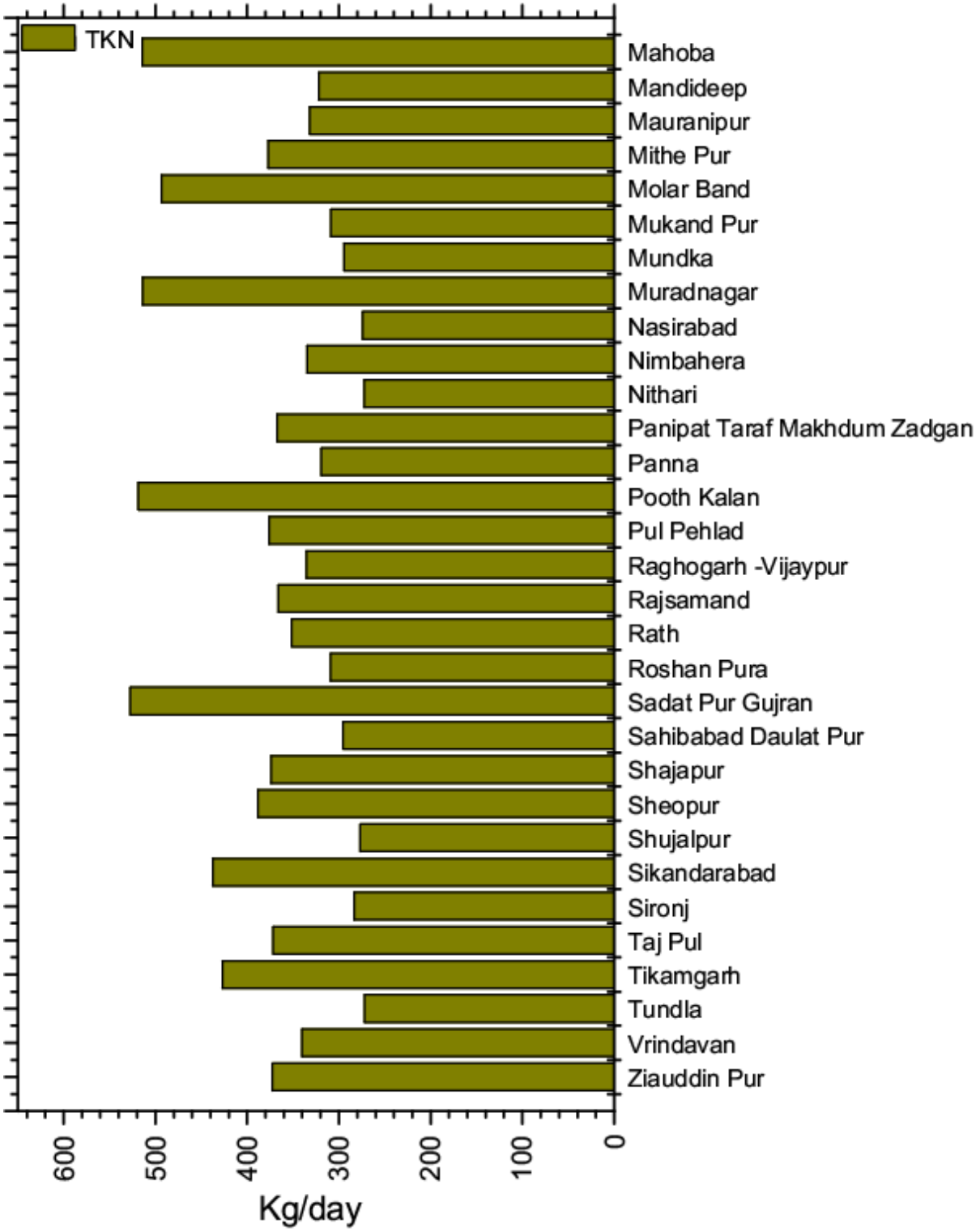


Figure 10b (Part ii): Assessment of Water TKN Load (kg/day) from Class II Towns inYamuna River Basin

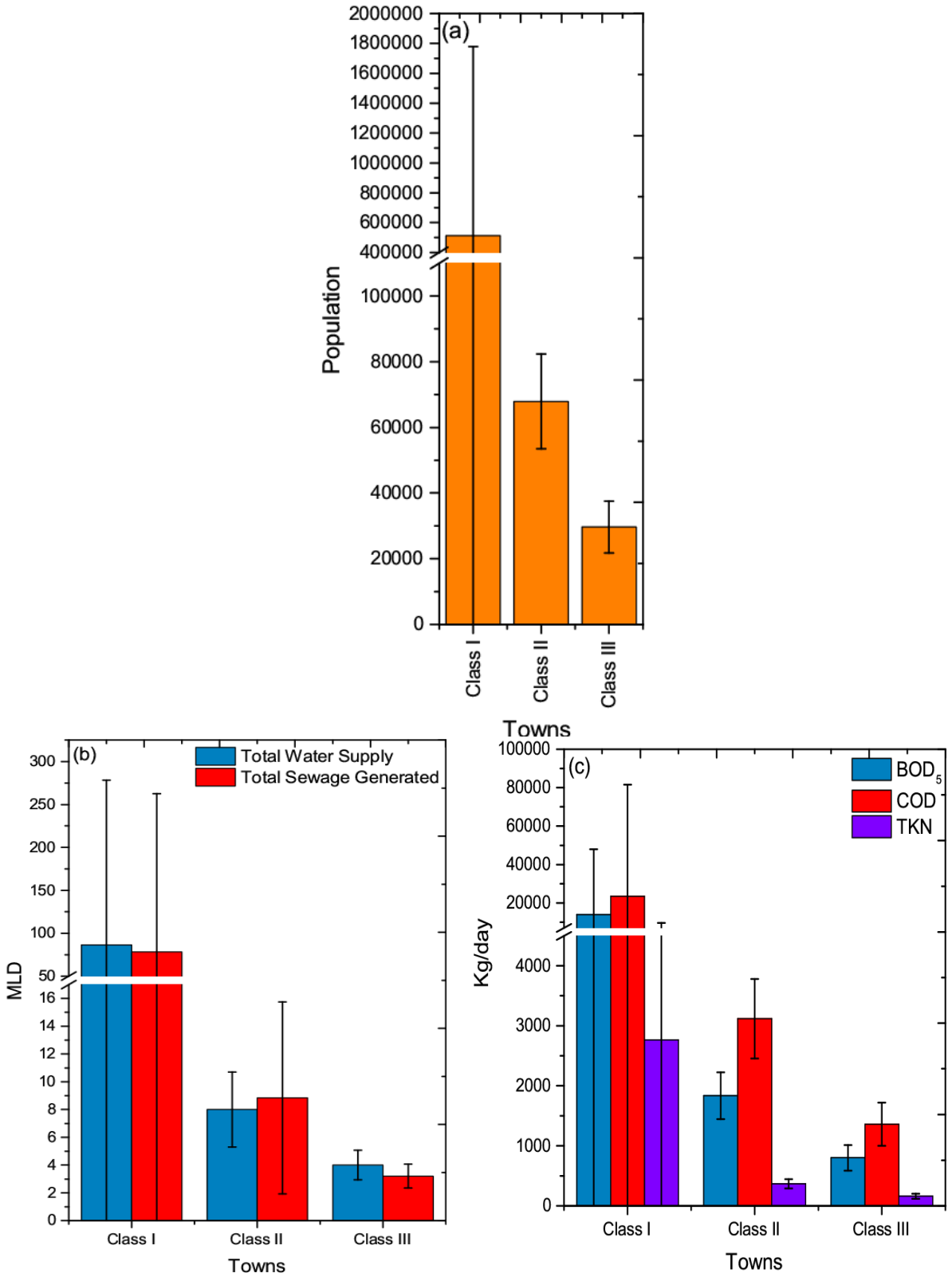


Figure 11: **Comparative Analysis of Class I, Class II and Class III Cities/Towns in Yamuna Basin: (a) Population (b) Total Water Supply and Sewage Generation (c) Pollution Load**

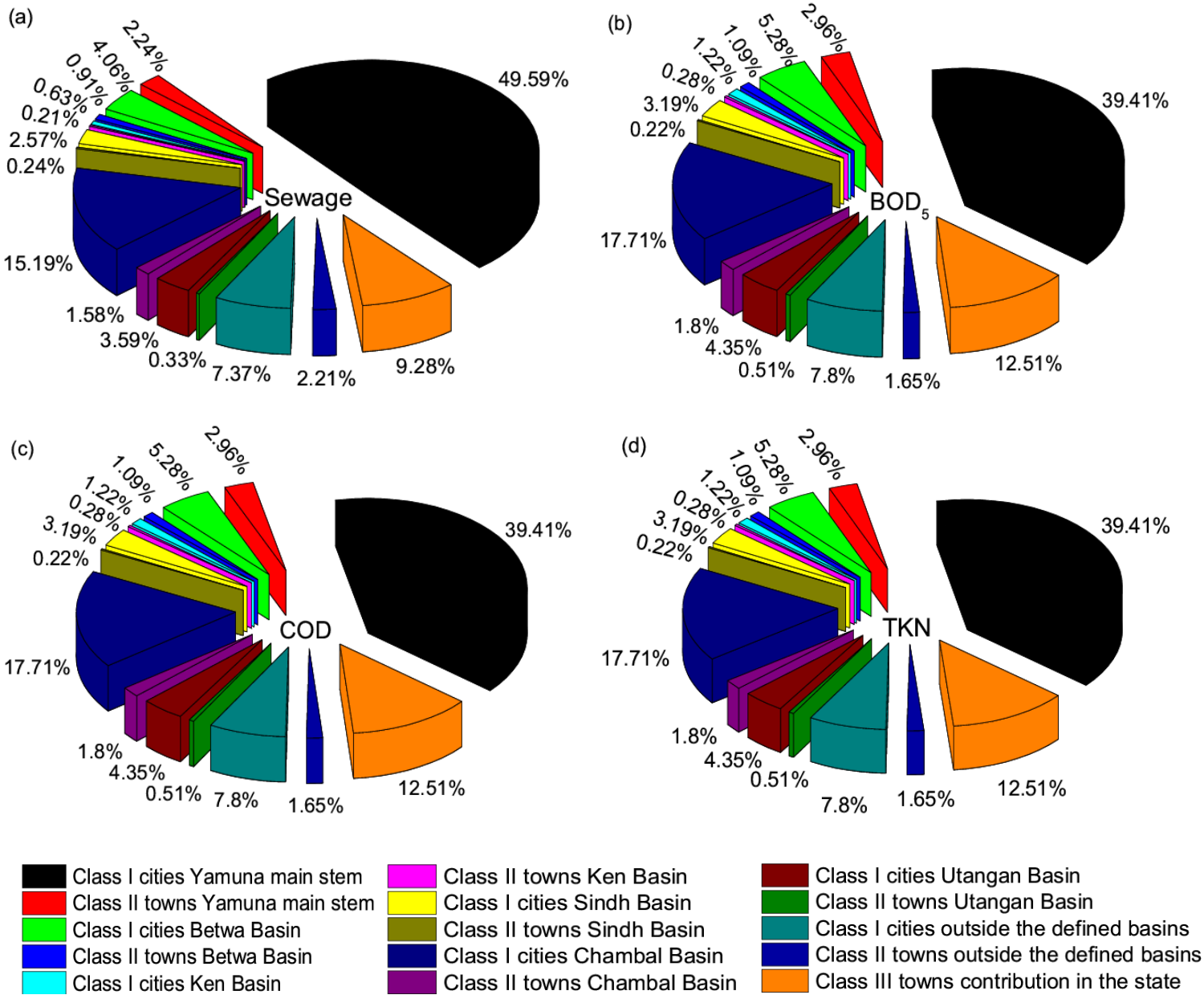


Figure 12 (a-d): Pollution load of Class I Cities and Class II, Class III Towns in Major Basins in Yamuna Basin and Along the Main Stem of the River Yamuna: (a) Sewage Generation; (b) BOD_5; (c) COD; (d) TKN

The pollution loads of Class I cities, Class II and Class III towns under the major sub-basins of river Yamuna in the Yamuna basin have been evaluated (Figure 12a) and the results revealed that the percentage of the total sewage generation is maximum in Class I cities situated along the main stem of Yamuna (49.59%) followed by Class I cities in the Chambal basin (15.19%). Apart from the Chambal basin, other basins generated relatively lesser amount of sewage for Class I cities (Betwa: 4.06%; Utangan: 3.59%; Sindh: 2.57%; Ken: 0.63%). Class I cities outside the selected basins generated 7.37%of the total sewage generated in the Yamuna Basin.The sewage generation for Class II towns in all the

selectedsub-basins underYamuna basin is less than one percent of the total sewage generated in the yamuna basin by Class I, II and III cities/ towns except in Chambalsub-basin where the Class II towns sewage generation is more than one percent (1.58%). Class II towns outside the major defined sub-basins release 2.21% of sewage water. The Class II towns along the main stem of river Yamuna also contribute a significant 2.24% of the total sewage generation in the Yamuna basin. The percentage sewage generation by Class III towns of the entire Yamuna basin is 9.28%.

The BOD, COD and TKN load contributed by Class I cities of the main stem of Yamuna is 39.41%. The Class III towns of the basin impart around 12.51% of the total BOD, COD and TKN load. The sub-basin wise major contributors of Class I cities for BOD, COD and TKN load are Chambal (17.71%), Betwa (5.28%), Utangan (4.35%), Sindh (3.19%) and Ken (1.22%).But significant BOD, COD and TKN loads are also contributed by the Class I cities and Class II towns lying outside the selected basins (7.80 and 1.65%, respectively). The sub-basin wise contributors of Class II cities for BOD, COD and TKN load are Chambal (1.80%), Betwa (1.09%), Utangan (0.51%), Ken (0.28%) and Sindh (0.22%). The details of the BOD and COD load in the state are presented in Figure 12b and c. The TKN load is presented in Figure 12d.

6.Conclusions

Yamuna river basin is one of the major river basin in India. River Yamunais a tributary of Ganga river system, originating from the Yamunotri glacier near Bundar Punch in the lower Himalayas at an elevation of about 6,320 m.It is being polluted by many point and nonpoint sources. The scenario of water quality in the system fluctuates from bad to worse based on the spatial and temporal alterations. Multitudinous problems also arise during lean season due to the continous discharge of untreated and/or partially treated sewage and industrial wastewater. The water quality of the river detoriates extensively in the middle stretch of the river between Delhi to Agra, where the river gets converted into an open drain due to unavilability of water and mergence of large number of cumulative discharges of domestic, industrial and agricultural waste waters.The catchment of the river bears the pollution load of 84 Class I cities, 69 Class II towns and 229 Class III towns, directly or indirectly. The main Class I cities of the state falling on at the bank of Yamuna river are Agra, Allahabad, Delhi, Yamuna Nagar, Etawah, Faridabad, Fatehpur, Greater Noida, Mathura and others.

The maximum sewage generation in the basin is from Class I cities (83.01%) followed by Class III (9.28%) and Class II towns (7.72%). Pollution load (BOD, COD and TKN load) also follows the same trend with maximum values for Class I cities. DMC(U) and Sikandrabad are the Class I and Class II towns, respectivelythat show maximum sewage generation in comparision to their water supply. The maximum BOD, COD and TKN contributing Class I cities, Class II and III towns are DMC(U), Sadat Pur Gujran and Kotputliwhile the minimum loadsare from Nagda (Class I), Hodal (Class II) and Maksi (Class III) in the basin.

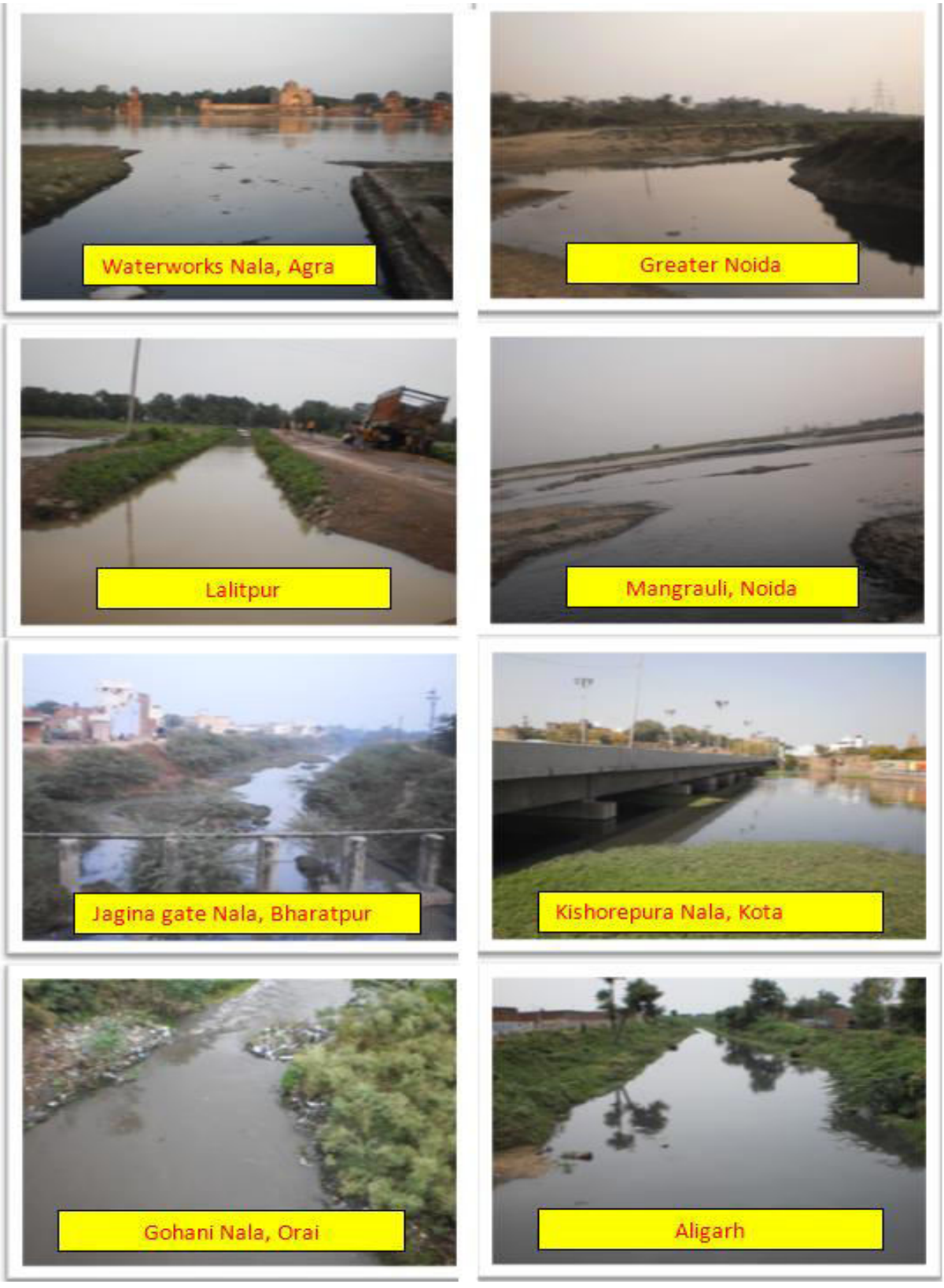


Plate1: Major Drains Disposing Sewage into River Yamuna

References

Central Pollution Control Board (CPCB) (2006). Water quality status of Yamuna River (1999 – 2005). Assessment and Development of River Basin Series: ADSORBS/41/2006-07. Accessible at http://www.cpcb.nic.in/newitems/11.pdf. Accessed:30th Nov 2012.

Chauhan, P.P., Nigam, A. and Santvan, V.K. (2014). Ethnobotanical survey of trees in Pabbarvalley, Distt. Shimla, Himachal Pradesh. Life Sciences Leaflets. 52: 24-39.

Dwivedi, A.C. (2006). Age structure of some commercially exploited fish stocks of the Ganga river system Banda-Mirzapur section. D Phil Thesis, Allahabad University, Allahabad, India.

Garg, V., Khwanchanok, A.,Gupta, P.K., Aggarwal, S.P., Kiriwongwattana, K., Thakur, P.K. andNikam, B.R. (2012). Urbanisation Effect on Hydrological Response: A Case Study of Asan River Watershed, India. Journal of Environment and Earth Science. 2 (9): 39-50.

Gopal, B. and Sah, M.(1993). Conservation and management of rivers in India: Case study of the River Yamuna. Environmental Conservation. 20: 243–254.

Gopal, B. (2003). Enhancing water flow in River Yamuna at Delhi: Research and Action Plan. http://www.aquaticecosystems.org/wp-content/uploads/2015/06/Yamuna-Flow-Report2002.pdf. Accessed: 15th April, 2015.

India-WRIS (2015). http://india-wris.nrsc.gov.in/wrpinfo/index.php?title=Large_Dams_in_India. Accessed: 22nd March, 2015.

Mathur, R.P. and Kapoor, V. (2013). Floral and Faunal Diversity in Yamuna River Yamnotri – Allahabad. http://52.7.188.233/sites/default/files/034_ENB_YAMUNA.pdf. Accessed: 20th May, 2013.

Misra, H.N. and Mishra, A. (2014). Perennials in Peril: A case of the Yamuna river basin. Mishra, H.N. (Eds.), PHI learning Private Ltd., Delhi, pp. 189-201.

Panwar, H.S. (2009). Reviving river Yamuna: An actionable blue print for a blue river. PEACE Institute Charitable Trust: Delhi, India.

Rai, R.K., Upadhyay, A., Ojha, C.S.P. and Singh, V.P. (2012). The Yamuna River Basin. Water Science and Technology Library, Vol. 66, DOI 10.1007/978-94-007-2001-5_7, ©Springer Science+Business Media B.V. 2012.

Raychaudhuri, S.P., Roy, B.B., Gupta, S.P. and Dewan, M.L. (1963). Slack soils ofIndia. National Institute of Science of India, India, p 163.

Appendix-1

Compilation of Data Sheets of Water Balance & Pollution Load (Domestic) of Major Class I Cities in Yamuna Basin

Water Balance & Pollution Load (Domestic) Data Sheet

City: Agra			State: Uttar Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	120.57
2	Population as in 2011		:	1585704
3	Population Growth Rate as in 2011 (%)		:	24.36
4	Total Number of Wards		:	90
5	Population per Ward (Thousands)		:	17,619
6	Total Number of Household as in 2011		:	267945
7	Number of Household per Ward		:	2977
8	Surface Water Supply (MLD)		:	285
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	7058
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	2
15	Total Pumping Capacity (MLD)		:	285
16	Average Water Supply Rate from ULB Sources (lpcd)		:	179.73
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	288.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	182.00
19	Total Sewage Generation (MLD)*		:	154.40
20	Per Capita Sewage Generation (lpcd)		:	88.20
21	Sewage Collection (MLD)		:	106.50
22	Percentage of Sewage Collection (%)		:	68.98
23	Number of STPs		:	5
24	Total Installed Capacity of STPs under GAP & YAP I & II (MLD)		:	116
25	Current Utilized Capacity of STPs (MLD)		:	106.50
26	Percentage Utilization of Installed Capacity (%)		:	91.80
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)		:	100
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	:	42814.00
		COD	:	72783.80
		TKN	:	8562.80
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	11
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Aligarh		State: Uttar Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	40.43
2	Population as in 2011		:	874408
3	Population Growth Rate as in 2011 (%)		:	30.69
4	Total Number of Wards		:	70
5	Population per Ward (Thousands)		:	12,492
6	Total Number of Household as in 2011		:	147363
7	Number of Household per Ward		:	2105
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	69.10
10	Number of Bore Wells		:	72
11	Ground Water Extraction per Bore Well (MLD)		:	0.96
12	Number of Hand Pumps/ Tubewells		:	4100
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	79.02
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	71.15
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	81.37
19	Total Sewage Generation (MLD)*		:	62.21
20	Per Capita Sewage Generation (lpcd)		:	71.14
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	23609.00
		COD	:	40135.30
		TKN	:	4721.80
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	21
34	Gross Area of Water Bodies (Hectare)		:	8.42
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Allahabad				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	70.05
2	Population as in 2011		:	1168385
3	Population Growth Rate as in 2011 (%)		:	14.76
4	Total Number of Wards		:	80
5	Population per Ward (Thousands)		:	14605
6	Total Number of Household as in 2011		:	205529
7	Number of Household per Ward		:	2569
8	Surface Water Supply (MLD)		:	70
9	Ground Water (GW) Supply (MLD)		:	171.50
10	Number of Bore Wells		:	189
11	Ground Water Extraction per Bore Well (MLD)		:	1.12
12	Number of Hand Pumps		:	2383
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	3
15	Total Pumping Capacity (MLD)		:	70
16	Average Water Supply Rate from ULB Sources (lpcd)		:	172.50
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	242.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	207.70
19	Total Sewage Generation (MLD)		:	221.40
20	Per Capita Sewage Generation (lpcd)		:	189.50
21	Sewage Collection (MLD)		:	87.50
22	Percentage of Sewage Collection (%)		:	39.50
23	Number of STPs		:	2
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	89
25	Current Utilized Capacity of STPs (MLD)		:	87.50
26	Percentage Utilization of Installed Capacity (%)		:	98.30
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)		:	60
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD_5	:	25203.60
		COD	:	67256.20
		TKN	:	10230.20
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD_5	:	31546.40
		COD	:	53628.90
		TKN	:	6309.30
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Ganga, Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	57 (Tapped: 15)
33	Number of Water Bodies		:	17
34	Gross Area of Water Bodies (Hectare)		:	8.44
35	Area of Water Bodies as % of Total Area		:	<<1.0

Water Balance & Pollution Load (Domestic) Data Sheet

City: Alwar				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	48.40
2	Population as in 2011		:	322568
3	Population Growth Rate as in 2011 (%)		:	21.17
4	Total Number of Wards		:	52
5	Population per Ward (Thousands)		:	6203
6	Total Number of Household as in 2011		:	62776
7	Number of Household per Ward		:	1207
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	350
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	36.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	112.20
19	Total Sewage Generation (MLD)*		:	29.00
20	Per Capita Sewage Generation (lpcd)		:	89.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	8709.30
		COD	:	14805.90
		TKN	:	1741.90
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	0
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bahadurgarh				State: Haryana
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	29.50
2	Population as in 2011		:	170767
3	Population Growth Rate as in 2011 (%)		:	29.44
4	Total Number of Wards		:	31
5	Population per Ward (Thousands)		:	5509
6	Total Number of Household as in 2011		:	34910
7	Number of Household per Ward		:	1126
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tube wells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	23.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	18.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	3.00
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	18.00
25	Current Utilized Capacity of STPs (MLD)		:	NA
26	Percentage Utilization of Installed Capacity (%)		:	NA
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)		:	1.00
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	:	4610.70
		COD	:	7838.20
		TKN	:	922.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Banda				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	16.00
2	Population as in 2011		:	160473
3	Population Growth Rate as in 2011 (%)		:	15.09
4	Total Number of Wards		:	28
5	Population per Ward (Thousands)		:	4980
6	Total Number of Household as in 2011		:	29162
7	Number of Household per Ward		:	1042
8	Surface Water Supply (MLD)		:	9.57
9	Ground Water (GW) Supply (MLD)		:	13.11
10	Number of Bore Wells		:	21
11	Ground Water Extraction per Bore Well (MLD)		:	0.62
12	Number of Hand Pumps/ Tubewells		:	834
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	9.57
16	Average Water Supply Rate from ULB Sources (lpcd)		:	141.14
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	23.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	143.90
19	Total Sewage Generation (MLD)*		:	13.50
20	Per Capita Sewage Generation (lpcd)*		:	84.30
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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)		:	4
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	:	4332.80
		COD	:	7365.70
		TKN	:	866.60
30	Wastewater Disposal Means		:	Land & River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Ken River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Baran		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	72.36
2	Population as in 2011		:	117992
3	Population Growth Rate as in 2011 (%)		:	49.99
4	Total Number of Wards		:	35
5	Population per Ward (Thousands)		:	3371
6	Total Number of Household as in 2011		:	23277
7	Number of Household per Ward		:	665
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	71.80
19	Total Sewage Generation (MLD)*		:	6.80
20	Per Capita Sewage Generation (lpcd)		:	57.60
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3185.80
		COD	:	5415.80
		TKN	:	637.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Parbati, Parvan, Kali Sindh River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	3
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Baraut				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	10.36
2	Population as in 2011		:	103764
3	Population Growth Rate as in 2011 (%)		:	21.07
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	4,151
6	Total Number of Household as in 2011		:	17924
7	Number of Household per Ward		:	717
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	21
10	Number of Bore Wells		:	18
11	Ground Water Extraction per Bore Well (MLD)		:	1.17
12	Number of Hand Pumps/ Tubewells		:	424
13	Ground Water Extraction per Hand Pump (lpd)		:	600
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	202.40
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	21.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	204.80
19	Total Sewage Generation (MLD)*		:	7.90
20	Per Capita Sewage Generation (lpcd)*		:	76.40
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2801.60
		COD	:	4762.80
		TKN	:	560.30
30	Wastewater Disposal Means		:	Land & River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bhalswa Jahangir Pur				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.70
2	Population as in 2011		:	197148
3	Population Growth Rate as in 2011 (%)		:	29.41
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	65716
6	Total Number of Household as in 2011		:	38157
7	Number of Household per Ward		:	12719
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	26.60
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	21.30
20	Per Capita Sewage Generation (lpcd)*		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	5323.00
		COD	:	9049.10
		TKN	:	1064.60
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	4
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bharatpur		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	57.77
2	Population as in 2011		:	252838
3	Population Growth Rate as in 2011 (%)		:	23.19
4	Total Number of Wards		:	53
5	Population per Ward (Thousands)		:	4771
6	Total Number of Household as in 2011		:	45914
7	Number of Household per Ward		:	9866
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	131
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	23.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	92.00
19	Total Sewage Generation (MLD)*		:	16.60
20	Per Capita Sewage Generation (lpcd)		:	65.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	6826.60
		COD	:	11605.30
		TKN	:	1365.30
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	8
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bhilwara		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	118.49
2	Population as in 2011		:	359483
3	Population Growth Rate as in 2011 (%)		:	28.33
4	Total Number of Wards		:	50
5	Population per Ward (Thousands)		:	7,190
6	Total Number of Household as in 2011		:	74184
7	Number of Household per Ward		:	1484
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	1600
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	32.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	90.10
19	Total Sewage Generation (MLD)*		:	21.70
20	Per Capita Sewage Generation (lpcd)		:	60.40
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	9706.00
		COD	:	16500.30
		TKN	:	1941.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kothari, Banas River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	9
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bhind		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	17.18
2	Population as in 2011		:	197585
3	Population Growth Rate as in 2011 (%)		:	28.51
4	Total Number of Wards		:	39
5	Population per Ward (Thousands)		:	5,066
6	Total Number of Household as in 2011		:	33592
7	Number of Household per Ward		:	861
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	19.08
10	Number of Bore Wells		:	42
11	Ground Water Extraction per Bore Well (MLD)		:	0.45
12	Number of Hand Pumps/ Tubewells		:	5400
13	Ground Water Extraction per Hand Pump (lpd)		:	1000
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	24.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	124.00
19	Total Sewage Generation (MLD)*		:	19.60
20	Per Capita Sewage Generation (lpcd)		:	99.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	5334.80
		COD	:	9069.20
		TKN	:	1067.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kunwari River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	27.00
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bhiwadi		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	44.06
2	Population as in 2011		:	104921
3	Population Growth Rate as in 2011 (%)		:	209.71
4	Total Number of Wards		:	35
5	Population per Ward (Thousands)		:	2998
6	Total Number of Household as in 2011		:	24449
7	Number of Household per Ward		:	699
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	14.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	NA
19	Total Sewage Generation (MLD)*		:	11.30
20	Per Capita Sewage Generation (lpcd)		:	107.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2832.90
		COD	:	4815.90
		TKN	:	566.60
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bhopal		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	285.88
2	Population as in 2011		:	1798218
3	Population Growth Rate as in 2011 (%)		:	23.30
4	Total Number of Wards		:	70
5	Population per Ward (Thousands)		:	25,689
6	Total Number of Household as in 2011		:	382690
7	Number of Household per Ward		:	5467
8	Surface Water Supply (MLD)		:	211.96
9	Ground Water (GW) Supply (MLD)		:	15.14
10	Number of Bore Wells		:	1675
11	Ground Water Extraction per Bore Well (MLD)		:	0.01
12	Number of Hand Pumps/ Tubewells		:	5275
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	211.96
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	229.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	127.70
19	Total Sewage Generation (MLD)*		:	168.50
20	Per Capita Sewage Generation (lpcd)		:	93.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	48551.90
		COD	:	82538.20
		TKN	:	9710.40
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Betwa River
32	Number of Drains/Nallah for Wastewater Disposal		:	5
33	Number of Water Bodies		:	29
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bundi		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	27.79
2	Population as in 2011		:	104919
3	Population Growth Rate as in 2011 (%)		:	18.06
4	Total Number of Wards		:	41
5	Population per Ward (Thousands)		:	2559
6	Total Number of Household as in 2011		:	20555
7	Number of Household per Ward		:	501
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	372
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	1
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	18.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	171.60
19	Total Sewage Generation (MLD)*		:	29.80
20	Per Capita Sewage Generation (lpcd)		:	284
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2832.80
		COD	:	4815.80
		TKN	:	566.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Mez River
32	Number of Drains/Nallah for Wastewater Disposal		:	4
33	Number of Water Bodies		:	7
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Burari		State: NCT Delhi		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	11.20
2	Population as in 2011		:	146190
3	Population Growth Rate as in 2011 (%)		:	110.85
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	48730
6	Total Number of Household as in 2011		:	28610
7	Number of Household per Ward		:	9537
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	NA
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	19.70
19	Total Sewage Generation (MLD)*		:	135.00
20	Per Capita Sewage Generation (lpcd)		:	15.80
21	Sewage Collection (MLD)		:	108.00
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3947.10
		COD	:	6710.10
		TKN	:	789.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Chhatarpur		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	15.56
2	Population as in 2011		:	142128
3	Population Growth Rate as in 2011 (%)		:	30.30
4	Total Number of Wards		:	40
5	Population per Ward (Thousands)		:	3,553
6	Total Number of Household as in 2011		:	26793
7	Number of Household per Ward		:	670
8	Surface Water Supply (MLD)		:	0.75
9	Ground Water (GW) Supply (MLD)		:	1.67
10	Number of Bore Wells		:	10
11	Ground Water Extraction per Bore Well (MLD)		:	0.17
12	Number of Hand Pumps/ Tubewells		:	16480
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	0.75
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	10.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	75.30
19	Total Sewage Generation (MLD)*		:	7.20
20	Per Capita Sewage Generation (lpcd)		:	50.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3837.50
		COD	:	6523.70
		TKN	:	767.50
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	7
34	Gross Area of Water Bodies (Hectare)		:	10.00
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Chittaurgarh		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	41.76
2	Population as in 2011/2001		:	116406
3	Population Growth Rate as in 2011 (%)		:	20.98
4	Total Number of Wards		:	40
5	Population per Ward (Thousands)		:	2,910
6	Total Number of Household as in 2011		:	24739
7	Number of Household per Ward		:	618
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	513
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	11.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	95.00
19	Total Sewage Generation (MLD)*		:	8.60
20	Per Capita Sewage Generation (lpcd)		:	74.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3143.00
		COD	:	5343.00
		TKN	:	628.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Gambhiri River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	18
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Dallo Pura		State: NCT Delhi		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.29
2	Population as in 2011/2001		:	154791
3	Population Growth Rate as in 2011 (%)		:	16.72
4	Total Number of Wards		:	4
5	Population per Ward (Thousands)		:	38697.75
6	Total Number of Household as in 2011		:	31009
7	Number of Household per Ward		:	7752
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	20.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	16.70
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	4179.40
		COD	:	7104.90
		TKN	:	835.90
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Damoh		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	33.23
2	Population as in 2011/2001		:	139561
3	Population Growth Rate as in 2011 (%)		:	9.06
4	Total Number of Wards		:	39
5	Population per Ward (Thousands)		:	3,578
6	Total Number of Household as in 2011		:	28274
7	Number of Household per Ward		:	725
8	Surface Water Supply (MLD)		:	6.30
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	550
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	6.30
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.60
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	47.30
19	Total Sewage Generation (MLD)*		:	5.30
20	Per Capita Sewage Generation (lpcd)		:	37.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3768.10
		COD	:	6405.80
		TKN	:	753.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Sunar River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	9
34	Gross Area of Water Bodies (Hectare)		:	119.44
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Datia		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.64
2	Population as in 2011/2001		:	100284
3	Population Growth Rate as in 2011 (%)		:	21.18
4	Total Number of Wards		:	36
5	Population per Ward (Thousands)		:	2,786
6	Total Number of Household as in 2011		:	19254
7	Number of Household per Ward		:	535
8	Surface Water Supply (MLD)		:	4
9	Ground Water (GW) Supply (MLD)		:	1
10	Number of Bore Wells		:	26
11	Ground Water Extraction per Bore Well (MLD)		:	0.04
12	Number of Hand Pumps/ Tubewells		:	3000
13	Ground Water Extraction per Hand Pump (lpd)		:	1000
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	4
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	79.80
19	Total Sewage Generation (MLD)*		:	8.50
20	Per Capita Sewage Generation (lpcd)		:	84.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2707.70
		COD	:	4603.00
		TKN	:	541.50
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Pahuj River
32	Number of Drains/Nallah for Wastewater Disposal		:	4
33	Number of Water Bodies		:	10
34	Gross Area of Water Bodies (Hectare)		:	60.80
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Deoli		State: NCT Delhi		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	10.10
2	Population as in 2011/2001		:	169122
3	Population Growth Rate as in 2011 (%)		:	41.56
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	56374
6	Total Number of Household as in 2011		:	32344
7	Number of Household per Ward		:	10781
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	NA
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	22.80
19	Total Sewage Generation (MLD)*		:	135.00
20	Per Capita Sewage Generation (lpcd)		:	18.30
21	Sewage Collection (MLD)		:	108.00
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	4566.30
		COD	:	7762.70
		TKN	:	913.30
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Dewas		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	100.22
2	Population as in 2011/2001		:	289550
3	Population Growth Rate as in 2011 (%)		:	24.98
4	Total Number of Wards		:	45
5	Population per Ward (Thousands)		:	6,434
6	Total Number of Household as in 2011		:	57397
7	Number of Household per Ward		:	1275
8	Surface Water Supply (MLD)		:	6.35
9	Ground Water (GW) Supply (MLD)		:	4
10	Number of Bore Wells		:	507
11	Ground Water Extraction per Bore Well (MLD)		:	0.01
12	Number of Hand Pumps/ Tubewells		:	236
13	Ground Water Extraction per Hand Pump (lpd)		:	4238
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	6.35
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	29.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	101.50
19	Total Sewage Generation (MLD)*		:	23.10
20	Per Capita Sewage Generation (lpcd)		:	79.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	7817.90
		COD	:	13290.30
		TKN	:	1563.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kshipra River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	3.06
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Dhaulpur		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	32.03
2	Population as in 2011		:	133075
3	Population Growth Rate as in 2011 (%)		:	36.08
4	Total Number of Wards		:	42
5	Population per Ward (Thousands)		:	3168
6	Total Number of Household as in 2011		:	22563
7	Number of Household per Ward		:	537
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	320
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	13.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	100.40
19	Total Sewage Generation (MLD)*		:	10.60
20	Per Capita Sewage Generation (lpcd)		:	79.40
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3593.00
		COD	:	6108.10
		TKN	:	718.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Chambal, Utangan River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	5
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: DMC (U)		State: NCT Delhi		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	561.27
2	Population as in 2011/2001		:	11034555
3	Population Growth Rate as in 2011 (%)		:	11.70
4	Total Number of Wards		:	217
5	Population per Ward (Thousands)		:	50850
6	Total Number of Household as in 2011		:	2306675
7	Number of Household per Ward		:	10630
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	NA
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	1489.70
19	Total Sewage Generation (MLD)*		:	135.00
20	Per Capita Sewage Generation (lpcd)		:	1191.70
21	Sewage Collection (MLD)		:	108.00
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	297933.00
		COD	:	506486.10
		TKN	:	59586.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna, Hindan River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Etawah		State: Uttar Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	28.94
2	Population as in 2011		:	256838
3	Population Growth Rate as in 2011 (%)		:	22.04
4	Total Number of Wards		:	36
5	Population per Ward (Thousands)		:	5,846
6	Total Number of Household as in 2011		:	44659
7	Number of Household per Ward		:	1241
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	23.00
10	Number of Bore Wells		:	43
11	Ground Water Extraction per Bore Well (MLD)		:	0.47
12	Number of Hand Pumps/ Tubewells		:	930
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	89.55
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	23.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	91.40
19	Total Sewage Generation (MLD)		:	22.40
20	Per Capita Sewage Generation (lpcd)		:	87.30
21	Sewage Collection (MLD)		:	10.45
22	Percentage of Sewage Collection (%)		:	46.60
23	Number of STPs		:	1
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	10.45
25	Current Utilized Capacity of STPs (MLD)		:	10.45
26	Percentage Utilization of Installed Capacity (%)		:	100
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	:	6934.60
		COD	:	11788.90
		TKN	:	1386.90
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	19
34	Gross Area of Water Bodies (Hectare)		:	7.29
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Faridabad				State: Haryana
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	204.00
2	Population as in 2011		:	1414050
3	Population Growth Rate as in 2011 (%)		:	33.91
4	Total Number of Wards		:	35
5	Population per Ward (Thousands)		:	40401
6	Total Number of Household as in 2011		:	290675
7	Number of Household per Ward		:	8305
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	190.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	152.72
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	142.30
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	4
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	:	38179.40
		COD	:	64904.90
		TKN	:	7635.90
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	4
33	Number of Water Bodies		:	4
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Fatehpur			State: Uttar Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	56.98
2	Population as in 2011		:	193193
3	Population Growth Rate as in 2011 (%)		:	27.04
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	6,440
6	Total Number of Household as in 2011		:	34745
7	Number of Household per Ward		:	1158
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	29.61
10	Number of Bore Wells		:	47
11	Ground Water Extraction per Bore Well (MLD)		:	0.63
12	Number of Hand Pumps		:	786
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	153.27
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	30.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	155.30
19	Total Sewage Generation (MLD)*		:	11.80
20	Per Capita Sewage Generation (lpcd)		:	60.90
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	5216.20
		COD	:	8867.60
		TKN	:	1043.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	7
34	Gross Area of Water Bodies (sq km)		:	2.30
35	Area of Water Bodies as % of Total Area		:	<<<1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Firozabad				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	21.35
2	Population as in 2011		:	604214
3	Population Growth Rate as in 2011 (%)		:	51.96
4	Total Number of Wards		:	42
5	Population per Ward (Thousands)		:	14,386
6	Total Number of Household as in 2011		:	99833
7	Number of Household per Ward		:	2377
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	42.65
10	Number of Bore Wells		:	194
11	Ground Water Extraction per Bore Well (MLD)		:	0.22
12	Number of Hand Pumps/ Tubewells		:	1415
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	70.59
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	43.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	71.80
19	Total Sewage Generation (MLD)		:	85.30
20	Per Capita Sewage Generation (lpcd)		:	141.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	16313.80
		COD	:	27733.40
		TKN	:	3262.80
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	16
34	Gross Area of Water Bodies (Hectare)		:	5.35
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Gangapur		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	52.31
2	Population as in 2011		:	119090
3	Population Growth Rate as in 2011 (%)		:	22.97
4	Total Number of Wards		:	20
5	Population per Ward (Thousands)		:	5955
6	Total Number of Household as in 2011		:	21068
7	Number of Household per Ward		:	1053
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	5242
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	100.90
19	Total Sewage Generation (MLD)*		:	5.60
20	Per Capita Sewage Generation (lpcd)		:	47.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3215.40
		COD	:	5466.20
		TKN	:	643.10
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kothari,Banas River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	0
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Ghaziabad		State: Uttar Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	220.00
2	Population as in 2011		:	1648643
3	Population Growth Rate as in 2011 (%)		:	70.27
4	Total Number of Wards		:	80
5	Population per Ward (Thousands)		:	20,608
6	Total Number of Household as in 2011		:	336069
7	Number of Household per Ward		:	4201
8	Surface Water Supply (MLD)		:	73
9	Ground Water (GW) Supply (MLD)		:	320
10	Number of Bore Wells		:	334
11	Ground Water Extraction per Bore Well (MLD)		:	0.96
12	Number of Hand Pumps/ Tubewells		:	5353
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	73
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	395.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	240.00
19	Total Sewage Generation (MLD)*		:	163.80
20	Per Capita Sewage Generation (lpcd)		:	99.40
21	Sewage Collection (MLD)		:	120.00
22	Percentage of Sewage Collection (%)		:	73.26
23	Number of STPs		:	3
24	Total Installed Capacity of STPs under YAP I & II (MLD)		:	126
25	Current Utilized Capacity of STPs (MLD)		:	120
26	Percentage Utilization of Installed Capacity (%)		:	95.24
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)		:	224
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	:	44513.40
		COD	:	75672.70
		TKN	:	8902.70
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna & Hindan River
32	Number of Drains/Nallah for Wastewater Disposal		:	9
33	Number of Water Bodies		:	121
34	Gross Area of Water Bodies (Hectare)		:	50.00
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Gokal Pur		State: NCT Delhi		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.30
2	Population as in 2011		:	121870
3	Population Growth Rate as in 2011 (%)		:	33.69
4	Total Number of Wards		:	5
5	Population per Ward (Thousands)		:	24374
6	Total Number of Household as in 2011		:	22592
7	Number of Household per Ward		:	4518
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	16.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	13.20
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
24	Total Installed Capacity of STPs under YAP 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	:	3290.50
		COD	:	5593.80
		TKN	:	658.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Greater Noida			State: Uttar Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	20.00
2	Population as in 2011		:	102054
3	Population Growth Rate as in 2011 (%)		:	NA
4	Total Number of Wards		:	58
5	Population per Ward (Thousands)		:	1,760
6	Total Number of Household as in 2011		:	20779
7	Number of Household per Ward		:	358
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	74.00
10	Number of Bore Wells		:	108
11	Ground Water Extraction per Bore Well (MLD)		:	0.69
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	1000
14	Number of Pumping Stations for Water Supply		:	1
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	74.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	725.10
19	Total Sewage Generation (MLD)*		:	110.20
20	Per Capita Sewage Generation (lpcd)		:	1080.30
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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)		:	47
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	:	2755.50
		COD	:	4684.30
		TKN	:	551.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Guna		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	45.75
2	Population as in 2011		:	180935
3	Population Growth Rate as in 2011 (%)		:	31.90
4	Total Number of Wards		:	37
5	Population per Ward (Thousands)		:	4,890
6	Total Number of Household as in 2011		:	34383
7	Number of Household per Ward		:	929
8	Surface Water Supply (MLD)		:	5
9	Ground Water (GW) Supply (MLD)		:	5.50
10	Number of Bore Wells		:	254
11	Ground Water Extraction per Bore Well (MLD)		:	0.02
12	Number of Hand Pumps/ Tubewells		:	284
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	5
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	11.60
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	64.10
19	Total Sewage Generation (MLD)*		:	9.30
20	Per Capita Sewage Generation (lpcd)		:	51.30
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	4885.20
		COD	:	8304.90
		TKN	:	977.00
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	3
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Gurgaon				State: Haryana
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	184.59
2	Population as in 2011		:	886519
3	Population Growth Rate as in 2011 (%)		:	340.30
4	Total Number of Wards		:	74
5	Population per Ward (Thousands)		:	11980
6	Total Number of Household as in 2011		:	208229
7	Number of Household per Ward		:	2814
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	119.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	95.70
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	3
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	148.00
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	:	23936.00
		COD	:	40691.20
		TKN	:	4787.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	4
33	Number of Water Bodies		:	7
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Gwalior				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	173.68
2	Population as in 2011		:	1054420
3	Population Growth Rate as in 2011 (%)		:	27.50
4	Total Number of Wards		:	60
5	Population per Ward (Thousands)		:	17,574
6	Total Number of Household as in 2011		:	199466
7	Number of Household per Ward		:	3324
8	Surface Water Supply (MLD)		:	135
9	Ground Water (GW) Supply (MLD)		:	10
10	Number of Bore Wells		:	1485
11	Ground Water Extraction per Bore Well (MLD)		:	0.01
12	Number of Hand Pumps/ Tubewells		:	1270
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	135
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	145.60
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	138.10
19	Total Sewage Generation (MLD)*		:	150.30
20	Per Capita Sewage Generation (lpcd)		:	142.50
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	28469.30
		COD	:	48397.90
		TKN	:	5693.90
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	14
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Hastsal			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.80
2	Population as in 2011		:	176877
3	Population Growth Rate as in 2011 (%)		:	104.35
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	58959
6	Total Number of Household as in 2011		:	33977
7	Number of Household per Ward		:	11326
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	23.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	19.10
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	4775.70
		COD	:	8118.70
		TKN	:	955.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Hathras				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.76
2	Population as in 2001		:	143020
3	Population Growth Rate as in 2001 (%)		:	13.19
4	Total Number of Wards		:	27
5	Population per Ward (Thousands)		:	4,680
6	Total Number of Household as in 2001		:	25402
7	Number of Household per Ward		:	941
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	10.23
10	Number of Bore Wells		:	14
11	Ground Water Extraction per Bore Well (MLD)		:	0.73
12	Number of Hand Pumps/ Tubewells		:	530
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	80.96
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	10.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	83.10
19	Total Sewage Generation (MLD)*		:	9.10
20	Per Capita Sewage Generation (lpcd)		:	64.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3861.50
		COD	:	6564.60
		TKN	:	772.30
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Karvan River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	1.30
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Hindaun		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	48.00
2	Population as in 2011		:	105452
3	Population Growth Rate as in 2011 (%)		:	24.26
4	Total Number of Wards		:	40
5	Population per Ward (Thousands)		:	2,636
6	Total Number of Household as in 2011		:	18299
7	Number of Household per Ward		:	457
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	150
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	5.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	50.00
19	Total Sewage Generation (MLD)*		:	2.70
20	Per Capita Sewage Generation (lpcd)		:	25.60
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2847.20
		COD	:	4840.20
		TKN	:	569.40
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Utangan River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Indore		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	172.39
2	Population as in 2011		:	1994397
3	Population Growth Rate as in 2011 (%)		:	32.42
4	Total Number of Wards		:	96
5	Population per Ward (Thousands)		:	20,775
6	Total Number of Household as in 2011		:	405090
7	Number of Household per Ward		:	4220
8	Surface Water Supply (MLD)		:	221.50
9	Ground Water (GW) Supply (MLD)		:	27
10	Number of Bore Wells		:	4000
11	Ground Water Extraction per Bore Well (MLD)		:	0.01
12	Number of Hand Pumps/ Tubewells		:	50000
13	Ground Water Extraction per Hand Pump (lpd)		:	2000
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	221.50
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	348.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	174.70
19	Total Sewage Generation (MLD)*		:	278.80
20	Per Capita Sewage Generation (lpcd)		:	139.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	53848.70
		COD	:	91542.80
		TKN	:	10769.70
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Saraswati River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	25
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Jagadhari		State: Haryana		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	24.80
2	Population as in 2011		:	124894
3	Population Growth Rate as in 2011 (%)		:	23.30
4	Total Number of Wards		:	31
5	Population per Ward (Thousands)		:	4029
6	Total Number of Household as in 2011		:	26716
7	Number of Household per Ward		:	862
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	16.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	13.49
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3372.10
		COD	:	5732.60
		TKN	:	674.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Jaipur		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	484.64
2	Population as in 2011		:	3046163
3	Population Growth Rate as in 2011 (%)		:	31.15
4	Total Number of Wards		:	77
5	Population per Ward (Thousands)		:	39,561
6	Total Number of Household as in 2011		:	599507
7	Number of Household per Ward		:	7786
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	1983
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	403.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	132.30
19	Total Sewage Generation (MLD)*		:	321.60
20	Per Capita Sewage Generation (lpcd)		:	105.60
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	82246.40
		COD	:	139818.90
		TKN	:	16449.30
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	14
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Jhansi		State: Uttar Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	150.00
2	Population as in 2011		:	505693
3	Population Growth Rate as in 2011 (%)		:	18.65
4	Total Number of Wards		:	60
5	Population per Ward (Thousands)		:	8,428
6	Total Number of Household as in 2011		:	91150
7	Number of Household per Ward		:	1519
8	Surface Water Supply (MLD)		:	66
9	Ground Water (GW) Supply (MLD)		:	9.00
10	Number of Bore Wells		:	29
11	Ground Water Extraction per Bore Well (MLD)		:	0.31
12	Number of Hand Pumps/ Tubewells		:	2812
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	66
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	76.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	151.10
19	Total Sewage Generation (MLD)*		:	12.00
20	Per Capita Sewage Generation (lpcd)		:	23.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1365.40
		COD	:	23211.30
		TKN	:	2730.70
30	Wastewater Disposal Means		:	Land & River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Betwa River
32	Number of Drains/Nallah for Wastewater Disposal		:	4
33	Number of Water Bodies		:	3
34	Gross Area of Water Bodies (Hectare)		:	1.80
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Karawal Nagar		State: NCT Delhi		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	4.80
2	Population as in 2011		:	224281
3	Population Growth Rate as in 2011 (%)		:	50.90
4	Total Number of Wards		:	4
5	Population per Ward (Thousands)		:	56070.25
6	Total Number of Household as in 2011		:	41116
7	Number of Household per Ward		:	10279
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	30.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	24.20
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	6055.60
		COD	:	10294.50
		TKN	:	1211.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Karnal			State: Haryana	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	29.46
2	Population as in 2011		:	302140
3	Population Growth Rate as in 2011 (%)		:	36.57
4	Total Number of Wards		:	20
5	Population per Ward (Thousands)		:	15,107
6	Total Number of Household as in 2011		:	63280
7	Number of Household per Ward		:	11062
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	40.79
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	32.63
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	30.84
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	2.00
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	48.00
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	:	8157.80
		COD	:	13868.20
		TKN	:	1631.60
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Khora		State: Uttar Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	4.26
2	Population as in 2011		:	190005
3	Population Growth Rate as in 2011 (%)		:	6.68
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	7,600
6	Total Number of Household as in 2011		:	37467
7	Number of Household per Ward		:	1499
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	25.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	20.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	5130.10
		COD	:	8721.20
		TKN	:	1026.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Hindan River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (sq km)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Khurja		State: Uttar Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	16.70
2	Population as in 2011		:	121207
3	Population Growth Rate as in 2011 (%)		:	22.92
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	4,848
6	Total Number of Household as in 2011		:	21548
7	Number of Household per Ward		:	862
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	16.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	13.10
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3272.60
		COD	:	5563.40
		TKN	:	654.50
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Hindan River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (sq km)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Kirari Suleman Nagar		State: NCT Delhi		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	4.70
2	Population as in 2011		:	283211
3	Population Growth Rate as in 2011 (%)		:	83.15
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	94403.66
6	Total Number of Household as in 2011		:	53072
7	Number of Household per Ward		:	17691
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	38.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	30.60
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	7646.70
		COD	:	12999.40
		TKN	:	1529.30
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	5
34	Gross Area of Water Bodies (sq km)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Kishangarh				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	45.49
2	Population as in 2011		:	154886
3	Population Growth Rate as in 2011 (%)		:	33.27
4	Total Number of Wards		:	45
5	Population per Ward (Thousands)		:	3,442
6	Total Number of Household as in 2011		:	28353
7	Number of Household per Ward		:	630
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	720
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	16.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	104.30
19	Total Sewage Generation (MLD)*		:	12.60
20	Per Capita Sewage Generation (lpcd)		:	81.60
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	4181.90
		COD	:	7109.30
		TKN	:	836.40
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	4
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Kota		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	527.03
2	Population as in 2011		:	1001694
3	Population Growth Rate as in 2011 (%)		:	44.27
4	Total Number of Wards		:	60
5	Population per Ward (Thousands)		:	16,695
6	Total Number of Household as in 2011		:	210135
7	Number of Household per Ward		:	3502
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	3115
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	271.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	271.30
19	Total Sewage Generation (MLD)*		:	216.20
20	Per Capita Sewage Generation (lpcd)		:	215.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	27045.70
		COD	:	45977.80
		TKN	:	5409.10
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Chambal, Kali Sindh River
32	Number of Drains/Nallah for Wastewater Disposal		:	5
33	Number of Water Bodies		:	9
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Lalitpur				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	17.35
2	Population as in 2011		:	133305
3	Population Growth Rate as in 2011 (%)		:	9.36
4	Total Number of Wards		:	26
5	Population per Ward (Thousands)		:	5,127
6	Total Number of Household as in 2011		:	24424
7	Number of Household per Ward		:	939
8	Surface Water Supply (MLD)		:	12.10
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	736
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	1
15	Total Pumping Capacity (MLD)		:	12.10
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	93.50
19	Total Sewage Generation (MLD)*		:	8.60
20	Per Capita Sewage Generation (lpcd)		:	64.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3599.20
		COD	:	6118.70
		TKN	:	719.80
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Betwa River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	20.23
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mandoli				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	5.87
2	Population as in 2011		:	120417
3	Population Growth Rate as in 2011 (%)		:	16.72
4	Total Number of Wards		:	4
5	Population per Ward (Thousands)		:	30104
6	Total Number of Household as in 2011		:	21916
7	Number of Household per Ward		:	5479
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	16.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	13.00
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3251.30
		COD	:	5527.10
		TKN	:	650.30
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna, Hindon River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mandsaur				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	36.36
2	Population as in 2011		:	141667
3	Population Growth Rate as in 2011 (%)		:	20.51
4	Total Number of Wards		:	40
5	Population per Ward (Thousands)		:	3,542
6	Total Number of Household as in 2011		:	28916
7	Number of Household per Ward		:	723
8	Surface Water Supply (MLD)		:	0.75
9	Ground Water (GW) Supply (MLD)		:	9.09
10	Number of Bore Wells		:	42
11	Ground Water Extraction per Bore Well (MLD)		:	0.22
12	Number of Hand Pumps/ Tubewells		:	350
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	0.75
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	10.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	70.60
19	Total Sewage Generation (MLD)*		:	18.10
20	Per Capita Sewage Generation (lpcd)		:	127.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3825.00
		COD	:	6502.50
		TKN	:	765.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Shivna River
32	Number of Drains/Nallah for Wastewater Disposal		:	5
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mathura			State: Uttar Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	28.05
2	Population as in 2011		:	349909
3	Population Growth Rate as in 2011 (%)		:	15.57
4	Total Number of Wards		:	45
5	Population per Ward (Thousands)		:	7,776
6	Total Number of Household as in 2011		:	59781
7	Number of Household per Ward		:	1328
8	Surface Water Supply (MLD)		:	11
9	Ground Water (GW) Supply (MLD)		:	18.36
10	Number of Bore Wells		:	90
11	Ground Water Extraction per Bore Well (MLD)		:	0.20
12	Number of Hand Pumps/ Tubewells		:	1447
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	11
16	Average Water Supply Rate from ULB Sources (lpcd)		:	92
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	32.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	93.70
19	Total Sewage Generation (MLD)*		:	117.90
20	Per Capita Sewage Generation (lpcd)		:	337.10
21	Sewage Collection (MLD)		:	28.10
22	Percentage of Sewage Collection (%)		:	22.98
23	Number of STPs		:	2
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	28.10
25	Current Utilized Capacity of STPs (MLD)		:	28.10
26	Percentage Utilization of Installed Capacity (%)		:	100
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	:	9447.50
		COD	:	16060.80
		TKN	:	1889.50
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	11
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Morena				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.00
2	Population as in 2011		:	200482
3	Population Growth Rate as in 2011 (%)		:	32.81
4	Total Number of Wards		:	39
5	Population per Ward (Thousands)		:	5,141
6	Total Number of Household as in 2011		:	33104
7	Number of Household per Ward		:	849
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	18
10	Number of Bore Wells		:	85
11	Ground Water Extraction per Bore Well (MLD)		:	0.21
12	Number of Hand Pumps/ Tubewells		:	2600
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	19.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	96.30
19	Total Sewage Generation (MLD)*		:	15.40
20	Per Capita Sewage Generation (lpcd)		:	77.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	5413.00
		COD	:	9202.10
		TKN	:	1082.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Asan, Chambal River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Murwara (Katni)		State: Madhya Pradesh		
S.No.	**Items**			**Value**
1	Total Area (sq km)		:	68.57
2	Population as in 2011		:	221883
3	Population Growth Rate as in 2011 (%)		:	18.64
4	Total Number of Wards		:	45
5	Population per Ward (Thousands)		:	4,931
6	Total Number of Household as in 2011		:	46261
7	Number of Household per Ward		:	1028
8	Surface Water Supply (MLD)		:	7.50
9	Ground Water (GW) Supply (MLD)		:	8
10	Number of Bore Wells		:	133
11	Ground Water Extraction per Bore Well (MLD)		:	0.06
12	Number of Hand Pumps/ Tubewells		:	565
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	7.50
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	30.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	24.00
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	5990.80
		COD	:	10184.40
		TKN	:	1198.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Katni River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	59
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mustafabad		State: NCT Delhi		
S.No.	**Items**			**Value**
1	Total Area (sq km)		:	1.30
2	Population as in 2011		:	127167
3	Population Growth Rate as in 2011 (%)		:	41.03
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	42389
6	Total Number of Household as in 2011		:	20348
7	Number of Household per Ward		:	6783
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	17.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	13.70
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3433.50
		COD	:	5837.00
		TKN	:	686.70
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Muzaffarnagar				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.04
2	Population as in 2011		:	392768
3	Population Growth Rate as in 2011 (%)		:	18.42
4	Total Number of Wards		:	45
5	Population per Ward (Thousands)		:	8,728
6	Total Number of Household as in 2011		:	68975
7	Number of Household per Ward		:	1533
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	50.00
10	Number of Bore Wells		:	40
11	Ground Water Extraction per Bore Well (MLD)		:	0.43
12	Number of Hand Pumps/ Tubewells		:	858
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	127.30
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	50.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	128.40
19	Total Sewage Generation (MLD)		:	46.70
20	Per Capita Sewage Generation (lpcd)		:	118.80
21	Sewage Collection (MLD)		:	22.00
22	Percentage of Sewage Collection (%)		:	47.13
23	Number of STPs		:	1
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	NA
25	Current Utilized Capacity of STPs (MLD)		:	35.00
26	Percentage Utilization of Installed Capacity (%)		:	62.86
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)		:	12
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	:	10604.70
		COD	:	18028.10
		TKN	:	2120.90
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kali River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	12.50
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: NDMC			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	42.74
2	Population as in 2011		:	257803
3	Population Growth Rate as in 2011 (%)		:	-14.74
4	Total Number of Wards		:	9
5	Population per Ward (Thousands)		:	28645
6	Total Number of Household as in 2011		:	59500
7	Number of Household per Ward		:	6611
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	34.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)		:	27.80
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	6960.70
		COD	:	11833.20
		TKN	:	1392.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Nagda			State: Madhya Pradesh	
S.No.	**Items**			**Value**
1	Total Area (sq km)		:	3.58
2	Population as in 2011		:	100039
3	Population Growth Rate as in 2011 (%)		:	23.83
4	Total Number of Wards		:	36
5	Population per Ward (Thousands)		:	2779
6	Total Number of Household as in 2011		:	20177
7	Number of Household per Ward		:	560
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	13.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	134.90
19	Total Sewage Generation (MLD)*		:	10.80
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2701.10
		COD	:	4591.80
		TKN	:	540.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Chambal, Kshipra River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Nangloi Jat			State: NCT Delhi	
S.No.	**Items**			**Value**
1	Total Area (sq km)		:	6.70
2	Population as in 2011		:	205596
3	Population Growth Rate as in 2011 (%)		:	36.20
4	Total Number of Wards		:	4
5	Population per Ward (Thousands)		:	51399
6	Total Number of Household as in 2011		:	39410
7	Number of Household per Ward		:	9853
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	27.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	22.20
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	5551.10
		COD	:	9436.90
		TKN	:	1110.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	3
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Neemach			State: Madhya Pradesh	
S.No.	**Items**			**Value**
1	Total Area (sq km)		:	22.04
2	Population as in 2011		:	128561
3	Population Growth Rate as in 2011 (%)		:	13.92
4	Total Number of Wards		:	40
5	Population per Ward (Thousands)		:	3,214
6	Total Number of Household as in 2011		:	25549
7	Number of Household per Ward		:	639
8	Surface Water Supply (MLD)		:	6.82
9	Ground Water (GW) Supply (MLD)		:	1
10	Number of Bore Wells		:	40
11	Ground Water Extraction per Bore Well (MLD)		:	0.03
12	Number of Hand Pumps/ Tubewells		:	193
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	6.82
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	96.50
19	Total Sewage Generation (MLD)*		:	7.30
20	Per Capita Sewage Generation (lpcd)		:	45.90
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3471.10
		COD	:	5900.90
		TKN	:	694.20
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	5
33	Number of Water Bodies		:	3
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Noida				State: Uttar Pradesh
S.	**Items**			**Value**
1	Total Area (sq km)		:	92.10
2	Population as in 2011		:	637272
3	Population Growth Rate as in 2011 (%)		:	108.90
4	Total Number of Wards		:	198
5	Population per Ward (Thousands)		:	3,219
6	Total Number of Household as in 2011		:	153474
7	Number of Household per Ward		:	775
8	Surface Water Supply (MLD)		:	48
9	Ground Water (GW) Supply (MLD)		:	264.82
10	Number of Bore Wells		:	249
11	Ground Water Extraction per Bore Well (MLD)		:	1.06
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	1000
14	Number of Pumping Stations for Water Supply		:	1
15	Total Pumping Capacity (MLD)		:	48
16	Average Water Supply Rate from ULB Sources (lpcd)		:	521.33
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	312.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	521.30
19	Total Sewage Generation (MLD)*		:	481.80
20	Per Capita Sewage Generation (lpcd)		:	756.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	17206.30
		COD	:	29250.80
		TKN	:	3441.30
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Orai				State: Uttar Pradesh
S.	**Items**			**Value**
1	Total Area (sq km)		:	23.20
2	Population as in 2011		:	190575
3	Population Growth Rate as in 2001 (%)		:	36.79
4	Total Number of Wards		:	28
5	Population per Ward (Thousands)		:	4,976
6	Total Number of Household as in 2001		:	33919
7	Number of Household per Ward		:	1211
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	12
10	Number of Bore Wells		:	27
11	Ground Water Extraction per Bore Well (MLD)		:	0.37
12	Number of Hand Pumps/ Tubewells		:	523
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	86.13
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	88.00
19	Total Sewage Generation (MLD)*		:	16.20
20	Per Capita Sewage Generation (lpcd)		:	85.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	437.40
		COD	:	743.60
		TKN	:	1029.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Betwa River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	4
34	Gross Area of Water Bodies (Hectare)		:	3.20
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Palwal				State: Haryana
S.	**Items**			**Value**
1	Total Area (sq km)		:	8.42
2	Population as in 2011		:	131926
3	Population Growth Rate as in 2011 (%)		:	30.98
4	Total Number of Wards		:	32
5	Population per Ward (Thousands)		:	4,123
6	Total Number of Household as in 2011		:	23742
7	Number of Household per Ward		:	742
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tube wells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	17.81
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	14.25
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	1
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	9
25	Current Utilized Capacity of STPs (MLD)		:	9
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	:	3562.00
		COD	:	6055.40
		TKN	:	712.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Panipat				State: Haryana
S.	**Items**			**Value**
1	Total Area (sq km)		:	21.86
2	Population as in 2011		:	295970
3	Population Growth Rate as in 2011 (%)		:	10.07
4	Total Number of Wards		:	24
5	Population per Ward (Thousands)		:	12,332
6	Total Number of Household as in 2011		:	60905
7	Number of Household per Ward		:	2538
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tube wells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	2
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	40.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	154.40
20	Per Capita Sewage Generation (lpcd)		:	88.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	2
24	Total Installed Capacity of STPs under GAP & YAP I & II (MLD)		:	45
25	Current Utilized Capacity of STPs (MLD)		:	45
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	:	7991.20
		COD	:	13585.00
		TKN	:	1598.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	3
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Pithampur		State: Madhya Pradesh		
S.No.	**Items**			**Value**
1	Total Area (sq km)		:	75.51
2	Population as in 2011		:	126200
3	Population Growth Rate as in 2011 (%)		:	85.37
4	Total Number of Wards		:	31
5	Population per Ward (Thousands)		:	4,071
6	Total Number of Household as in 2011		:	31136
7	Number of Household per Ward		:	1004
8	Surface Water Supply (MLD)		:	1
9	Ground Water (GW) Supply (MLD)		:	1.20
10	Number of Bore Wells		:	30
11	Ground Water Extraction per Bore Well (MLD)		:	0.04
12	Number of Hand Pumps/ Tubewells		:	225
13	Ground Water Extraction per Hand Pump (lpd)		:	900
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	1
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	2.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	19.00
19	Total Sewage Generation (MLD)*		:	1.90
20	Per Capita Sewage Generation (lpcd)		:	15.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3407.40
		COD	:	5792.60
		TKN	:	681.50
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Ratlam			State: Madhya Pradesh	
S.No.	**Items**			**Value**
1	Total Area (sq km)		:	39.19
2	Population as in 2011		:	264914
3	Population Growth Rate as in 2011 (%)		:	19.22
4	Total Number of Wards		:	49
5	Population per Ward (Thousands)		:	5,406
6	Total Number of Household as in 2011		:	53133
7	Number of Household per Ward		:	1084
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	96
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	961
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	35.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	133.60
19	Total Sewage Generation (MLD)*		:	28.60
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	7152.70
		COD	:	12159.60
		TKN	:	1430.50
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	5
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Rewari				State: Haryana
S.	**Items**			**Value**
1	Total Area (sq km)		:	22.50
2	Population as in 2011		:	143021
3	Population Growth Rate as in 2011 (%)		:	42.05
4	Total Number of Wards		:	31
5	Population per Ward (Thousands)		:	4614
6	Total Number of Household as in 2011		:	28702
7	Number of Household per Ward		:	926
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	19.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	15.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3861.60
		COD	:	6564.70
		TKN	:	772.30
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Rohtak				State: Haryana
S.	**Items**			**Value**
1	Total Area (sq km)		:	72.18
2	Population as in 2011		:	374292
3	Population Growth Rate as in 2011 (%)		:	27.06
4	Total Number of Wards		:	31
5	Population per Ward (Thousands)		:	12074
6	Total Number of Household as in 2011		:	75528
7	Number of Household per Ward		:	2436
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	50.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	40.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	3
24	Total Installed Capacity of STPs under GAP & YAP I & II (MLD)		:	20
25	Current Utilized Capacity of STPs (MLD)		:	NA
26	Percentage Utilization of Installed Capacity (%)		:	NA
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)		:	16.0
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	:	10105.90
		COD	:	17180.00
		TKN	:	2021.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	4
34	Gross Area of Water Bodies (Hectare)		:	6.88
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sagar				State: Madhya Pradesh
S.	**Items**			**Value**
1	Total Area (sq km)		:	72.18
2	Population as in 2011		:	374292
3	Population Growth Rate as in 2011 (%)		:	27.06
4	Total Number of Wards		:	31
5	Population per Ward (Thousands)		:	12074
6	Total Number of Household as in 2011		:	75528
7	Number of Household per Ward		:	2436
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	50.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	40.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	3
24	Total Installed Capacity of STPs under GAP & YAP I & II (MLD)		:	20
25	Current Utilized Capacity of STPs (MLD)		:	NA
26	Percentage Utilization of Installed Capacity (%)		:	NA
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)		:	16.0
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	:	10105.90
		COD	:	17180.00
		TKN	:	2021.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	4
34	Gross Area of Water Bodies (Hectare)		:	6.88
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Saharanpur			State: Uttar Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	46.74
2	Population as in 2011		:	705478
3	Population Growth Rate as in 2011 (%)		:	14.05
4	Total Number of Wards		:	60
5	Population per Ward (Thousands)		:	7,596
6	Total Number of Household as in 2011		:	129856
7	Number of Household per Ward		:	2164
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	79.00
10	Number of Bore Wells		:	60
11	Ground Water Extraction per Bore Well (MLD)		:	0.76
12	Number of Hand Pumps/ Tubewells		:	1511
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	173.34
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	79.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	175.00
19	Total Sewage Generation (MLD)*		:	97.60
20	Per Capita Sewage Generation (lpcd)		:	138.30
21	Sewage Collection (MLD)		:	35.00
22	Percentage of Sewage Collection (%)		:	57.66
23	Number of STPs		:	1
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	NA
25	Current Utilized Capacity of STPs (MLD)		:	35
26	Percentage Utilization of Installed Capacity (%)		:	92
27	Capacity of STPs Sanctioned under JNNURM & Others (MLD)		:	12
28	Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)	BOD_5	:	10038.80
		COD	:	NA
		TKN	:	NA
29	Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d)	BOD_5	:	19047.90
		COD	:	32381.40
		TKN	:	3809.60
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Dhamola River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	365
34	Gross Area of Water Bodies (Hectare)		:	122.34
35	Area of Water Bodies as % of Total Area		:	1.65

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sawai Madhopur		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	59.00
2	Population as in 2011		:	121106
3	Population Growth Rate as in 2011 (%)		:	18.73
4	Total Number of Wards		:	40
5	Population per Ward (Thousands)		:	3,028
6	Total Number of Household as in 2011		:	22841
7	Number of Household per Ward		:	571
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	469
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	66.30
19	Total Sewage Generation (MLD)*		:	11.80
20	Per Capita Sewage Generation (lpcd)		:	97.40
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	3269.90
		COD	:	5558.80
		TKN	:	654.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Banas River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	15
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sehore		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	15.11
2	Population as in 2011		:	109118
3	Population Growth Rate as in 2011 (%)		:	17.94
4	Total Number of Wards		:	35
5	Population per Ward (Thousands)		:	3,118
6	Total Number of Household as in 2011		:	20314
7	Number of Household per Ward		:	580
8	Surface Water Supply (MLD)		:	40
9	Ground Water (GW) Supply (MLD)		:	10
10	Number of Bore Wells		:	55
11	Ground Water Extraction per Bore Well (MLD)		:	0.18
12	Number of Hand Pumps/ Tubewells		:	440
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	40
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	50.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	460.10
19	Total Sewage Generation (MLD)*		:	40.20
20	Per Capita Sewage Generation (lpcd)		:	368.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2946.20
		COD	:	5008.50
		TKN	:	589.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Karbala River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Shamli				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	26.23
2	Population as in 2011		:	107266
3	Population Growth Rate as in 2011 (%)		:	19.11
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	4,291
6	Total Number of Household as in 2011		:	18622
7	Number of Household per Ward		:	745
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	14.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	11.60
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2896.20
		COD	:	4923.50
		TKN	:	579.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Shikohabad			State: Uttar Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	8.48
2	Population as in 2011		:	107404
3	Population Growth Rate as in 2011 (%)		:	21.83
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	4,296
6	Total Number of Household as in 2011		:	18622
7	Number of Household per Ward		:	745
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	14.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	11.60
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2899.90
		COD	:	4929.80
		TKN	:	580.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Shivpuri		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	81.11
2	Population as in 2011		:	179977
3	Population Growth Rate as in 2011 (%)		:	22.52
4	Total Number of Wards		:	39
5	Population per Ward (Thousands)		:	4,615
6	Total Number of Household as in 2011		:	33803
7	Number of Household per Ward		:	867
8	Surface Water Supply (MLD)		:	5
9	Ground Water (GW) Supply (MLD)		:	7
10	Number of Bore Wells		:	430
11	Ground Water Extraction per Bore Well (MLD)		:	0.02
12	Number of Hand Pumps/ Tubewells		:	80
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	5
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	66.70
19	Total Sewage Generation (MLD)*		:	9.60
20	Per Capita Sewage Generation (lpcd)		:	53.30
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	4859.40
		COD	:	8260.90
		TKN	:	971.90
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	7
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sonipat				State: Haryana
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	42.61
2	Population as in 2011		:	289333
3	Population Growth Rate as in 2011 (%)		:	28.55
4	Total Number of Wards		:	31
5	Population per Ward (Thousands)		:	9,333
6	Total Number of Household as in 2011		:	57740
7	Number of Household per Ward		:	1863
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	39.06
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	31.25
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	1
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	30
25	Current Utilized Capacity of STPs (MLD)		:	30
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	:	7812.00
		COD	:	13280.40
		TKN	:	1562.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sultan Pur Majra			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.80
2	Population as in 2011		:	181554
3	Population Growth Rate as in 2011 (%)		:	10.42
4	Total Number of Wards		:	5
5	Population per Ward (Thousands)		:	36311
6	Total Number of Household as in 2011		:	33029
7	Number of Household per Ward		:	6606
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	24.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	19.60
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
24	Total Installed Capacity of STPs under GAP & YAP 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	:	4902.00
		COD	:	8333.30
		TKN	:	980.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Tonk				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	60.50
2	Population as in 2011		:	165294
3	Population Growth Rate as in 2011 (%)		:	21.82
4	Total Number of Wards		:	45
5	Population per Ward (Thousands)		:	3,673
6	Total Number of Household as in 2011		:	29098
7	Number of Household per Ward		:	647
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	546
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	12.90
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	77.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	10.10
19	Total Sewage Generation (MLD)*		:	61.00
20	Per Capita Sewage Generation (lpcd)		:	NA
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
24	Total Installed Capacity of STPs under GAP & YAP 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	:	4462.90
		COD	:	7587.00
		TKN	:	892.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Banas River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	14
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Udaipur		State: Rajasthan		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	56.92
2	Population as in 2011		:	451100
3	Population Growth Rate as in 2011 (%)		:	15.83
4	Total Number of Wards		:	55
5	Population per Ward (Thousands)		:	8,202
6	Total Number of Household as in 2011		:	94704
7	Number of Household per Ward		:	1722
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	2380
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	82.60
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	183.10
19	Total Sewage Generation (MLD)*		:	65.10
20	Per Capita Sewage Generation (lpcd)		:	144.40
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	12179.70
		COD	:	20705.50
		TKN	:	2435.90
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Ayad River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	3
34	Gross Area of Water Bodies (Hectare)		:	17254.00
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Ujjain		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	92.68
2	Population as in 2011		:	515215
3	Population Growth Rate as in 2011 (%)		:	19.49
4	Total Number of Wards		:	54
5	Population per Ward (Thousands)		:	9,541
6	Total Number of Household as in 2011		:	102401
7	Number of Household per Ward		:	1896
8	Surface Water Supply (MLD)		:	87.06
9	Ground Water (GW) Supply (MLD)		:	3.79
10	Number of Bore Wells		:	85
11	Ground Water Extraction per Bore Well (MLD)		:	0.04
12	Number of Hand Pumps/ Tubewells		:	1282
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	87.06
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	91.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	177.60
19	Total Sewage Generation (MLD)*		:	73.20
20	Per Capita Sewage Generation (lpcd)		:	142.10
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	13910.80
		COD	:	23648.40
		TKN	:	2782.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kshipra River
32	Number of Drains/Nallah for Wastewater Disposal		:	9
33	Number of Water Bodies		:	23
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Vidisha		State: Madhya Pradesh		
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	5.83
2	Population as in 2011		:	155951
3	Population Growth Rate as in 2011 (%)		:	24.31
4	Total Number of Wards		:	36
5	Population per Ward (Thousands)		:	4,332
6	Total Number of Household as in 2011		:	31627
7	Number of Household per Ward		:	879
8	Surface Water Supply (MLD)		:	9
9	Ground Water (GW) Supply (MLD)		:	1
10	Number of Bore Wells		:	12
11	Ground Water Extraction per Bore Well (MLD)		:	0.08
12	Number of Hand Pumps/ Tubewells		:	4830
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	9
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	79.50
19	Total Sewage Generation (MLD)*		:	9.92
20	Per Capita Sewage Generation (lpcd)		:	63.60
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	4210.70
		COD	:	7158.20
		TKN	:	842.10
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Betwa River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Yamunanagar			State: Haryana	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	16.48
2	Population as in 2011		:	217071
3	Population Growth Rate as in 2011 (%)		:	14.43
4	Total Number of Wards		:	31
5	Population per Ward (Thousands)		:	7002
6	Total Number of Household as in 2011		:	45351
7	Number of Household per Ward		:	1463
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	29.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	23.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	2
24	Total Installed Capacity of STPs under GAP I & II (MLD)		:	35
25	Current Utilized Capacity of STPs (MLD)		:	35
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	:	5860.90
		COD	:	9963.60
		TKN	:	1172.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	4
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	3.70
35	Area of Water Bodies as % of Total Area		:	<<< 1

Appendix-2

Compilation of Data Sheets of Water Balance & Pollution Load (Domestic) of Major Class II Towns in Yamuna Basin

Water Balance & Pollution Load (Domestic) Data Sheet

City: Askok Nagar				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	4.43
2	Population as in 2011		:	81828
3	Population Growth Rate as in 2011 (%)		:	41.80
4	Total Number of Wards		:	22
5	Population per Ward (Thousands)		:	3,719
6	Total Number of Household as in 2011		:	15806
7	Number of Household per Ward		:	718
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	11.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	134.40
19	Total Sewage Generation (MLD)*		:	8.80
20	Per Capita Sewage Generation (lpcd)		:	107.50
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2209.40
		COD	:	3755.90
		TKN	:	441.90
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Aur River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Ashta				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	15.78
2	Population as in 2011		:	53184
3	Population Growth Rate as in 2011 (%)		:	30.90
4	Total Number of Wards		:	19
5	Population per Ward (Thousands)		:	2,799
6	Total Number of Household as in 2011		:	10006
7	Number of Household per Ward		:	527
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.40
19	Total Sewage Generation (MLD)*		:	5.70
20	Per Capita Sewage Generation (lpcd)		:	107.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1436.00
		COD	:	2441.10
		TKN	:	287.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Parbati River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Auraiya				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	9.00
2	Population as in 2011		:	87736
3	Population Growth Rate as in 2011 (%)		:	35.52
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,590
6	Total Number of Household as in 2011		:	15898
7	Number of Household per Ward		:	636
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	5.53
10	Number of Bore Wells		:	14
11	Ground Water Extraction per Bore Well (MLD)		:	0.22
12	Number of Hand Pumps/ Tubewells		:	440
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	66.11
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	68.60
19	Total Sewage Generation (MLD)*		:	5.40
20	Per Capita Sewage Generation (lpcd)		:	61.50
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2368.90
		COD	:	4027.10
		TKN	:	508.90
30	Wastewater Disposal Means		:	Land & River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	5
34	Gross Area of Water Bodies (Hectare)		:	11.15
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Baghpat				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.83
2	Population as in 2011		:	50310
3	Population Growth Rate as in 2011 (%)		:	38.28
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,012
6	Total Number of Household as in 2011		:	7880
7	Number of Household per Ward		:	315
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	3.71
10	Number of Bore Wells		:	7
11	Ground Water Extraction per Bore Well (MLD)		:	0.53
12	Number of Hand Pumps/ Tubewells		:	457
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	73.74
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	3.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	78.30
19	Total Sewage Generation (MLD)*		:	1.10
20	Per Capita Sewage Generation (lpcd)		:	21.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1358.40
		COD	:	2309.20
		TKN	:	271.70
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bangarda Chhota				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	11.19
2	Population as in 2011		:	64213
3	Population Growth Rate as in 2011 (%)		:	18.94
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	64,213
6	Total Number of Household as in 2011		:	13345
7	Number of Household per Ward		:	13345
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.50
19	Total Sewage Generation (MLD)*		:	6.90
20	Per Capita Sewage Generation (lpcd)		:	107.50
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1733.80
		COD	:	2947.40
		TKN	:	346.80
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kherkhali River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bapraula			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	5.62
2	Population as in 2011		:	52744
3	Population Growth Rate as in 2011 (%)		:	291.51
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	52744
6	Total Number of Household as in 2011		:	10069
7	Number of Household per Ward		:	10069
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.70
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1424.10
		COD	:	2420.90
		TKN	:	284.80
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City:Bari				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	22.27
2	Population as in 2011		:	62721
3	Population Growth Rate as in 2011 (%)		:	24.26
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	2091
6	Total Number of Household as in 2011		:	10456
7	Number of Household per Ward		:	349
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	143.10
19	Total Sewage Generation (MLD)*		:	6.80
20	Per Capita Sewage Generation (lpcd)		:	108.40
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1693.50
		COD	:	2878.90
		TKN	:	338.70
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Ayad River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	0
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Basoda				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	16.55
2	Population as in 2011		:	78289
3	Population Growth Rate as in 2011 (%)		:	20.56
4	Total Number of Wards		:	24
5	Population per Ward (Thousands)		:	3,262
6	Total Number of Household as in 2011		:	14219
7	Number of Household per Ward		:	592
8	Surface Water Supply (MLD)		:	2.27
9	Ground Water (GW) Supply (MLD)		:	2.33
10	Number of Bore Wells		:	29
11	Ground Water Extraction per Bore Well (MLD)		:	0.08
12	Number of Hand Pumps/ Tubewells		:	3520
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	2.27
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	10.60
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	158.40
19	Total Sewage Generation (MLD)*		:	8.50
20	Per Capita Sewage Generation (lpcd)		:	75.40
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2113.80
		COD	:	3593.50
		TKN	:	422.80
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Betwa River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bawana				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	17.00
2	Population as in 2011		:	73680
3	Population Growth Rate as in 2011 (%)		:	219.04
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	73680
6	Total Number of Household as in 2011		:	12961
7	Number of Household per Ward		:	12961
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	8.00
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1989.40
		COD	:	3381.90
		TKN	:	397.90
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Begum Pur			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	1.90
2	Population as in 2011		:	53682
3	Population Growth Rate as in 2011 (%)		:	135.05
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	53682
6	Total Number of Household as in 2011		:	10446
7	Number of Household per Ward		:	10446
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.80
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1449.40
		COD	:	2464.00
		TKN	:	289.90
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Bina				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.00
2	Population as in 2011		:	64529
3	Population Growth Rate as in 2011 (%)		:	26.08
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,581
6	Total Number of Household as in 2011		:	12356
7	Number of Household per Ward		:	494
8	Surface Water Supply (MLD)		:	4
9	Ground Water (GW) Supply (MLD)		:	2
10	Number of Bore Wells		:	32
11	Ground Water Extraction per Bore Well (MLD)		:	0.06
12	Number of Hand Pumps/ Tubewells		:	1520
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	4
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	7.00
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1742.30
		COD	:	2961.90
		TKN	:	348.50
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Motichur, Bina, Betwa River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Budhana				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	7.61
2	Population as in 2011		:	53722
3	Population Growth Rate as in 2011 (%)		:	63.04
4	Total Number of Wards		:	17
5	Population per Ward (Thousands)		:	3,160
6	Total Number of Household as in 2011		:	8252
7	Number of Household per Ward		:	485
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.80
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1450.50
		COD	:	2465.80
		TKN	:	290.10
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kali River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Chilla Saroda Bangar				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.58
2	Population as in 2011		:	83217
3	Population Growth Rate as in 2011 (%)		:	24.76
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	27739
6	Total Number of Household as in 2011		:	18124
7	Number of Household per Ward		:	6041
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	11.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	9.00
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2246.90
		COD	:	3819.70
		TKN	:	449.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Chitrakoot Dham (Karwi)				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	7.77
2	Population as in 2011		:	57402
3	Population Growth Rate as in 2011 (%)		:	17.41
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,296
6	Total Number of Household as in 2011		:	10250
7	Number of Household per Ward		:	410
8	Surface Water Supply (MLD)		:	5.12
9	Ground Water (GW) Supply (MLD)		:	1.21
10	Number of Bore Wells		:	4
11	Ground Water Extraction per Bore Well (MLD)		:	0.30
12	Number of Hand Pumps/ Tubewells		:	298
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	5.12
16	Average Water Supply Rate from ULB Sources (lpcd)		:	110.17
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	113.10
19	Total Sewage Generation (MLD)*		:	19.40
20	Per Capita Sewage Generation (lpcd)		:	337.40
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1549.90
		COD	:	2634.80
		TKN	:	310.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Mandakini River
32	Number of Drains/Nallah for Wastewater Disposal		:	6
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	1.00
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Chomu				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	22.53
2	Population as in 2011		:	64417
3	Population Growth Rate as in 2011 (%)		:	27.04
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	2147
6	Total Number of Household as in 2011		:	9921
7	Number of Household per Ward		:	331
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	142.40
19	Total Sewage Generation (MLD)*		:	7.00
20	Per Capita Sewage Generation (lpcd)		:	108.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1739.30
		COD	:	2956.70
		TKN	:	347.90
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Dabra				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	3.79
2	Population as in 2011		:	61277
3	Population Growth Rate as in 2011 (%)		:	8.13
4	Total Number of Wards		:	24
5	Population per Ward (Thousands)		:	2,553
6	Total Number of Household as in 2011		:	11085
7	Number of Household per Ward		:	462
8	Surface Water Supply (MLD)		:	1.50
9	Ground Water (GW) Supply (MLD)		:	4
10	Number of Bore Wells		:	107
11	Ground Water Extraction per Bore Well (MLD)		:	0.04
12	Number of Hand Pumps/ Tubewells		:	130
13	Ground Water Extraction per Hand Pump (lpd)		:	3000
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	1.50
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	6.60
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1654.50
		COD	:	2812.60
		TKN	:	330.90
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Sindh River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Dadri				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.50
2	Population as in 2011		:	91189
3	Population Growth Rate as in 2011 (%)		:	58.82
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	3,648
6	Total Number of Household as in 2011		:	16215
7	Number of Household per Ward		:	649
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	2.10
10	Number of Bore Wells		:	2
11	Ground Water Extraction per Bore Well (MLD)		:	1.05
12	Number of Hand Pumps/ Tubewells		:	1200
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	23.00
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	2.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	29.60
19	Total Sewage Generation (MLD)*		:	12.20
20	Per Capita Sewage Generation (lpcd)		:	134.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2462.10
		COD	:	4185.60
		TKN	:	492.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	-
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Dausa				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	16.00
2	Population as in 2011		:	85960
3	Population Growth Rate as in 2011 (%)		:	39.54
4	Total Number of Wards		:	35
5	Population per Ward (Thousands)		:	2456
6	Total Number of Household as in 2011		:	15465
7	Number of Household per Ward		:	442
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	140.50
19	Total Sewage Generation (MLD)*		:	9.30
20	Per Capita Sewage Generation (lpcd)		:	108.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2320.90
		COD	:	3945.60
		TKN	:	464.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Banganga RIver
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Deoband				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	7.90
2	Population as in 2011		:	97037
3	Population Growth Rate as in 2011 (%)		:	18.86
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	3,881
6	Total Number of Household as in 2011		:	15630
7	Number of Household per Ward		:	625
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	6.00
10	Number of Bore Wells		:	11
11	Ground Water Extraction per Bore Well (MLD)		:	0.55
12	Number of Hand Pumps/ Tubewells		:	175
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	61.81
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	62.70
19	Total Sewage Generation (MLD)*		:	36.20
20	Per Capita Sewage Generation (lpcd)		:	372.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	976.50
		COD	:	1660.10
		TKN	:	524.00
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	-
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Dhar				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	36.00
2	Population as in 2011		:	93917
3	Population Growth Rate as in 2011 (%)		:	24.60
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	3,131
6	Total Number of Household as in 2011		:	18531
7	Number of Household per Ward		:	618
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	263
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.20
19	Total Sewage Generation (MLD)*		:	10.10
20	Per Capita Sewage Generation (lpcd)		:	107.50
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2535.80
		COD	:	4310.80
		TKN	:	507.20
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	4
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Gangoh				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.00
2	Population as in 2011		:	59279
3	Population Growth Rate as in 2011 (%)		:	9.95
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,371
6	Total Number of Household as in 2011		:	9657
7	Number of Household per Ward		:	386
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	5.50
10	Number of Bore Wells		:	13
11	Ground Water Extraction per Bore Well (MLD)		:	0.42
12	Number of Hand Pumps/ Tubewells		:	315
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	92.46
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	5.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	95.10
19	Total Sewage Generation (MLD)*		:	12.40
20	Per Capita Sewage Generation (lpcd)		:	209.30
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1600.50
		COD	:	2720.90
		TKN	:	320.10
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Buriyamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Gharoli				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	3.56
2	Population as in 2011		:	92540
3	Population Growth Rate as in 2011 (%)		:	33.26
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	30847
6	Total Number of Household as in 2011		:	19819
7	Number of Household per Ward		:	6606
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	10.00
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2498.60
		COD	:	4247.60
		TKN	:	499.70
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna, Hindan River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Gohad				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	14.91
2	Population as in 2011		:	58939
3	Population Growth Rate as in 2011 (%)		:	30.30
4	Total Number of Wards		:	18
5	Population per Ward (Thousands)		:	3,274
6	Total Number of Household as in 2011		:	10161
7	Number of Household per Ward		:	565
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.70
19	Total Sewage Generation (MLD)*		:	6.40
20	Per Capita Sewage Generation (lpcd)		:	108.60
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1591.40
		COD	:	2705.30
		TKN	:	318.30
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Hodal			State: Haryana	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	5.39
2	Population as in 2011		:	50143
3	Population Growth Rate as in 2011 (%)		:	30.89
4	Total Number of Wards		:	17
5	Population per Ward (Thousands)		:	2,950
6	Total Number of Household as in 2011		:	8579
7	Number of Household per Ward		:	505
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.77
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135
19	Total Sewage Generation (MLD)*		:	5.42
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1353.90
		COD	:	2301.60
		TKN	:	270.80
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Jaffrabad				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	0.90
2	Population as in 2011		:	54601
3	Population Growth Rate as in 2011 (%)		:	-4.96
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	18200
6	Total Number of Household as in 2011		:	8815
7	Number of Household per Ward		:	2938
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.90
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1474.20
		COD	:	2506.20
		TKN	:	294.80
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Jait Pur			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	3.60
2	Population as in 2011		:	59330
3	Population Growth Rate as in 2011 (%)		:	140.10
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	59330
6	Total Number of Household as in 2011		:	11070
7	Number of Household per Ward		:	11070
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	6.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1601.90
		COD	:	2723.20
		TKN	:	320.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Jalaun				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.34
2	Population as in 2011		:	56909
3	Population Growth Rate as in 2011 (%)		:	13.69
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,276
6	Total Number of Household as in 2011		:	9560
7	Number of Household per Ward		:	382
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	4.32
10	Number of Bore Wells		:	6
11	Ground Water Extraction per Bore Well (MLD)		:	0.72
12	Number of Hand Pumps/ Tubewells		:	484
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	75.96
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	4.60
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	80.90
19	Total Sewage Generation (MLD)*		:	8.60
20	Per Capita Sewage Generation (lpcd)		:	151.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1536.50
		COD	:	2612.10
		TKN	:	307.30
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	9
34	Gross Area of Water Bodies (Hectare)		:	4.15
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Jaora				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	14.54
2	Population as in 2011		:	74907
3	Population Growth Rate as in 2011 (%)		:	15.05
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	2,497
6	Total Number of Household as in 2011		:	13102
7	Number of Household per Ward		:	437
8	Surface Water Supply (MLD)		:	3.25
9	Ground Water (GW) Supply (MLD)		:	0.15
10	Number of Bore Wells		:	61
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	159
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	3.25
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	10.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	8.10
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2022.50
		COD	:	3438.20
		TKN	:	404.50
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Maleni River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City:Jhalawar				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.95
2	Population as in 2011		:	66919
3	Population Growth Rate as in 2011 (%)		:	39.26
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	2231
6	Total Number of Household as in 2011		:	13595
7	Number of Household per Ward		:	453
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.60
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	128.10
19	Total Sewage Generation (MLD)*		:	9.30
20	Per Capita Sewage Generation (lpcd)		:	139.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1806.80
		COD	:	3071.60
		TKN	:	361.40
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kali Sindh,Ahu River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	10
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Kairana				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	7.11
2	Population as in 2011		:	89000
3	Population Growth Rate as in 2011 (%)		:	21.90
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	3,560
6	Total Number of Household as in 2011		:	13951
7	Number of Household per Ward		:	558
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	12.43
10	Number of Bore Wells		:	23
11	Ground Water Extraction per Bore Well (MLD)		:	0.54
12	Number of Hand Pumps/ Tubewells		:	235
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	130.72
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.55
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	131.95
19	Total Sewage Generation (MLD)*		:	5.31
20	Per Capita Sewage Generation (lpcd)		:	59.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2403.00
		COD	:	4085.10
		TKN	:	480.60
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Kalpi				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	9.73
2	Population as in 2011		:	51670
3	Population Growth Rate as in 2011 (%)		:	20.46
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,067
6	Total Number of Household as in 2011		:	8408
7	Number of Household per Ward		:	336
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.60
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1395.10
		COD	:	2371.70
		TKN	:	279.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Kapas Hera			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	3.40
2	Population as in 2011		:	74073
3	Population Growth Rate as in 2011 (%)		:	242.66
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	74073
6	Total Number of Household as in 2011		:	21370
7	Number of Household per Ward		:	21370
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	10.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	8.00
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2000.00
		COD	:	3400.00
		TKN	:	400.00
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City:Karauli				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	35.00
2	Population as in 2011		:	82960
3	Population Growth Rate as in 2011 (%)		:	25.24
4	Total Number of Wards		:	35
5	Population per Ward (Thousands)		:	2370
6	Total Number of Household as in 2011		:	14578
7	Number of Household per Ward		:	417
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	11.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	140.70
19	Total Sewage Generation (MLD)*		:	9.00
20	Per Capita Sewage Generation (lpcd)		:	108.50
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2239.90
		COD	:	3807.90
		TKN	:	448.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Utangan River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	0
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Khanjoori Khas			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	0.90
2	Population as in 2011		:	76640
3	Population Growth Rate as in 2011 (%)		:	69.98
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	76640
6	Total Number of Household as in 2011		:	13186
7	Number of Household per Ward		:	13186
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	10.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	8.30
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2069.30
		COD	:	3517.80
		TKN	:	413.90
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Khurai				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	11.03
2	Population as in 2011		:	51108
3	Population Growth Rate as in 2011 (%)		:	23.12
4	Total Number of Wards		:	27
5	Population per Ward (Thousands)		:	1,893
6	Total Number of Household as in 2011		:	9798
7	Number of Household per Ward		:	363
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.50
20	Per Capita Sewage Generation (lpcd)		:	107.60
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1379.90
		COD	:	2345.90
		TKN	:	276.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Bina River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Konch				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.95
2	Population as in 2011		:	53412
3	Population Growth Rate as in 2011 (%)		:	5.05
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,136
6	Total Number of Household as in 2011		:	8655
7	Number of Household per Ward		:	346
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	4.70
10	Number of Bore Wells		:	9
11	Ground Water Extraction per Bore Well (MLD)		:	0.52
12	Number of Hand Pumps/ Tubewells		:	462
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	87.97
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	4.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	92.30
19	Total Sewage Generation (MLD)*		:	1.10
20	Per Capita Sewage Generation (lpcd)		:	20.50
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1442.10
		COD	:	2451.60
		TKN	:	288.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Betwa River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	3
34	Gross Area of Water Bodies (Hectare)		:	24.62
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Koshi Kalan				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	4.50
2	Population as in 2011		:	60074
3	Population Growth Rate as in 2011 (%)		:	31.39
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,403
6	Total Number of Household as in 2011		:	9879
7	Number of Household per Ward		:	395
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	6.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1622.00
		COD	:	2757.40
		TKN	:	324.40
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City:Kuchaman				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.50
2	Population as in 2011		:	61969
3	Population Growth Rate as in 2011 (%)		:	22.50
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	2066
6	Total Number of Household as in 2011		:	9643
7	Number of Household per Ward		:	321
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	143.20
19	Total Sewage Generation (MLD)*		:	6.70
20	Per Capita Sewage Generation (lpcd)		:	108.10
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1673.20
		COD	:	2844.40
		TKN	:	334.60
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mahoba			State: Uttar Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.15
2	Population as in 2011		:	95216
3	Population Growth Rate as in 2011 (%)		:	20.86
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	3,809
6	Total Number of Household as in 2011		:	17283
7	Number of Household per Ward		:	691
8	Surface Water Supply (MLD)		:	11.86
9	Ground Water (GW) Supply (MLD)		:	4.25
10	Number of Bore Wells		:	20
11	Ground Water Extraction per Bore Well (MLD)		:	0.21
12	Number of Hand Pumps/ Tubewells		:	1090
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	11.86
16	Average Water Supply Rate from ULB Sources (lpcd)		:	168.77
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	16.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	174.48
19	Total Sewage Generation (MLD)*		:	14.66
20	Per Capita Sewage Generation (lpcd)		:	153.91
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2570.80
		COD	:	4370.40
		TKN	:	514.20
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Ken River
32	Number of Drains/Nallah for Wastewater Disposal		:	4
33	Number of Water Bodies		:	4
34	Gross Area of Water Bodies (Hectare)		:	194.70
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mandideep				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.78
2	Population as in 2011		:	59654
3	Population Growth Rate as in 2011 (%)		:	49.66
4	Total Number of Wards		:	18
5	Population per Ward (Thousands)		:	3,314
6	Total Number of Household as in 2011		:	14330
7	Number of Household per Ward		:	796
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NIL
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.80
19	Total Sewage Generation (MLD)*		:	6.40
20	Per Capita Sewage Generation (lpcd)		:	107.30
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1610.70
		COD	:	2738.10
		TKN	:	322.10
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kaliasot River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mauranipur				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	5.53
2	Population as in 2011		:	61449
3	Population Growth Rate as in 2011 (%)		:	20.77
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,458
6	Total Number of Household as in 2011		:	10879
7	Number of Household per Ward		:	435
8	Surface Water Supply (MLD)		:	2.84
9	Ground Water (GW) Supply (MLD)		:	0.90
10	Number of Bore Wells		:	4
11	Ground Water Extraction per Bore Well (MLD)		:	0.23
12	Number of Hand Pumps/ Tubewells		:	453
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	2.84
16	Average Water Supply Rate from ULB Sources (lpcd)		:	63.98
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	4.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	67.90
19	Total Sewage Generation (MLD)*		:	10.20
20	Per Capita Sewage Generation (lpcd)		:	166.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1659.10
		COD	:	2820.50
		TKN	:	331.80
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Suknai River
32	Number of Drains/Nallah for Wastewater Disposal		:	6
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mithe Pur			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	1.80
2	Population as in 2011		:	69837
3	Population Growth Rate as in 2011 (%)		:	71.83
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	69837
6	Total Number of Household as in 2011		:	14160
7	Number of Household per Ward		:	14160
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	7.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1885.60
		COD	:	3205.50
		TKN	:	377.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Molar Band			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	4.10
2	Population as in 2011		:	91402
3	Population Growth Rate as in 2011 (%)		:	125.55
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	30467
6	Total Number of Household as in 2011		:	18159
7	Number of Household per Ward		:	6053
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	12.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	9.90
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2467.90
		COD	:	4195.40
		TKN	:	493.60
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mukand Pur			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.50
2	Population as in 2011		:	57135
3	Population Growth Rate as in 2011 (%)		:	167.62
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	57135
6	Total Number of Household as in 2011		:	10975
7	Number of Household per Ward		:	10975
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	6.20
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1542.60
		COD	:	2622.50
		TKN	:	308.50
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Mundka				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	11.90
2	Population as in 2011		:	54541
3	Population Growth Rate as in 2011 (%)		:	24.32
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	18180
6	Total Number of Household as in 2011		:	10615
7	Number of Household per Ward		:	3538
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.90
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1472.60
		COD	:	2503.40
		TKN	:	294.50
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Muradnagar				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.00
2	Population as in 2011		:	95208
3	Population Growth Rate as in 2011 (%)		:	28.40
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	3,808
6	Total Number of Household as in 2011		:	15241
7	Number of Household per Ward		:	610
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	6.16
10	Number of Bore Wells		:	5
11	Ground Water Extraction per Bore Well (MLD)		:	1.23
12	Number of Hand Pumps/ Tubewells		:	294
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	61.60
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	63.10
19	Total Sewage Generation (MLD)*		:	6.80
20	Per Capita Sewage Generation (lpcd)		:	71.60
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2570.60
		COD	:	4370.00
		TKN	:	514.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Hindon River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	1.57
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City:Nasirabad				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	22.93
2	Population as in 2011		:	50804
3	Population Growth Rate as in 2011 (%)		:	3.41
4	Total Number of Wards		:	7
5	Population per Ward (Thousands)		:	7258
6	Total Number of Household as in 2011		:	9078
7	Number of Household per Ward		:	1297
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	145.20
19	Total Sewage Generation (MLD)*		:	5.50
20	Per Capita Sewage Generation (lpcd)		:	108.30
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1371.70
		COD	:	2331.90
		TKN	:	274.30
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City:Nimbahera				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	12.74
2	Population as in 2011		:	61949
3	Population Growth Rate as in 2011 (%)		:	16.17
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	2065
6	Total Number of Household as in 2011		:	12776
7	Number of Household per Ward		:	426
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	4.50
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	72.20
19	Total Sewage Generation (MLD)*		:	10.40
20	Per Capita Sewage Generation (lpcd)		:	167.90
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1672.60
		COD	:	2843.50
		TKN	:	334.50
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Nithari				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.29
2	Population as in 2011		:	50464
3	Population Growth Rate as in 2011 (%)		:	44.08
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	50464
6	Total Number of Household as in 2011		:	9460
7	Number of Household per Ward		:	9460
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1362.50
		COD	:	2316.30
		TKN	:	272.50
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Panipat Taraf Makhdum Zadgan			State: Haryana	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.54
2	Population as in 2011		:	67998
3	Population Growth Rate as in 2011 (%)		:	93.42
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	67,998
6	Total Number of Household as in 2011		:	14066
7	Number of Household per Ward		:	14066
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.18
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	7.34
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1835.90
		COD	:	3121.10
		TKN	:	367.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Panna				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	10.00
2	Population as in 2011		:	59091
3	Population Growth Rate as in 2011 (%)		:	13.51
4	Total Number of Wards		:	22
5	Population per Ward (Thousands)		:	2,686
6	Total Number of Household as in 2011		:	10019
7	Number of Household per Ward		:	455
8	Surface Water Supply (MLD)		:	2.34
9	Ground Water (GW) Supply (MLD)		:	1.06
10	Number of Bore Wells		:	65
11	Ground Water Extraction per Bore Well (MLD)		:	0.02
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	2.34
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	6.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1595.50
		COD	:	2712.30
		TKN	:	319.10
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Kilkila, Ken River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	12
34	Gross Area of Water Bodies (Hectare)		:	54.47
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Pooth Kalan				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	7.00
2	Population as in 2011		:	96002
3	Population Growth Rate as in 2011 (%)		:	89.74
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	96002
6	Total Number of Household as in 2011		:	19516
7	Number of Household per Ward		:	19516
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	13.00
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	10.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2592.10
		COD	:	4406.50
		TKN	:	518.40
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Pul Pehlad				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.20
2	Population as in 2011		:	69657
3	Population Growth Rate as in 2011 (%)		:	31.79
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	69657
6	Total Number of Household as in 2011		:	14734
7	Number of Household per Ward		:	14734
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	7.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1880.70
		COD	:	3197.30
		TKN	:	376.10
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Raghogarh -Vijaypur				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	73.79
2	Population as in 2011		:	62163
3	Population Growth Rate as in 2011 (%)		:	26.42
4	Total Number of Wards		:	24
5	Population per Ward (Thousands)		:	2,590
6	Total Number of Household as in 2011		:	12409
7	Number of Household per Ward		:	517
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	8.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.10
19	Total Sewage Generation (MLD)*		:	6.70
20	Per Capita Sewage Generation (lpcd)		:	107.80
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1678.40
		COD	:	2853.30
		TKN	:	335.70
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Parbati, Chopan River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	7
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City:Rajsamand				State: Rajasthan
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	55.00
2	Population as in 2011		:	67798
3	Population Growth Rate as in 2011 (%)		:	21.75
4	Total Number of Wards		:	30
5	Population per Ward (Thousands)		:	2260
6	Total Number of Household as in 2011		:	13765
7	Number of Household per Ward		:	459
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	950
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	142.70
19	Total Sewage Generation (MLD)*		:	7.30
20	Per Capita Sewage Generation (lpcd)		:	107.70
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1830.50
		COD	:	3111.90
		TKN	:	366.10
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Banas,Gomati River
32	Number of Drains/Nallah for Wastewater Disposal		:	3
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Rath				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	8.12
2	Population as in 2011		:	65056
3	Population Growth Rate as in 2011 (%)		:	16.28
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,238
6	Total Number of Household as in 2011		:	11274
7	Number of Household per Ward		:	451
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	5.50
10	Number of Bore Wells		:	11
11	Ground Water Extraction per Bore Well (MLD)		:	0.50
12	Number of Hand Pumps/ Tubewells		:	348
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	84.49
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	5.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	87.20
19	Total Sewage Generation (MLD)*		:	4.20
20	Per Capita Sewage Generation (lpcd)		:	65.20
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1756.50
		COD	:	2986.10
		TKN	:	351.30
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Betwa/ Dhasan River
32	Number of Drains/Nallah for Wastewater Disposal		:	1
33	Number of Water Bodies		:	9
34	Gross Area of Water Bodies (Hectare)		:	19.90
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Roshan Pura alias Dichaon Khurd			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	2.80
2	Population as in 2011		:	57217
3	Population Growth Rate as in 2011 (%)		:	48.30
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	57217
6	Total Number of Household as in 2011		:	10956
7	Number of Household per Ward		:	10956
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	6.20
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1544.90
		COD	:	2626.30
		TKN	:	309.00
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sadat Pur Gujran				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	1.10
2	Population as in 2011		:	97641
3	Population Growth Rate as in 2011 (%)		:	125.91
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	97641
6	Total Number of Household as in 2011		:	18679
7	Number of Household per Ward		:	18679
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	13.20
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	10.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2636.30
		COD	:	4481.70
		TKN	:	527.30
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sahibabad Daulat Pur			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	5.70
2	Population as in 2011		:	54773
3	Population Growth Rate as in 2011 (%)		:	52.23
4	Total Number of Wards		:	1
5	Population per Ward (Thousands)		:	54773
6	Total Number of Household as in 2011		:	11720
7	Number of Household per Ward		:	11720
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.90
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1478.90
		COD	:	2514.10
		TKN	:	295.80
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna, Hindan River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Shajapur				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	17.19
2	Population as in 2011		:	69263
3	Population Growth Rate as in 2011 (%)		:	19.79
4	Total Number of Wards		:	29
5	Population per Ward (Thousands)		:	2,388
6	Total Number of Household as in 2011		:	13066
7	Number of Household per Ward		:	451
8	Surface Water Supply (MLD)		:	4
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	60
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	4
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.40
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	7.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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)		:	NIL
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	:	1870.10
		COD	:	3179.20
		TKN	:	374.00
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Chiler, Lakhunder River
32	Number of Drains/Nallah for Wastewater Disposal		:	9
33	Number of Water Bodies		:	2
34	Gross Area of Water Bodies (Hectare)		:	3.04
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sheopur				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.29
2	Population as in 2011		:	71951
3	Population Growth Rate as in 2011 (%)		:	23.33
4	Total Number of Wards		:	23
5	Population per Ward (Thousands)		:	3,128
6	Total Number of Household as in 2011		:	13724
7	Number of Household per Ward		:	597
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	7.80
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1942.70
		COD	:	3302.60
		TKN	:	388.50
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Parbati River
32	Number of Drains/Nallah for Wastewater Disposal		:	5
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Shujalpur			State: Madhya Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	7.74
2	Population as in 2011		:	51225
3	Population Growth Rate as in 2011 (%)		:	20.63
4	Total Number of Wards		:	21
5	Population per Ward (Thousands)		:	2,439
6	Total Number of Household as in 2011		:	9833
7	Number of Household per Ward		:	468
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.90
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1383.10
		COD	:	2351.20
		TKN	:	276.60
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Newaj River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sikandrabad				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	1.14
2	Population as in 2011		:	81028
3	Population Growth Rate as in 2011 (%)		:	15.97
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	3,241
6	Total Number of Household as in 2011		:	13231
7	Number of Household per Ward		:	529
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	6.00
10	Number of Bore Wells		:	5
11	Ground Water Extraction per Bore Well (MLD)		:	1.20
12	Number of Hand Pumps/ Tubewells		:	235
13	Ground Water Extraction per Hand Pump (lpd)		:	500
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	75
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	76.47
19	Total Sewage Generation (MLD)*		:	48.79
20	Per Capita Sewage Generation (lpcd)		:	602.18
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2187.80
		COD	:	3719.20
		TKN	:	437.60
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Sironj			State: Madhya Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	9.99
2	Population as in 2011		:	52460
3	Population Growth Rate as in 2011 (%)		:	24.37
4	Total Number of Wards		:	21
5	Population per Ward (Thousands)		:	2,498
6	Total Number of Household as in 2011		:	9928
7	Number of Household per Ward		:	473
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.10
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.70
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1416.40
		COD	:	2407.90
		TKN	:	283.30
30	Wastewater Disposal Means		:	Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Land Disposal
32	Number of Drains/Nallah for Wastewater Disposal		:	2
33	Number of Water Bodies		:	1
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Taj Pul				State: NCT Delhi
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	1.20
2	Population as in 2011		:	68796
3	Population Growth Rate as in 2011 (%)		:	15.35
4	Total Number of Wards		:	2
5	Population per Ward (Thousands)		:	34398
6	Total Number of Household as in 2011		:	13825
7	Number of Household per Ward		:	6913
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	7.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1857.50
		COD	:	3157.70
		TKN	:	371.50
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Tikamgarh				State: Madhya Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	6.22
2	Population as in 2011		:	79106
3	Population Growth Rate as in 2011 (%)		:	15.61
4	Total Number of Wards		:	27
5	Population per Ward (Thousands)		:	2,930
6	Total Number of Household as in 2011		:	14587
7	Number of Household per Ward		:	540
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	10.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	8.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	2135.90
		COD	:	3631.00
		TKN	:	427.20
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Jamani River
32	Number of Drains/Nallah for Wastewater Disposal		:	7
33	Number of Water Bodies		:	6
34	Gross Area of Water Bodies (Hectare)		:	125.28
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Tundla				State: Uttar Pradesh
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	8.25
2	Population as in 2011		:	50423
3	Population Growth Rate as in 2011 (%)		:	24.63
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,017
6	Total Number of Household as in 2011		:	8744
7	Number of Household per Ward		:	350
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	6.80
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	5.40
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1361.40
		COD	:	2314.40
		TKN	:	272.30
30	Wastewater Disposal Means		:	River & Land Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Vrinadavan			State: Uttar Pradesh	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	13.49
2	Population as in 2011		:	63005
3	Population Growth Rate as in 2011 (%)		:	11.14
4	Total Number of Wards		:	25
5	Population per Ward (Thousands)		:	2,520
6	Total Number of Household as in 2011		:	11637
7	Number of Household per Ward		:	465
8	Surface Water Supply (MLD)		:	1.50
9	Ground Water (GW) Supply (MLD)		:	6
10	Number of Bore Wells		:	28
11	Ground Water Extraction per Bore Well (MLD)		:	0.21
12	Number of Hand Pumps/ Tubewells		:	400
13	Ground Water Extraction per Hand Pump (lpd)		:	600
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	1.50
16	Average Water Supply Rate from ULB Sources (lpcd)		:	119.04
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	7.70
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	122.80
19	Total Sewage Generation (MLD)*		:	13.00
20	Per Capita Sewage Generation (lpcd)		:	206.90
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1701.10
		COD	:	2891.90
		TKN	:	340.20
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	6
33	Number of Water Bodies		:	7
34	Gross Area of Water Bodies (Hectare)		:	2.00
35	Area of Water Bodies as % of Total Area		:	<<< 1

Water Balance & Pollution Load (Domestic) Data Sheet

City: Ziauddin Pur			State: NCT Delhi	
S. No.	**Items**			**Value**
1	Total Area (sq km)		:	1.80
2	Population as in 2011		:	68993
3	Population Growth Rate as in 2011 (%)		:	43.61
4	Total Number of Wards		:	3
5	Population per Ward (Thousands)		:	22998
6	Total Number of Household as in 2011		:	12057
7	Number of Household per Ward		:	4019
8	Surface Water Supply (MLD)		:	NA
9	Ground Water (GW) Supply (MLD)		:	NA
10	Number of Bore Wells		:	NA
11	Ground Water Extraction per Bore Well (MLD)		:	NA
12	Number of Hand Pumps/ Tubewells		:	NA
13	Ground Water Extraction per Hand Pump (lpd)		:	NA
14	Number of Pumping Stations for Water Supply		:	NA
15	Total Pumping Capacity (MLD)		:	NA
16	Average Water Supply Rate from ULB Sources (lpcd)		:	NA
17	Total Water Supply from ULB and Non-ULB Sources (MLD)		:	9.30
18	Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)		:	135.00
19	Total Sewage Generation (MLD)*		:	7.50
20	Per Capita Sewage Generation (lpcd)		:	108.00
21	Sewage Collection (MLD)		:	NA
22	Percentage of Sewage Collection (%)		:	NA
23	Number of STPs		:	NA
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	:	1862.80
		COD	:	3166.80
		TKN	:	372.60
30	Wastewater Disposal Means		:	River Disposal
31	Name of River/Streams for Wastewater Disposal		:	Yamuna River
32	Number of Drains/Nallah for Wastewater Disposal		:	NA
33	Number of Water Bodies		:	NA
34	Gross Area of Water Bodies (Hectare)		:	NA
35	Area of Water Bodies as % of Total Area		:	<<< 1

Pulp and Paper Industries in Ganga River Basin:

Achieving Zero Liquid Discharge

GRBMP : Ganga River Basin Management Plan

by

Indian Institutes of Technology

IIT Bombay | IIT Delhi | IIT Guwahati | IIT Kanpur | IIT Kharagpur | IIT Madras | IIT Roorkee

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 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 (GRBMP). 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 GRBMP. 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.

Dr Vinod Tare
Professor and Coordinator
Development of GRBMP
IIT Kanpur

The Team

1. A A Kazmi, IIT Roorkee *kazmifce@iitr.ernet.in*
2. A K Gupta, IIT Kharagpur *akgupta18@rediffmail.com,akgupta@iitkgp.ac.in*
3. A K Mittal, IIT Delhi *akmittal@civil.iitd.ernet.in*
4. A K Nema, IIT Delhi *aknema@gmail.com*
5. Ajay Kalmhad, IIT Guwahati *kajay@iitg.ernet.in*
6. Anirban Gupta, BESU Shibpur *guptaanirban@hotmail.com*
7. Arun Kumar, IIT Delhi *arunku@civil.iitd.ac.in*
8. G J Chakrapani, IIT Roorkkee *gjcurfes@iitr.ernet.in*
9. Gazala Habib, IIT Delhi *gazalahabib@gmail.com*
10. Himanshu Joshi, IIT Roorkee *himanshujoshi58@gmail.com*
11. Indu Mehrotra, IIT Roorkee *indumfce@iitr.ernet.in*
12. I M Mishra, IIT Roorkee *imishfch@iitr.ernet.in*
13. Ligy Philip, IIT Madras *ligy@iitm.ac.in*
14. M M Ghangrekar, IIT Kharagpur *ghangrekar@civil.iitkgp.ernet.in*
15. Mukesh Doble, IIT Bombay *mukeshd@iitm.ac.in*
16. P K Singh, IT BHU *dr_pksingh1@rediffmail.com*
17. Purnendu Bose, IIT Kanpur *pbose@iitk.ac.in*
18. R Ravi Krishna, IIT Madras *rrk@iitm.ac.in*
19. Rakesh Kumar, NEERI Nagpur *r_kumar@neeri.res.in*
20. S M Shivnagendra, IIT Madras *snagendra@iitm.ac.in*
21. Saumyen Guha, IIT Kanpur *sguha@iitk.ac.in*
22. Shyam R Asolekar, IIT Bombay *asolekar@iitb.ac.in*
23. Sudha Goel, IIT Kharagpur *sudhagoel@civil.iitkgp.ernet.in*
24. Suparna Mukherjee, IIT Bombay *mitras@iitb.ac.in*
25. T R Sreekrishanan, IIT Delhi *sree@dbeb.iitd.ac.in*
26. Vinod Tare, IIT Kanpur *vinod@iitk.ac.in*
27. Vivek Kumar, IIT Roorkee *vivekfpt@iitr.ernet.in*

Lead Persons

1. Dr Vinod Tare and Dr Purnendu Bose, IIT Kanpur
2. Dr Arvind K Nema, Dr T R Sreekrishnan and Dr A K Mittal, IIT Delhi
3. Dr Dharm Dutt, Dr C H Tyagi, Dr Ram Kumar and Dr Vivek, IIT Roorkee
4. Dr Suresh Panwar, Dr M K Gupta, Dr S Mishra and Dr Nitin Endlay, CPPRI, Saharanpur
5. Er Ajit K Vidyarthi, Er V P Yadav and Er Kamlesh Singh, CPCB, New Delhi

Contents

1. Prologue

The water quality in the rivers in the Ganga basin is largely affected by pollution from domestic, industrial and other sources. Significant quantities of industrial effluents are transported by the rivulets namely Dhella, Bahella, Kosi, Pilakhar, Kalyani, Baigul and Gola to river Ramganga. It is estimated that the total wastewater discharge directly or indirectly into the river Ramganga from Uttarakhand and Uttar Pradesh is ≈162 and ≈74 MLD respectively. This discharge not only affects the water quality of the river Ramganga but also adversely impacts river Ganga downstream of the confluence of the two rivers. Similarly, in the catchments of river Kali (East), 73 major industrial units discharge ≈86 MLD of wastewater bringing in an estimated 13,000 TPD of BOD load in the river system. River Kali meets river Ganga a few kilometres after the confluence of rivers Ganga and Ramganga at Kannauj, and further degrades water quality of the river Ganga.

Pulp and paper Industries, particularly the agro based, are one of the major contributors in polluting rivers Ramganga and Kali, and hence the river Ganga. Out of the total wastewater discharge into the river Ramganga from Uttarakhand and Uttar Pradesh, pulp and paper sector contributes about 146 MLD (90%) and 39 MLD (53%) respectively. It has also been estimated that out of the total wastewater discharge into the river Kali (East) system, contribution from 15 pulp and paper industries located in Uttar Pradesh is about 37 MLD.

The pulp and paper industries located in the clusters in Kashipur, Muzaffarnagar, Meerut and Moradabad are manufacturing a variety of unbleached and bleached grade of paper and paper products using agro residues, waste paper and imported pulp. The main varieties of paper produced are writing and printing paper, kraft paper, duplex board and newsprint. The scale of operation varies from 25 to 250 TPD with the use of either single or multiple paper machines. The mills having pulp mill capacity above 100 TPD and producing bleached variety of paper have already installed chemical recovery plant for black liquor while other mills making unbleached kraft paper from agro residues are operating without chemical recovery plant. All mills generally have effluent treatment facilities comprising primary clarifier, aeration system and secondary clarifier. The performance efficiency of existing effluent treatment plants (ETPs), however, is highly variable and is generally unsatisfactory.

2. Proposed Water Management Strategy

A team of scientists and engineers from IIT Delhi, IIT Kanpur, IIT Roorkee and CPPRI Saharanpur conducted a detailed study, sponsored by the Central Pollution Control Board (CPCB) New Delhi, in the identified clusters of pulp and paper industries in Uttar Pradesh and Uttarakhand. The study involved collection of secondary data, representative primary data, meetings and workshop with various stakeholders, visits to some pulp and paper industries within the identified clusters as well as those which are outside the study area but following some of the best practices. A detailed report covering (i) background, (ii) objectives and methodology, (iii) inventory and status of pulp and paper mills in the identified clusters, (iv) cleaner technology and best practices options for overall

improvement with selected case studies, (v) water consumption benchmarks and strategies for minimizing water consumption, (vi) feasibility of setting up common chemical recovery plant (CCRP) and common effluent treatment plant (CETP), and (vii) action plan for wastewater management is presented elsewhere (Report No.: 023_GBP_IIT_EQP_ANL_01 Ver 1_Sep 2011).

In order to improve the health of the rivers in the Ganga basin, discharge of pollutants in the river channels needs to be stopped. Also, the trade effluent could be viewed as a source of water that can be used for various processes. Management of water in the pulp and paper mills needs a two prong action plan. First is to reduce water consumption through process improvements and implementation of recycle and reuse of water. Second is to have quantum improvement on the individual ETPs by adding tertiary treatment units. This would result in producing industry grade water from excess back water discharged from various processes within the industry.

At present there seem to be inadequate control on the quantity of water used and wastewater discharged from the pulp and paper industries of the study region due to availability of water and lack of implementation of polluter pays principle. These are the main de-motivating factors responsible for conservation of water in most of the industries. Hence a strict metering of the water used and wastewater generation is recommended. Proposed wastewater management strategies for wastepaper based and agro based mills are illustrated in Figure 1.

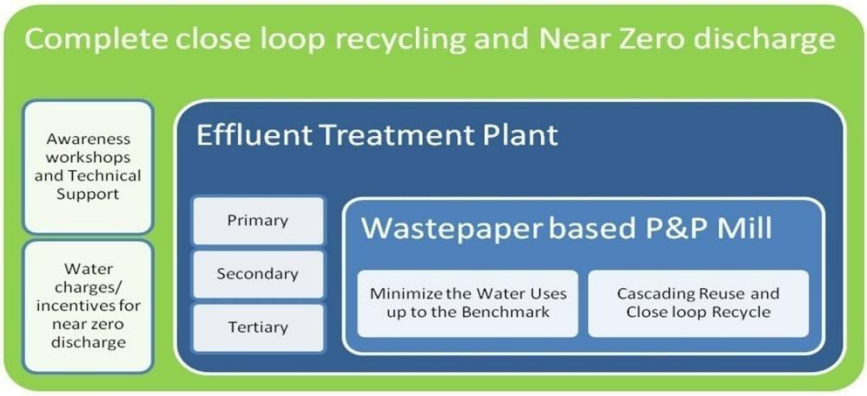


Figure 1: Proposed Water Management Strategy for the Pulp and Paper Mills

A survey was conducted in the study region to assess the existing water consumption for different operations in various industries. Also, a one day brainstorming meeting was conducted in order to synthesize the information on the best achieved water consumption in different categories of the mills within and outside the study region. Based on the consultation with the industries and the sector experts, the benchmarks for water consumption in the four different categories of pulp and paper industries were set. Table 1 presents the summary of results on four different estimates on water consumption based on field survey and outcome of the brainstorming.

Several technological and process improvements are plausible to reduce net water abstraction from natural sources and thereby also reduce the amounts of effluents generated. Suggested technological up-gradation/measures for reduction in water consumption for achieving the benchmark are mentioned in Table 2.

Table 1: Water requirements for four different categories of the pulp and paper mills

Category	Existing Water Consumption m^3 / T paper (Average)	Achievable Water Consumption m^3 /T paper* (Average)	Best Achieved Water Consumption m^3 /T paper (Average)	Bench mark for water Consumption m^3 /T paper (Average)
A1: Agro Based *Writing & printing paper mills*	**100**	**80**	**60**	**50**
A2: Agro Based *Kraft paper mills*	**75**	**45**	**45**	**30**
B1: RCF Based *Writing & printing paper, Duplex board, newsprint*	**50**	**20**	**30**	**20**
B2: RCF based *Kraft paper mills*	**35**	**10**	**15**	**10**

** as per discussions with the representatives of the pulp and paper industries*

Table 2: Technological up-gradation/measures for reduction in water consumption for four different categories of industries

Category	Technological Up-gradation/ Adoption
A1: Agro Based *Writing & printing paper mills*	• Effective raw material washing/cleaning • Use of Continuous Digester (CD) for cooking of raw materials. • Adoption of Screw press/belt filter press for black liquor extraction followed by 2-3 stage Brown Stock Washer(BSW) • Adoption of Oxygen delignification • Adoption of Elemental Chlorine free (ECF) Bleaching • Oxygen/peroxide reinforced alkali extraction in bleaching process • Installation of PDF for fibre recovery as well as increased reuse of back water. • Use of self cleaning, oscillating type high pressure showers at paper machine
A2: Agro Based *Kraft paper mills*	• Effective Raw material washing/ cleaning • Installation of screw press with 2-3 stage Brown Stock Washer(BSW) • Installation of Chemical Recovery process(individual or common) • Installation of fibre recovery unit for paper machine back water • Self-cleaning, oscillating type high pressure showers at paper machine
B1: RCF Based *Writing & printing paper, Duplex board, newsprint mills*	• High Consistency pulper/Drum Pulper for imported waste paper • Replacement of Decker thickner with pressurised drum washer • Hydrogen Peroxide bleaching • Replacement of Potcher washers with 2 stage Brown Stock Washer(BSW) • Fibre recovery unit for paper machine back water • Self cleaning, oscillating high pressure shower at paper machine
B2: RCF Based *Kraft paper mills*	• Installation of high consistency pulper /Drum Pulper • Replacement of Decker Thickener with pressurised Drum washers • Fibre recovery unit for paper machine back water • Self Cleaning, Oscillating High Pressure shower at paper machine

3. Feasibility of CETPs

Table 3 presents the comparison of two options for treatment of pulp and paper effluents namely, effluent treatment at each industry (ETP) and effluent treatment in a common effluent treatment plant (CETP) for a group of industries in vicinity. The trade of is between the cost and efficacy of effluent treatment in a number of small size ETP within the premises of each industry and economy of scale and better management of CETP for a group of industries. As can be seen from the comparison of the estimated cost of treatment in ETP and CETP (refer last two columns in Table 3), the advantage of economy of scale is not applicable for the four clusters of Pulp and Paper industries under study in the Ganga Basin. In addition large length of conveyance system due to distant location of the industries would require substantial investment on conveyance (refer column 4 of Table 3) system. In addition the pumping cost, though much less in comparison to other costs, will increase the operation and maintenance burden on each of the industries. Further, the CETP option will discourage the industry to adopt recycling of treated water due to additional cost of conveying treated water back to the industry. This would act as a deterrent to move towards the concept of zero discharge. Based on the aforementioned information and arguments it can be inferred that the option of collecting effluents and treating in CETP is infeasible for the identified clusters in the Ganga Basin

Table 3: Comparison of ETP and CETP options for different clusters of Pulp and Paper Industries in the Ganga Basin

CETP	No. of Mills	Range of Quantity of Effluent Generated from each mill, MLD	Estimated Discharge to CETP, MLD	Conveyance System		Estimated Cost, `/m^3	
				Distance, km	Estimated Capital Cost, ` in lacs	ETP	CETP
Cluster I: Kashipur							
I A	15	2.5 - 25	38.8	51	1500 – 2500	10-15	10
I B	03	1 - 3	4.7			15	15
I C	03	1 - 3	5.0			15	15
I D	03	1 - 5	10.2			15	12
Cluster II: Muzaffarnagar							
II A	8	3 - 10	40.0	25	750 – 1250	10 - 14	10
	7	CETP Option Impractical					
	2	CETP Option Impractical					
	6	CETP Option Impractical					
Cluster III: Meerut							
III A	2	5 - 6	11	3	90 – 150	12	12
	3	1 - 3	07			15	13
	3	CETP Option Impractical					
Cluster IV: Moradabad							
IV A	4	1 - 3	5.9	3	90 – 150	15	14

4. Feasibility of Zero Discharge Paradigm

The typical characteristics of raw water used and effluent discharged from four different categories of industries are shown in Table 4. The individual industries are required to shift towards a near zero discharge paradigm. The financial implications of achieving zero liquid discharge have been worked out separately for the agro based and RCF as follows.

A - Agro Based: In this case two types of liquid wastes are generated. Black liquor is to be sent to the CRP while other effluents to be sent to the Effluent Treatment Plant (ETP) within the industry. The concept of CCRP is feasible for smaller mills within a cluster of industries while larger mills can have separate CRP. The ETP is to produce two types of industry grade water. The water required for pulp production for manufacturing of unbleached kraft paper should be used tertiary treated back water/wastewater without control on TDS while that required for other processes should include RO process as part of tertiary treatment. However, the reuse of back water/wastewater into process in mills manufacturing bleached grade quality paper will involve the application of RO process as a part of tertiary treatment for removal of colour. Thus cost of attaining zero discharge paradigm will involve (i) cost incurred in treating black liquor in CRP or CCRP as the case may be, (ii) cost of producing industry grade water from effluent without control on TDS for pulp production, and (iii) cost of producing industry grade water with TDS control of the balance effluent.

B - RCF Based: In this case part or all of the effluent may have to be tertiary treated to produce industry grade water with TDS control. Thus cost of attaining zero discharge paradigm will involve cost of producing industry grade water with tertiary and partly with RO treatment of the total effluent. The treatment can be done in ETPs installed in each industry or CETP. The option of CETP is not considered feasible due to (i) the amount of effluent generated in each of the industry is not small to make individual ETPs unviable, and (ii) the industries within the cluster are not close by and hence the cost of conveying effluents to the CETP and the cost of conveying industry grade water from CETP to each of the member industry is very high.

Table 4: Typical characteristics of water and wastewater from four different categories of industries

Parameters	Raw Water	Effluent			
		A1: Agro Based *Writing & printing paper mills*	**A2: Agro Based** *Kraft paper mills*	**B1: RCF Based** *Writing & printing paper, Duplex board, newsprint mills*	**B2: RCF Based** *Kraft paper mills*
pH	7.5 -7.8	7.0 -7.8	6	6.8 -7.3	6
TDS, mg/l	290	1100-6800	1560	800-1720	840-3240
TSS, mg/l	Nil	384-1950	466	160- 4387	56-680
COD, mg/l	Nil	776-5048	1010	262-1715	704-2016
BOD, mg/l	Nil	450-2234	543	180- 958	593-1058
Colour, RCO	Nil	800-1200	-*	-	-
Turbidity, NTU	Nil	35-19	106	2 -35	22- 299
Hardness, mg/l as $CaCO_3$	180 -185				

** Mills are using RCF only at present*

The capital and operation and maintenance cost of effluent treatment plants can be estimated based on information gathered from existing sewage and effluent treatment plants (STPs and ETPs) in India (reference report 003_GBP_IIT_EQP_S&R 02 Ver 1_Dec 2010). Three stage treatment, consisting of preliminary/pre treatment, primary and secondary treatment, and tertiary treatment without and with RO treatment as the case may be, has been considered to achieve industry grade water from effluents discharged with characteristics as reported in Table 4. The estimated costs are given for various ranges of capacities assuming 2010 as base year. The estimated costs for different capacity ranges are presented in Table 5.

Table 5: Estimated Capital and Operation and Maintenance Costs for ETPs

Capacity, *MLD*	**Treatment Cost up to Tertiary Treatment without RO , `/m^3** *(including capital, O & M, and Reinvestment Cost assuming 15 Years Life of ETP as on 2010)*	**Treatment Cost up to Tertiary Treatment with RO , `/m^3** *(including capital, O & M, and Reinvestment Cost assuming 15 Years Life of ETP as on 2010)*
0 – 5	15	100
5 - 20	15-10	100
> 20	10	100

Note: Actual cost will be technology and location specific

Estimated production costs for different grades of paper as obtained from informal market survey and discussions with some of the industry persons are given in Table 6.

Table 6: Estimated Production Cost and Selling Price for different grades of paper

Grade of Paper	**Production cost** *` / T paper*	**Selling Price** *` / T paper*
A1: Agro Based *Writing & printing paper*	32000 – 34000	38000 – 40000
A2: Agro Based *Kraft paper (100 % agro)*	19000 – 20000	23000 – 24000
B1: RCF Based *Writing & printing paper*	32000 – 33000	35000 – 36000
B2: RCF Based *Kraft paper*	22000 – 22500	23000 – 24000

Estimated costs of water reuse/recycle after tertiary treatment in a typical 25 TPD paper and pulp mill of four different categories are presented in Table 7. The estimated costs are based on the assumption that new treatment plants would be built by the industry, and hence the estimates are slightly on the higher side. The estimates are thus very conservative and meant for supporting policy decisions. If the existing effluent treatment infrastructure in each industry is taken into account, the percentage increase in the average production cost may marginally decrease. However, this decrease can be worked out through detailed design and estimates for each case and may not reflect in the crude estimates used in preparing this report.

Table 7: Estimated cost of water reuse/ recycle after tertiary treatment in a typical mill of capacity of 25 TPD paper and pulp mill

Category of Mill	Achievable Water Consumption m^3/T paper* (Average)	Average Production Cost `/ T paper	Estimated Cost, `/ T paper			Percentage Increase in the Average Production Cost
			Chemical Recovery from Black Liquor Using CRP/CCRP	Complete Recycling of Effluent	Attaining Zero Discharge Paradigm	
A1: Agro Based *Writing & printing paper*	80	33000	163	1,200 (5,875)#	1,363 (6,038)#	4.1 (18.3)#
A2: Agro Based *Kraft paper*	45	19500	163	675 (3,225)$	838 (3,388)$	4.3 (17.4)$
B1: RCF Based *Writing & printing paper, Duplex board, newsprint*	20	32500	Not Applicable	300 (2,000)*	300 (3,000)*	0.9 (6.2)*
B2: RCF Based *Kraft paper*	10	22250	Not Applicable	150 (1,000)*	150 (1,000)*	0.7 (4.5)*

 # Considering 25 and 55 m^3/T paper *without and with RO treatment respectively; $ Considering 15* and 30 m^3/T paper *without and with RO treatment respectively; *Considering RO treatment; Cost of recovery of solids from RO Reject on drying is included in the RO treatment*

Note: This analysis does not include the water charges and expenses levied on the fresh water use. Inclusion of that will further increase the economy of reuse/recycle.

Following observations and comments can be made based on the information given in Table 7.

1) Increase in average production cost for B1 and B2 categories of industry is in the range of 4 – 6 %. This analysis shows that the cost of tertiary treatment of the trade effluent is not prohibitive and is technically feasible. Achieving zero liquid discharge by all categories of the pulp and paper industries thus implies only an increase in cost of the paper production by a few percent of the production cost for B1 and B2 category of industry and must be enforced to save the precious resources like river Ganga in particular and Ganga system in particular. The implementation of this may result in slight reduction in profit margin or alternatively the cost will be passed on to the consumers. Thus it is strongly recommended that the "polluter pays principle" must be strongly adhered to achieve zero discharge paradigm in case of the pulp and paper industries. This will immensely help saving the rivers, in particular the river Ganga, from adverse impacts without significant impact on the industry or economy or employment opportunities.

2) Increase in average production cost for A1 and A2 categories of industry to attain zero discharge paradigm is in the range of 17-19 %. This is on the higher side. However, in

the nations' larger interest zero discharge paradigm must be enforced to protect rivers like Ganga, and the Ganga system. At the same time these category of industry are important from several considerations including utilization of renewable agro based residues that will otherwise be burnt and create air pollution problems. Hence closure of these types of industry is not in the larger interest.

5. Justification for Tertiary Treatment and Implementing Zero Discharge Concept

Pulp and paper Industries, particularly the agro based, are one of the major contributors in polluting rivers Ramganga and Kali, and hence the river Ganga. Out of the total wastewater discharge into the river Ramganga from Uttarakhand and Uttar Pradesh, pulp and paper sector contributes about 146 MLD (90%) and 39 MLD (53%) respectively. It has also been estimated that out of the total wastewater discharge into the river Kali (East) system, contribution from 15 pulp and paper industries located in Uttar Pradesh is about 37 MLD. The experience of effluent treatment to specified standards has been highly unsatisfactory and the National River Ganga continues to get polluted.

Unlike the western countries, rain fall in India is highly uneven and occurs essentially during monsoon season which is spread over not more than 90 days. This results in very low flows during the lean period. The effluent discharge standards implemented so far are based on the premise that the back ground river water quality is very good and at least 10 times dilution is available. However, these conditions are not met in most of the Indian rivers including Ramganga and Kali in which treated/partially treated/untreated industrial and domestic effluents are discharged. As such it is essential that treatment up to tertiary level is made mandatory. Further, over exploitation of ground water has resulted in decrease in the base flow during lean period. If the current trend of ground water exploitation continues, it is likely that many rivers of the Ganga Basin may dry during the lean period. Thus it is essential that ground water abstraction is reduced through efficient water uses and recycling of industrial effluents. This is plausible through implementation of the concept of zero discharge. Also, it is relatively easy to monitor and implement the zero discharge paradigm compared to monitoring the quality of discharge from the industries by the regulating agencies. Thus in long term perspective in the larger interest of the nation and saving rivers from drying and getting polluted, it is essential to implement the zero discharge paradigm for industrial effluents in general, and pulp and paper industries in the Ganga Basin in particular.

6. Design, Build and Operate (DBO) Model for ETPs within the Industry

The past experiences reveal that most of the ETPs perform much bellow the expected level and most of the times effluent discharge norms are violated. Number of reasons, including lack of knowledge and expertise to manage the ETPs, has been cited by the

industry for poor performance. Also the regulating agencies, such as State Pollution Control Boards (SPCBs), have cited many reasons including lack of resources and man power for enforcing the regulations and taking actions for unabated pollution of rivers due to discharge of industrial effluents. In several instances, as shown in the case of pulp and paper industries, causes beyond technical and financial are responsible for unabated pollution of rivers.

Experience with other industrial sectors, particularly in water scarce areas, suggests that third party involvement and ETPs producing industrial grade water have been performing well. As such it is recommended that ETPs are planned on design, build and operate (DBO) model with the involvement of a company floated by the Association of Industries. This company will be responsible for managing the effluent recycling plants through service provider using DBO model and will receive funds in the beginning of the year from each of the industry towards supply of treated water of industrial grade produced from effluents discharged by the same industry. The ETPs will be in the premises of the industry. Land for the ETP is to be provided by the industry. The service provider will get the payment based on quantity of industrial grade water produced from the effluents on monthly basis. Renewing consent to operate the industry may be linked to deposition of funds in the accounts of the company floated by the Association of Industries by the member industries.

7. Action Plan for Zero Discharge Paradigm

S No	Action		Time Frame	Monitoring Mechanism
I.	**Process improvement and Water use Benchmarks**			
	Installation of the meters for water uses and effluent generated Flow measuring devices should be installed for input water as well as at the outlet of the treatment plant. These flow devices should be of properly calibrated V notch with arrangements for automatic measurement of head. Additional electronic or other type of flow meters may also be installed. Arrangements should be made for real time display of measured (both current and monthly cumulative) flows at prominent places		4 months	Checking of the installation of water meters for water withdrawal and effluent discharge points by SPCBs
	Achieving the Benchmark		6 months	Monthly check by SPCBs + Random check by CPCB Monthly check by SPCBs + Random check by CPCB Monthly check by SPCBs + Random check by CPCB + Water, Energy and Waste Audit by Third Party, every six months + Annual check by an Independent Monitoring Committee
	Short-term standards-Best Achieved			
	Category A1- Agro based writing-printing paper (Bleach Variety) mills	60m^3/T		
	Category A2: Agro–based Kraft paper mills	45 m^3/T		
	Category B1: Waste paper based writing-printing paper mills	30 m^3/T		
	Category-B2: Waste paper based Kraft paper mills	15 m^3/T		
	Benchmark standards		18 months	
	Category A1: Agro based writing-printing paper (Bleach Variety) mills	50 m^3/T		
	Category A2: Agro–based Kraft paper mills	30 m^3/T		
	Category B1: Waste paper based writing-printing paper mills	20 m^3/ T		
	Category B2: Waste paper based Kraft paper mills	10 m^3/ T		
II.	**Improved ETP with tertiary treatment** The Treated wastewater should be reused for industrial purpose. The suggested unit operations include: Screen (Coarse followed by medium/fine) -> Equalization tank -> Primary clarifier (plate/ tube settler) Biological treatment with coagulation – flocculation -> Micro-filter and/or Pressure Sand Filter (part wastewater be recycled) -> RO for partial or full stream as the case may be with recovery of solids from reject water by drying.		18 months	ETPs to be managed by the Company formed by Association of Industries. Consent to operate the industry is to be given only on advance payment to the company. DBO model is to be applied for ETPs. Service provider is to be paid on the basis of quantity of treated water produced from the effluents of each of the industries from the ETPs operated within the premises of the industry. **Limits on Fresh Water uses (fresh water to be used only as make-up water)**
III.	**CRP/ CCRP**		24 months	Design check by SPCB/CPCB After implementation: Monthly check by SPCBs + Random check by CPCB + Audit by an Independent Party

8. Highlights

- Pulp and Paper Industries, both agro and RCF based, are important for growth and development.
- Shifting towards zero liquid discharge paradigm is feasible and must be implemented to save rivers and help maintain “Nirmal and Aviral Dhara”.
- Improvements in technology and following best practices can lead to substantial reduction in water consumption and lower the cost of attaining zero discharge paradigm.
- Black liquor from agro based pulp and paper industries must be sent to CCRP for smaller units (< 100 TPD). Larger units may be allowed to have their own CRP.
- ETPs must be upgraded to tertiary level treatment. Some or all, depending on requirement, tertiary treated water may have to be treated using RO.
- The cost of treatment up to tertiary treatment including RO treatment may increase the production cost only by 4-6 % for RCF based industries and must be enforced.
- The cost of treatment up to tertiary treatment including RO treatment may increase the production cost by 17-19 % for agro based industries, but also must be enforced. However, some concessions may be offered to promote agro based industries.
- CETPs do not appear to be viable for Pulp and Paper Industries in the identified clusters in the Ganga River Basin. However, all ETPs are to be managed by a company formed by association of industries.
- Renewing consent for operating the industry may be linked to annual advance payment to the company for producing industry grade water by operating state-of-the-art ETP in each industry.
- DBO model may be applied for all ETPs. Service provider is to be selected by the company and paid on the basis of quantity of industry grade water produced from the effluents.
- Flow meters to be installed at the inlet and outlet of each ETP.
- Industries are allowed to take fresh water only to make up for the losses due to evaporation, minor leakages, etc.
- The suggested action plan is to be implemented within 24 months.

Assessment of Approaches for Eliminating use of Fresh Water in Tanneries at Jajmau, Kanpur

GRBMP: Ganga River Basin Management Plan

by

Indian Institutes of Technology

IIT Bombay | IIT Delhi | IIT Guwahati | IIT Kanpur | IIT Kharagpur | IIT Madras | IIT Roorkee

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 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 (GRBMP). 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 GRBMP. 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.

Dr Vinod Tare
Professor and Coordinator
Development of GRBMP
IIT Kanpur

The Team

1. A A Kazmi, IIT Roorkee *kazmifce@iitr.ernet.in*
2. A K Gupta, IIT Kharagpur *akgupta18@rediffmail.com,akgupta@iitkgp.ac.in*
3. A K Mittal, IIT Delhi *akmittal@civil.iitd.ernet.in*
4. A K Nema, IIT Delhi *aknema@gmail.com*
5. Ajay Kalmhad, IIT Guwahati *kajay@iitg.ernet.in*
6. Anirban Gupta, BESU Shibpur *guptaanirban@hotmail.com*
7. Arun Kumar, IIT Delhi *arunku@civil.iitd.ac.in*
8. G J Chakrapani, IIT Roorkkee *gjcurfes@iitr.ernet.in*
9. Gazala Habib, IIT Delhi *gazalahabib@gmail.com*
10. Himanshu Joshi, IIT Roorkee *himanshujoshi58@gmail.com*
11. Indu Mehrotra, IIT Roorkee *indumfce@iitr.ernet.in*
12. I M Mishra, IIT Roorkee *imishfch@iitr.ernet.in*
13. Ligy Philip, IIT Madras *ligy@iitm.ac.in*
14. M M Ghangrekar, IIT Kharagpur *ghangrekar@civil.iitkgp.ernet.in*
15. Mukesh Doble, IIT Bombay *mukeshd@iitm.ac.in*
16. P K Singh, IT BHU *dr_pksingh1@rediffmail.com*
17. Purnendu Bose, IIT Kanpur *pbose@iitk.ac.in*
18. R Ravi Krishna, IIT Madras *rrk@iitm.ac.in*
19. Rakesh Kumar, NEERI Nagpur *r_kumar@neeri.res.in*
20. S M Shivnagendra, IIT Madras *snagendra@iitm.ac.in*
21. Saumyen Guha, IIT Kanpur *sguha@iitk.ac.in*
22. Shyam R Asolekar, IIT Bombay *asolekar@iitb.ac.in*
23. Sudha Goel, IIT Kharagpur *sudhagoel@civil.iitkgp.ernet.in*
24. Suparna Mukherjee, IIT Bombay *mitras@iitb.ac.in*
25. T R Sreekrishanan, IIT Delhi *sree@dbeb.iitd.ac.in*
26. Vinod Tare, IIT Kanpur *vinod@iitk.ac.in*
27. Vivek Kumar, IIT Roorkee *vivekfpt@iitr.ernet.in*

Lead Persons

1. Vinod Tare, IIT Kanpur
2. Rajat Verma, IIT Kanpur

1. Introduction

National Ganga River Basin Authority (NRGBA) is an empowered planning, financing, monitoring and coordinating body formed on 20 Feb 2009 under the Environment Protection Act, 1986 for cleaning the river Ganga. A consortium of 7 Indian Institute of Technology has been engaged by the Government of India to prepare an action plan for "Un-polluted Flow" or "Nirmal Dhara" in all the rivers of Ganga River Basin (GRB). The main approach to achieve the ultimate objective of "Nirmal Dhara" has been to identify the type of polluting wastes, their sources of generation (point and non-point sources), and the techno-economic feasibility of collecting and treating them for their safe environmental discharge and/or possible recycle or reuse.

Among the point sources, industrial wastewaters are significant sources of pollution affecting the water quality in the Ganga basin and require expeditious remediation. The leather tanning industry though contributes sigrivernificantly to Indian exports, poses severe threat to the environment. Leather and leather goods manufacturing industries located in Jajmau, Kanpur and Unnao in Uttar Pradesh and Kolkata in West Bengal, are major contributors to pollution in Ganga River Basin (Figure 1.01).

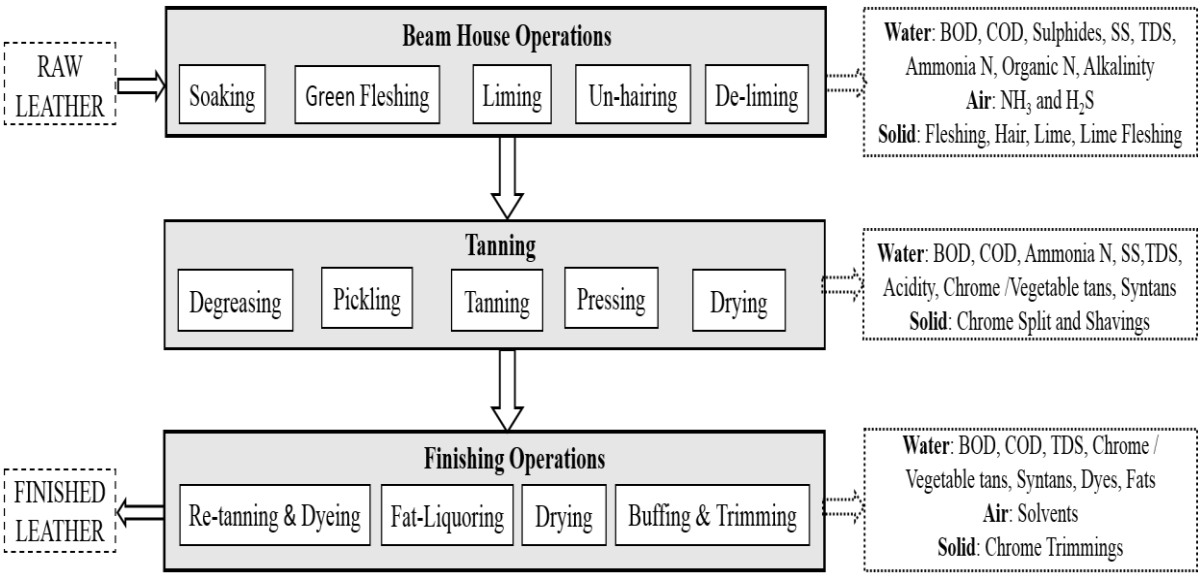


Figure 1.01: A typical process flow sheet in an integrated leather tanning industry with types of pollutants generated in leather processing

The current practise at Jajmau, Kanpur, of primary treatment of tannery effluent at individual units followed by secondary treatment at a central facility is insufficient primarily due to under-design of the central facility to handle the current potential discharge and poor operation and maintenance practices. Hence a major portion of tannery effluent flows untreated into the Ganga River. The industry being a repeated offender often faces the fear of heavy fines and closure notices. Hence the problem is three-fold, firstly it causes the rampant pollution of valuable surface

water sources, secondly it exerts a severe pressure on ground water resources, and third it limits the growth of the industry. The following steps are considered essential for solving the problem.

1) Complete stoppage of either treated or un-treated wastes into any rivers of GRB or at most extremely regulated discharge of concentrated salt streams when river flows are very large.
2) All tannery effluent should be segregated and collected into two categories, namely 'chrome stream' and 'composite stream'. The 'chrome stream' should be physico-chemically treated to precipitate chrome and to bring Total Chromium < 2 mg/L in the supernatant. The 'composite stream' should be first treated to secondary level with treated effluent standards of: Bio-chemical Oxygen Demand < 30 mg/L, Suspended Solids < 5mg/L, COD < 250 mg/L, Total Chromium < 2 mg/L.
3) This should be followed by tertiary treatment including Dual Media Filtration and Activated Carbon Filtration. The tertiary treated water should be passed through the multi-stage Reverse Osmosis plant to bring down Total Dissolved Solids and the permeate should be recycled and reused by the tannery industry for manufacturing of leather. The concentrate water may be stored in lined lagoons and discharged into rivers during the high flow monsoon periods or can be condensed using multi-effect evaporators.

The above measures are essential to overcome the declining state of industrial wastewater management and declining groundwater levels in GRB. Although much money and effort have been spent in Ganga Action Plan over the past few decades, the overall achievement has been limited. And, yet, the same approach has persisted over the years, leading to general disillusionment and cynicism.

But such despondency and cynicism can be easily overcome if wastewater is considered as "resource" rather than as "dirt" and the "Polluter Pays Principle" is rigidly adhered to. By adequately treating wastewater and re-using it instead of dumping the untreated or partially treated wastewater to sully the environment, industrial/urban wastewater treatment can achieve "Zero Liquid Discharge" (or ZLD) and recover the value of water as a "resource". However, costs and benefits of such strategies need to be delineated in quantitative terms to convey policy makers. It is to satisfy this end that the present study was initiated.

2. Background and Review of Literature

2.1. General

The genesis of this study has been the recommendations of the Environment Quality and Pollution (EQP) Group of the Consortium of 7 IITs preparing the Ganga River Basin Management Plan to have “un-polluted flow” in the rivers of the basin and addresses one of the aspects which is adoption of complete water recycling by water polluting industries in National River Ganga Basin (NRGB). Prior to recycling of water it is important to have an appropriate framework for complete treatment of industrial effluents and sewage so as to ensure that the treated water is fit for recycle and/or reuse. A complete treatment facility includes effluent collection and conveyance, effluent treatment and recycled water distribution system. It is also important to have appropriate ballpark estimates of expenditure on construction and operation and maintenance of these facilities.

2.2. Tanning Process

The process of converting raw hides and skins into finished leather by following a series of physical and chemical operations is called tanning of leather. The industries which house the facilities for carrying out these operations are referred as tanneries. A typical flowchart of the operations and the description of phases carried out in tanneries are presented in Fig. 2.01. The list of pollutants generated in the composite effluent of these processes, their concentrations assuming water consumption of 25 m3 per tonne of raw hide and their permissible limit of discharge in inland surface water bodies is presented in Table 2.1.

2.3. Treatment of Tannery Effluent

Conventional methods of tannery effluent treatment include physico-chemical primary treatment of tannery effluent followed by secondary treatment mostly by aerobic activated sludge process and in some instances by anaerobic processes. The tanneries are often located into clusters, and the primary treatment is often done in individual units called Primary Effluent Treatment Plants (PETPs) to decrease the pollutant load on secondary treatment facilities, followed by secondary treatment at Common Effluent Treatment Plant (CETP) facility motivated by the economies of scale.

The main objective of primary treatment of effluent is to reduce coarse material SS that could clog pumps, pipes, etc., significantly reduce BOD/COD load and reduce Cr before sending it to centralized or decentralized facility for further treatment. Conventional primary treatment facility includes i) coarse and fine screen for SS removal, ii) coagulation, flocculation and primary sedimentation facility for removal of colloidal SS, iii) chrome recovery unit to physico-chemically recover unspent chrome during the tanning process, and iv) sludge dewatering facility.

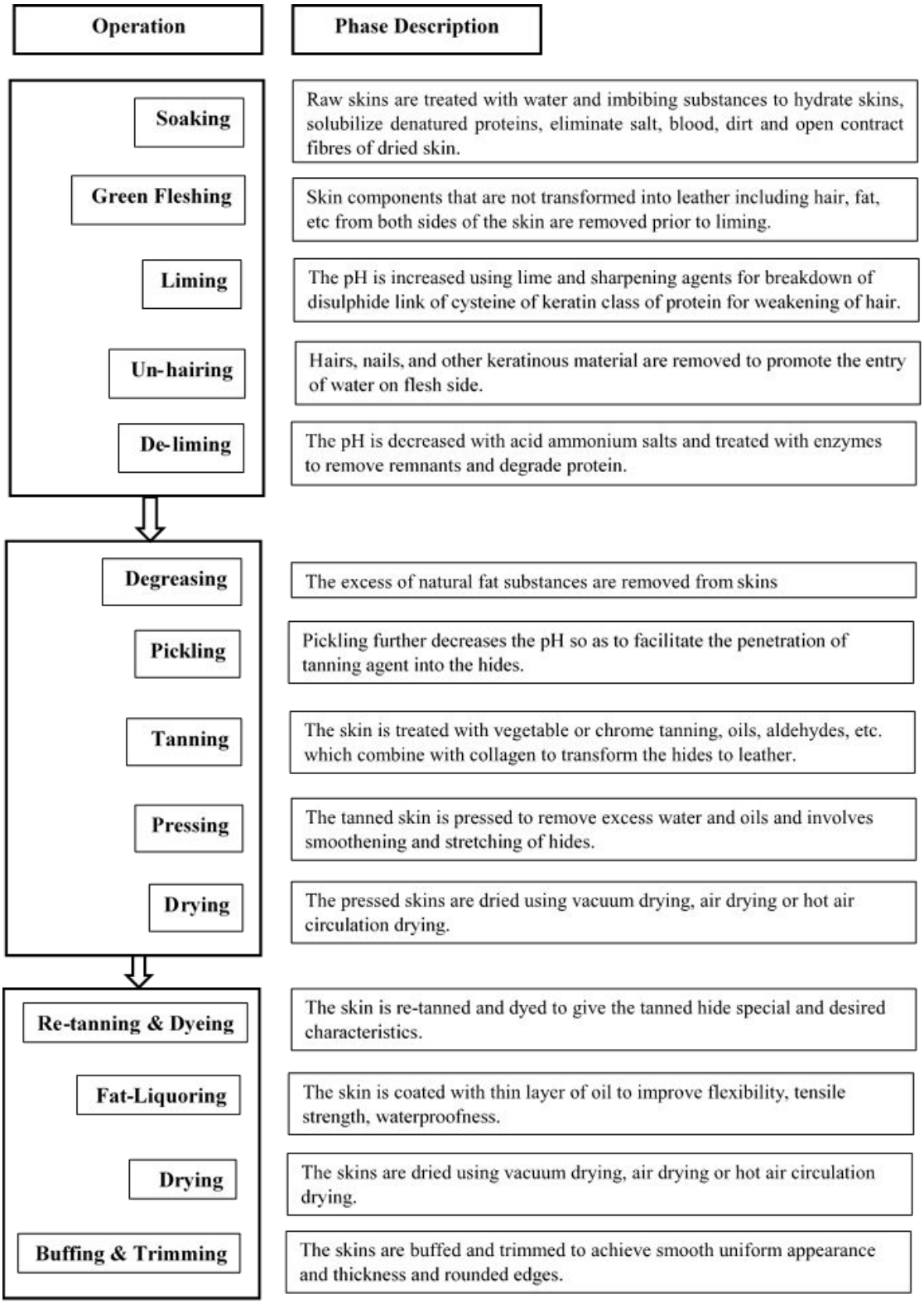


Figure 2.01: Flowchart of operations and brief description of various operations carried out in tanneries

Table 2.01: Typical average pollutant concentrations in combined raw tannery effluent based on conventional process using water 25 m^3 per tonne of raw hide (modified: UNIDO, 2011)

S. No.	Parameter	Unit	Average Total Pollutant Concentration	Typical Limits for Disposal in Surface Waters
1	BOD (3 Days at 27 ^{o}C)	mg O_2/L	3600	30-40
2	COD	mg O_2/L	7200	125-250
3	Suspended Solids (SS)	mg/L	3600	35-100
4	Cr^{+3}	mg Cr/L	270	1.5-2.0
5	Sulphide	mg S/L	290	1.0-2.0
6	Total Nitrogen (TKN)	mg N/L	290	100
7	Chloride	mg Cl/L	9000	Locally specific (India -1000)
8	Sulphate	mg SO_4/L	2500	Locally specific (India -1000)
9	Oil and Grease	mg/L	235	Locally specific India- 10
10	TDS	mg/L	18000	Locally specific (India- 2100)
11	pH		6-9	5.5-9.5

The PETPs have been reported to have varied efficiency in removal of pollutants: 30-37% (Song *et.al.*, 2004); 40-70% (Kabdasli *et al.*, 1999); >70% (Ates *et al.*, 1997); and >75% (Lofrano *et. al.*, 2006) of total Chemical Oxygen Demand (COD), 38-46% (Song *et.al.*, 2004) of Suspended Solids (SS); 74-99% of Chromium (Song *et.al.*, 2004). A report of United Nations Industrial Development Organisation (UNIDO, 2011) suggests 25-50% removal of incoming Biochemical Oxygen Demand (BOD), 50-70% of TSS and 65% of oil and grease. However in Jajmau, Kanpur often the performance of PETPs which are expected to significantly lower down grit and suspended solid load and recover chromium (Cr), is found to be poor. High concentrations (up to the order of 55 mg/L; Tare *et al.*, 2003) have been observed at the inlet of CETP. This large Cr loading in the CETPs leads to subsequent high concentrations in effluent and sludge. Subsequent use for irrigation leads to extensive Cr contamination and bio-accumulation in plants and soils (Adriano, 2001). The oxidized form Cr (VI) is class A carcinogen by inhalation, and Cr (III) has low acute and chronic toxicity (James *et.al.*, 1997).

The primary treatment is followed by secondary treatment at a centralized or decentralized facility. The main objective of secondary treatment is the removal of bio-degradable dissolved and colloidal organic matter using aerobic or anaerobic biological treatment processes. Secondary treatment is usually carried out by aerobic activated sludge process and in some instances by anaerobic processes. A conventional activated sludge plant consists of: i) equalization tank, ii) mixed liquor tank with aerators, iii) secondary clarifier, iv) sludge recirculation facility, and v) sludge dewatering facility.

Variable removal efficiency of 67% (Gisi *et al*., 2009) and 40% (Tammaro *et al*., 2014) of COD has been reported in activated sludge process pilot studies. However, many residual recalcitrant organics and micro-pollutants cannot be removed by conventional treatment method. In Jajmau, Kanpur, owing to the poor operation and maintenance practises, the plant operates at less than 70% treatment efficiency (Tare *et al.*, 2003).

No provision for removal of fixed dissolved solids (FDS) is made in the conventional primary and secondary treatment practices. Hence the practise of disposing the CETP effluent into surface water bodies or use in irrigation is violation of the discharge standards. The sustained use of high TDS water for irrigation purposes leads to salinity and decreased crop productivity. Moreover the tanning of leather uses large amounts of water (25-45 m^3/ton) and often the source of water is ground water. Thus the industry exerts huge pressure on declining groundwater resources. Thus there is a need to treat the water to remove TDS and re-use the water in tanneries, especially in areas with scarce drinking water resources.

An exhaustive tertiary treatment of secondary treated tannery wastewater followed by Reverse Osmosis (RO) treatment is imperative to render the treated wastewater fit for reuse in tanneries. The tertiary treatment is necessary to prevent the fouling of membranes. About 93-98% TDS, 92-99% sodium, and 91-96% chloride and ammonia removal efficiency with 70-85% recovery of water as RO permeate (Ranganathan *et al.*, 2011) have been reported. Another study (Bhattacharya *et al,* 2013) has shown 99% reduction of TOC and almost complete removal of metals like lead, copper, zinc and nickel, etc. Improvement in tensile strength by 19%, increased elongation by 6.2% and increased dye uptake (Bhattacharya *et al,* 2013) has been observed in leather prepared from treated effluent in comparison to that prepared from freshwater.

The next challenge which arises is the management or disposal of RO concentrate. The concentrate which has high levels of COD and TDS is not fit for discharge as per the current discharge standards. The conventional method uses multi-effect evaporators (MEE) for concentration followed by crystallization. However, the process is highly energy intensive, incurs high operational costs, and faces difficulties mainly due to corrosion, crystallization of salts, scaling of heat exchanger (UNIDO, 1998).The salt obtained after crystallization is a mixture of salts, rather than one salt, thus has low economic value, usually Indian National Rupee (INR) 4 per kg. Thus there is an urgent need to devise a cost effective environment friendly method for management of RO concentrate.

Another possibility of concentrate disposal in inland water bodies with relaxed discharge norms during the high flow monsoon season can be explored. The concentrate can be stored in lined lagoons and can be safely discharged with minimal effects on background concentration in the high discharge periods of the river. This method, other than having the distinct advantages of cost effectiveness and minimal damage to environment in comparison to other alternates, also helps in completing the salt cycle by assigning the river its natural function of transporting salts to the sea during monsoon season.

Another solution of effective management of waste is to create a central facility for carrying out the most polluting operations of tanning. The tanners can get partial processing of hides done from the central facility and carry out further operations in their individual units. This will provide an opportunity for good housekeeping by effective collection and handling of solid wastes like hooves, hairs, tails, etc. and will also provide an opportunity for industrial symbiosis by sharing of useful by-products.

A further challenge is the estimation of complete expenditure on these facilities and subsequent estimation on tariffs of recycled water. The Public-Private Partnership model can be explored for operating the facility. The tariffs could be determined for per KL of recycled water. The costs of: i) effluent collection and conveyance, ii) effluent treatment, and iii) distribution of recycled water can be considered for determining the tariff. Following points may be considered for cost estimates:

a) Capital expenditure (Capex) to include the cost of inventory and its installation cost, material supply, engineering design and supervision charge, interest on loan, and
b) Operation and maintenance expenditure (Opex), after the project is started, to consider the expenditure on manpower, chemicals, transport and repair work.

The tariffs will also be required for pricing of valuable fresh water resources, mainly ground water, so as to incentivise the use of recycled water and limit the rampant and unsustainable use of precious groundwater for economic gains.

3. Objective and Scope

Ganga River Basin is one of the most densely populated regions of India and due to adequacy of vast water resources and manpower it houses a large number of industries. A major industry among these which accounts for a 2.47 per cent share (average, 2001-12) of total Indian exports is leather tanning industry. However, the state of effluent management infrastructure remains extremely poor. Even though stringent Central Pollution Control Board (CPCB) discharge norms of environmental pollutants have been notified, they alone fail to ensure the effluent is treated to desired levels before being discharged into rivers.

A large number of tanneries are centered in Jajmau, Kanpur. A Common Effluent Treatment Plant (CETP) was setup in 1994 under the first phase of Ganga Action Plan with bilateral co-operation of Government of India and Netherland Government. 334 units are members of the CETP. The plant however is under designed for current effluent generation capacities of the member units and thus large volumes of untreated effluent gets bypassed to Ganga River. Often the Primary Effluent Treatment Plants (PETPs) at individual units are not working properly resulting in high Cr and Suspended Solids concentration. These units are heavily fined and often closed by courts which hampers the growth of industry and economy. The CETP mixes tannery effluent with domestic sewage in ratio of 1:3 to 1:1.5 and treats the blend by anaerobic Up-flow Sludge Blanket method. The plant though operational, is poorly operated and maintained, and operates on less than 70%

treatment efficiency. The treated effluent is used for irrigation and disposed in Ganga River. No provision for removal of Dissolved Solids (inorganic) below the discharge standards of 2100 mg/L are made. Along with pollution of surface water sources, the industries put huge pressure on the declining ground water resources. Thus it is very vital that an appropriate techno-commercial frame work is developed for sustainable effluent management as well as the growth of these industries.

Tannery effluent management requires proper infrastructure, but remains mainly plagued due to indifference of the tanners to the treatment efficiency of the CETP. A major reason behind this is no immediate direct effect of the poor effluent treatment on the tanners and availability of under-priced raw ground water resource. Hence a policy change along with proper infrastructure for effluent treatment is the need of the hour. Moreover the sharing of operation and maintenance costs by the tanners and the state government has been another hurdle for the efficient operation of the CETP. The plant is in poor economic state due to irregular/ non-payment of O & M costs by the units and state government. Thus a Public-Private Partnership (PPP) model for managing the facilities may serve as a viable option. Provisioning of effluent treatment systems and rational pricing of natural resources is necessary so that the cost of abatement is truly borne by the polluters. This necessity has been the genesis of the present study. Because of all above mentioned reasons Consortium of 7 IITs preparing Ganga River Basin Management Plan (GRBMP) is considering complete and efficient collection of tannery effluent and treatment of waste so that most of the waste could be recycled and/ or reused as we approach towards the goal of “Minimum or Zero Discharge” instead of disposal in open lands and/or water bodies.

This study is a part of the larger framework of achieving “Unpolluted Flow” in Ganga River and aims at evolving the financial plan for provisioning of industrial effluent treatment system. Following specific objectives are set for this study to achieve this goal.

1. Develop suitable methodology for efficient and complete effluent collection and treatment promoting waste reuse/recycle and distribution of recycled water.
2. Obtain ballpark estimates of capital investments and annualized expenditure towards Capex and Opex for collection and treatment of effluent and distribution of recycled water.
3. Obtain tariff rates for recycled water under different options of financing the capital expenditure.
4. Obtain ballpark estimates of land and energy footprint of these collection, treatment and distribution facilities.
5. Approach towards the goal of “Minimum Discharge” and encouraging the use of recycled water.

The scope of this study is restricted to availability of information in i) DPRs for proposed up-gradation of CETP facilities at Jajmau, ii) thesis report on design and cost estimation of sewerage network and pumping for urban centres, iii) secondary data and reports on design and cost estimation of effluent treatment facilities, and iv) secondary data for land and energy footprint of effluent treatment facilities.

4. Methodology

4.1. General

The production of tanned leather can be broadly classified into following set of operations i) Beam-house operations: soaking, fleshing, liming, un-hairing and de-liming; ii) Tanning operations: pickling and tanning; and iii) Finishing and other operations: re-tanning, dyeing fat liquoring, drying, buffing and trimming. A typical buffalo hide weighs 25 kg and has an average area of 37.5 square feet and uses a total of 25 litres per kg of hide processed. The nature of the effluent for the three operations with respective percentage share of water (Italprogetti Engineering, 2014) is shown in Table 4.01.

Table 4.01: Typical Share of Water in Various Tanning Operations with Effluent Characteristics

Name of Operation	Water Share, Percent	Effluent Quality	
		TDS, mg/l	COD, mg/l
Beam-house operations	40	25667	10000
Tanning operation	4	150000	10000
Finishing and other operations	56	4286	2143
Total	100	18667	5600

An efficient treatment of tannery effluent up to tertiary treatment may reduce all other environmental pollutants except Total Dissolved Solids (TDS) below the CPCB discharge standards. The current practise of using this water for irrigation will would lead to soil salinity. Hence in order to control TDS levels use of Reverse Osmosis (RO) treatment and subsequent reuse of RO permeate as recycled water for industrial use is suggested in this study. The loss of water as RO concentrate is made up by purchasing treated domestic wastewater (DWW) of similar grade from Kanpur Nagar Nigam at the same tariff rates as that of recycled water. Since the cost of treating the DWW will be much lower than the tariff, the excess amount will help in cross subsidizing the treatment of city's domestic waste. The government in return can co-operate by providing loans and land for the construction of such CETPs.

Tannery effluent treatment infrastructure includes: i) effluent conveyance network, ii) effluent pumping, iii) effluent treatment plants, iv) reverse osmosis concentrate treatment or disposal, and v) distribution of recyclable water. A schematic flow sheet for treatment of tannery effluent is shown in Figure 4.01. The effluent treatment plants are proposed to be built in modules of recycled water generation capacity of 16 MLD. For this study the cost estimations of 32 MLD and 64 MLD facilities has been considered. Estimation of capital (Capex) and operation and maintenance (Opex) costs for the five components has been worked out for Jajmau tannery cluster in the Ganga River Basin (GRB) using the following two approaches:

a) Effluent treatment without Common Beam-House Facility

b) Effluent treatment with Common Beam-House Facility

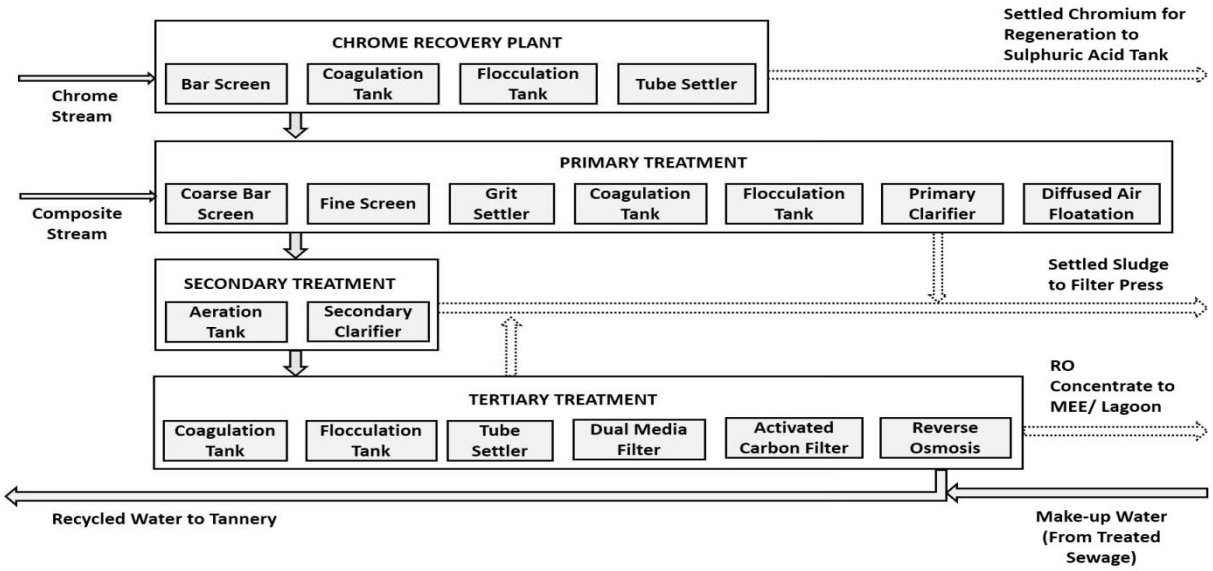


Figure 4.01: Schematic Flow Sheet for Treatment Facility of Tannery Effluent

4.2. Effluent treatment without Common Beam-House Facility

This approach assumes that all the operations are carried out in individual tanneries. Hence, two separate effluent conveyance lines, one for tanning operations and the other for effluents of all other operations. The share of water for tanning is assumed at 6.25 percent, a conservative estimate, for cost estimation purposes. Chrome stream has been separated so as to recover chrome by physico-chemical treatment in Common Chrome Recovery Plant (CCRP) and reused for tanning process. The supernatant of the CCRP will be treated in common effluent treatment plant (CETP).

4.2.1. Estimation of Capex and Opex of Effluent Conveyance Network

This involves estimation of length of conveyance pipes of different diameter and cost of laying unit length including the supply of materials, barricading the area, timbering in trenches, excavation of earth, laying, jointing of conveyance lines, surface relaying, cost of manholes, labours, dewatering etc.

An earlier study (Shukla, 2013) using data of 45 different urban locations where sewer networks have been laid or designed was gathered from various local bodies and consulting firms. This data included population, area covered, lengths of various diameter pipes, bill of quantities (BOQs), cost estimates and total cost of the project. The BOQs and cost estimates had all the details which are required for the estimation of sewerage network costs.

The unit cost (average per meter length of sewer laid including all items in BOQs) is taken as the total cost of the sewerage network project divided by the total sewer length (all diameter

sewers). This cost comes around ₹ 4,000 to 5,500 per meter of the sewer length. In general this unit cost could be considered for green field projects i.e. for newly developed areas or colonies where there are no obstructions (rail lines, roads, buildings, other infrastructure networks such as water supply lines, cable networks, etc., encroachments and/or monuments of historical or religious importance, etc.). This unit cost increases to ₹ 6,000 -10,000 when some miscellaneous items like crossing of railway lines, crossing through drains etc., some extra sewer lines due to uncertainties in estimation of total sewer lengths, adoption of trenchless technology for some area, dismantling of roads, relaying of roads, etc.

However, considering low to moderate level of hindrances average unit costs is considered to be ₹ 6000 per m length of trunk sewers on a gradient of 1 in 80 metres for both composite and chrome stream for estimating the expenditure on tannery effluent sewerage network. The diameter for rising mains of the composite and chrome stream is calculated using the Manning's equation as 2000 mm and 700 mm respectively. The unit cost of laying the pipes is ₹ 12,000 per m length and 4000 per m length on an almost flat gradient of 1 in 1000 meters respectively.

Operation and maintenance (Opex) costs are estimated based on thumb rules and taken as 1.5% of Capex as per the survey conducted by Water and Sanitation Program, (WSP Flagship Report, 2011) The cost of effluent collection and conveyance network 19.2 MLD and 32 MLD CETP facilities has been estimated for 38.4 MLD and 64 MLD CETP facilities respectively. The reason behind this is that in case of further increase number of modules in the future, no fresh cost of laying a new conveyance network is incurred.

Another approach of conveyance of chrome waste water using tankers has also been used for estimating the Capex and Opex. However the option was rejected owing to higher cost.

4.2.2. Estimation of Capex and Opex for Effluent Pumping

Effluent pumping involves pumps, pumping stations and some miscellaneous material supplies such as valves, inlet and outlet pipes, pipe fittings, etc. Pump capacity is estimated based on (i) total daily effluent flow, (ii) average 12 hours pumping in a day, (iii) pumping head assuming 1 in 80 slope of the trunk sewer and 1 in 1000 slope of rising mains and the length of the trunk sewer and rising mains as 20.62 km and 2.3 km respectively as per the Detailed Project Report (Revised Draft) for Proposed Up-gradation of CETP Facilities (IL&FS Limited, 2011) for Tannery Cluster at Jajmau, Kanpur. Power of pump is calculated assuming 12 hours of operation of pumping stations. Costs of the pumps is estimated based on market survey and information provided by practicing engineers as ₹ 25,000/KW. Cost of miscellaneous material supplies such as valves, inlet and outlet pipes, pipe fittings, etc. generally varies in the range 1-2 % of the pump cost. To have conservative estimates, a value of 2 % is assumed in this study. Estimated cost of pumping stations is assumed as 10 % of the cost of pumps based on thumb rule generally used by practicing engineers and consulting firms.

Opex cost of effluent pumping is computed based on energy consumption for running the pumps for twelve hours on a daily basis considering prevailing average electricity tariff (₹

6 per KW-h or a unit of electricity consumed). In addition, 10 % of energy bill for running the pumps is considered as other miscellaneous Opex for effluent pumping based on thumb rule generally used by practicing engineers and consulting firms.

4.2.3. Estimation of Capex and Opex of Effluent Treatment Plants

The two segregated streams bring the chrome effluent and composite effluent form individual tannery units to the common effluent treatment plant. The chrome stream is physico-chemically precipitated to recover chrome, which has a high commercial value and can be reused for tanning purposes. The common chrome recovery plant (CCRP) effluent after recovering chrome can be mixed with composite stream for further treatment. For cost estimation bar screen, coagulation flocculation followed by sedimentation in tube settler and recovery by dissolving the precipitate in coated civil tanks with H_2SO_4 to obtain $CrSO_4$ is considered for chrome recovery process. The Opex has been estimated using the energy, manpower and chemical demands for the operation of the treatment plant. The inventory required for treatment per MLD of chrome stream at CCRP is listed in Table 4.02.

Table 4.02: Details of Inventory Considered for Treatment per MLD of Chrome Stream

S No	Inventory	Specifications	Quantity
01	Bar Screen	6mm	1
02	Sewage Pump	14 litre per second, 15 m head	2
03	Equalisation Tank	500 m^3	1
04	Dosing tank	1 cu. m. with agitator	2
05	Dosing Pump	10-26 litre per hour	2
06	Flash Mixer	4.5 cu. m., MS made FRP lined	1
07	Flocculation Tank	20 m^3, MS made FRP lined	1
08	Tube Settler Tank	50 m^3	1
09	Filter Press	32'x32', 51 plates	1
10	Coated Civil Tanks	4 m^3	3
11	Sludge pump	1.7 litre per second, 50 m head	2

Estimation of cost of effluent treatment has been done considering that the common effluent treatment plants will use effluent as source of water and produce industry grade water that would be suitable for reuse in tannery industry for production of leather. Typically the treatment will be done in four stages, namely primary, secondary, tertiary followed by membrane treatment/ reverse osmosis (RO) treatment of the tertiary treated water. Since a fraction of water will be rejected as the RO concentrate, for cost estimation purposes the costs for these four stages are over estimated for higher capacities such that the goal of recycling of 100 % water is achieved.

For cost estimations coarse bar screen, grit settlers, drum screen, Konica fine screen, primary clarifier followed by coagulation-flocculation and diffused air floatation (DAF) is considered

in the primary treatment. For low density wastes an oil skimmer is also considered for cost estimation purposes. The inventory required for primary treatment per MLD of composite stream is listed in Table 4.03.

Table 4.03: Details of Inventory Considered for Primary Treatment per MLD of Composite Stream

S No	Inventory	Specifications	Quantity
01	Bar screens	20mm, 10mm and 6mm	1 each
02	Drum screen	4 mm	1
03	Konica fine screen	1.5 mm	1
04	Submersible pump for Konica fine screen	100 m^3 per hour, 10 m head, $D_s < 10$ mm	1 1
05	Grit settler(with sluice gates)	14 m^3	1
06	Equalisation tank with venturi-pump	500 m^3, 1400 rpm	1
07	Dosing tank	2000 litre with agitator	6
08	Dosing pump	10-26 litre per hour	6
09	Coagulation tank (with agitator)	4.5 m^3	2
10	Flocculation tank (with agitator)	9 m^3	1
11	Primary clarifier with scrapper	100 m^3	1
12	DAF with oil skimmer	40 m^3	1
13	Sewage pump	14 litre per second, 15 m head	2
14	Sludge pump	1.7 litre per second, 50 m head	1
15	Filter press	32'x32', 31 plates	1

Moving bed bio-film reactor (MBBR) is considered at the secondary level. Filter press is adopted for sludge dewatering purposes in both primary and secondary treatment. The inventory required for secondary treatment per MLD of composite stream is listed in Table 4.04.

Table 4.04: Details of Inventory Considered for Secondary Treatment per MLD of Composite Stream

S No	Inventory	Specifications	Quantity
01	MBBR aeration tank	520 cu. m.	1
02	Root blowers	1120 cu. m. per hour, 50 HP	2
03	Air diffusers	63 mm diameter bubble air diffuser, 1000 mm long	139
04	MBBR media	BF-22, Float type	45
05	Secondary clarifier with	100 m^3	1

06	Sewage pump	14 litre per second, 15 m head	2
07	Sludge pump	1.7 litre per second, 50 m head	1
08	Filter press	36'x36', 51 plates	1

At the tertiary level, coagulation-flocculation followed by sedimentation in tube settler, and filtration through dual media filter (DMF) and activated carbon filter (ACF) followed by multi-stage Reverse Osmosis (RO) is considered for cost estimation purposes. The inventory required for secondary treatment per MLD composite stream is listed in Table 4.05.

Table 4.05: Details of Inventory Required for Tertiary Treatment per MLD of Composite Stream

S No	Inventory	Specifications	Quantit
01	Flocculation tank with agitators	9 m^3	1
02	Tube settler	45 m^3	1
03	Dual media filter	MS made FRP lined, 50 m^3 per hour	1
04	Activated carbon filter	MS made FRP lined, 50 m^3 per hour	1
05	Storage tank	250 m^3	2
06	Sewage pumps	14 litre per second, 15 m head	2
07	Dosing tanks		4
08	Multi-stage pump	14 litre per second, 30 m head	1
09	Reverse osmosis plant	80 % recovery, TDS 13000 ppm	1

Much of the information used for cost estimation is adopted from the report prepared by Tirubala Tri Environment Pvt. Ltd. submitted to IIT Kanpur (Tannery Zero Liquid Discharge Report, 2014). An additional amount of 40 % of the cost of the inventory has been considered as installation costs for calculation of the capital expenditure. The cost of civil work wherever required is calculated at the rate of ₹ 8000 per m^3. The Opex has been estimated using the energy, manpower and chemical demands for the operation of the treatment plant.

4.2.4. Estimation of Capex and Opex of Treatment/Disposal of Reverse Osmosis Concentrate

Estimation of cost of treatment/ disposal of RO concentrate has been done using two approaches, outlined as follows by which unit costs could be worked out.

Approach I: The concentrate of reverse osmosis is further concentrated using multi-effect evaporators (MEE) and the salt will be reused in the tannery industry or for other commercial purposes. The information for cost estimation is adopted from the report prepared by Tirubala Tri Environment Pvt. Ltd. (Tannery Zero Liquid Discharge Report, 2014).

Approach II: The concentrate of reverse osmosis is stored in geo-membrane lined lagoons during the lean flow periods and can be safely discharged into river Ganga during high flow monsoon periods. A study to assess the assimilation and transport capacity of river using daily discharge and monthly concentration data over a period of 30 years from 1980 to 2010 is used. Ninety per cent dependable flows are calculated and change in TDS, BOD and Total Chromium levels is computed by simulating the concentrate discharge during the monsoon period. The discharge period is considered to starts on 15 July and ends on 15 October. A provision for storage for extra 30 days has also been provided. Loss due to evaporation at the rate of 186 cm per year by Central Water Commission (CWC, 2006) from a suitably assumed average top width of 9 meter of the water surface for the trapezoidal section described later has also been incorporated. The costs of earthwork, concreting and lining of lagoon, conveyance from CETP to lagoon and lagoon to river, and cost of pumps is considered for the Capex. The lagoon is assumed to be of trapezoidal section with a bed width of 4 metre, side slope of 1 H: 1 V, depth of 4 metre and free board of 0.5 metre. Cost of an additional concrete cover of 0.3 metre thickness and geo-membrane lining for rendering the lagoon seepage free is also considered. The rates of the following have been worked out using a Detailed Project Report of Vadodara Solid Waste Management (SENES Consultants India (P). Ltd., 2007): i) earth work is assumed to be ₹ 150 per m^3, ii) rate of concreting at ₹ 4000 per cubic meter, and iii) rate of HDPE and geo-membrane lining at ₹ 500 per square meter. The cost of conveyance from CETP to lagoons and lagoon to river is considered to be ₹ 6000 per m length and the respective lengths to be 200 m and 500 m respectively. The cost estimation of pump has been done as stated in Section 4.2.2.

Opex cost of concentrate pumping during the monsoon period is computed based on energy consumption for running the pumps for twelve hours on a daily basis considering prevailing average electricity tariff (₹ 6 per KW-h or a unit of electricity consumed). In addition, 10 % of energy bill for running the pumps is considered as other miscellaneous Opex for effluent pumping based on thumb rule generally used by practicing engineers and consulting firms.

4.2.5. Estimation of Capex and Opex of Distribution of Recycled Water

Estimation of cost of distribution of recyclable water has been done considering that the water treated for reuse in leather industry will be distributed back at a uniform rate for 12 hours on a daily basis. The total area is divided into five zones such that the length of distribution mains and the discharge for each zone is equal for each zone. The total length of the distribution pipes in the five zones is worked out to be 21 km similar to effluent conveyance network.

Capex cost of the distribution system included the cost of construction of the overhead tank, cost of pumping of the recycled water to the overhead tank and cost of the pipe distribution system. The head of the overhead tank is calculated using i) a slope of 1 in 1200 metres for distribution mains, ii) a residual head of 5 metres at the terminal end of the distribution mains, and iii) calculation of head loss in the distribution mains by calculating friction slope

using modified Hazen William's formula. The diameter of the pipe was chosen such that the total annualised cost of the distribution system was minimised. The cost of the distribution system was then calculated by using data for cost of per unit length of the pipe of the specified diameter. The capital cost of the pumps is estimated similar to the Capex of pumping stations for effluent pumping. The capital cost of overhead tank was calculated using Capex of ₹ 20 per litre after consulting engineers and studying DPR's of related projects.

Opex cost of recyclable water pumping is estimated based on energy consumption for running the pumps considering prevailing average electricity tariff (₹ 6 per KW-h or a unit of electricity consumed). In addition, 10 % of energy bill for running the pumps is considered as other miscellaneous Opex for effluent pumping based on thumb rule generally used by practicing engineers and consulting firms.

4.3. Effluent treatment with Common Beam-House Facility

This approach uses a common beam-house facility (CBHF) for the purpose of carrying out beam-house operations and a tariff will be charged that will be inclusive of the treatment of wastewater generated as well as the cost of carrying out the operations. The CBHF will have its own effluent treatment facility which will be designed for 40 percent of total wastewater generated in the complete tanning process. Thus 32 MLD and 64 MLD CETP facilities will be replaced by combination of 12.8 MLD CBHF & 19.2 CETP facility and 25.6 MLD CBHF & 38.4 MLD CETP facility respectively. For cost estimation purposes an additional amount to compensate for the loss as RO concentrate is also considered. A large amount of organic solid waste is generated in the beam house operations and the effluent generated also has higher levels of chemical oxygen demand (COD) and total dissolved solids. Separating the beam house operations provides an opportunity for good housekeeping, reuse of solid wastes of commercial value and better handling of the high TDS and high COD effluent.

De-limed hides at the end of beam-house operations will be used by industries to carry-out other operations. Two separate effluent conveyance lines i) chrome stream (6.25 percent of the total wastewater) and ii) all other streams (53.75 percent of the total waste water) will carry the effluent from the tanneries to the CETP. The CETP will be designed for handling 60 percent of the total effluent generated. For cost estimation purposes an additional amount to compensate for the loss as RO concentrate is also considered.

Estimation of cost of operations has been done considering that soaking, green fleshing, liming, un-hairing and de-liming operations will be carried out at CBHF. The Capex included the cost of the wooden drums for liming and de-liming, dry salt-shaker, fleshing machines, hair filters, and factory shed for the facility centre and miscellaneous electrical and other expenses. The Opex is estimated based on consumption of electricity and chemicals, and the manpower required in the beam-house operations. The inventory required for common beam- house operations per 30 ton of raw hide is listed in Table 4.06.

Table 4.06: Details of Inventory Required for Common Beam-House Operations per 30 Ton of Raw Hide

Sl. No.	Inventory	Specifications	Quantity
01	Dry hide shaker		1
02	Fleshing Machine	150 hides per hour	2
03	Soaking Drums	200 hides	3
04	Liming De-liming Drums	200 hides	7
05	Hair Filters		7
06	Factory Shed	1800 sq. m.	1

All the Capex and Opex for the effluent treatment of CBHF, except reverse osmosis, has been done similar to cost estimation in Section 4.2. The Capex and Opex of the reverse osmosis process have been estimated using sea water membranes and high pressure pumps respectively for the purpose.

4.4. Estimation of Tariff of Recycled Water

A large capital and operation expenditure is incurred in the construction and operation of these effluent treatment facilities. Hence various financing options using a public private partnership model are considered.

The equity is assumed to be 30 % of the Capex, and the rest of the Capex is obtained in the form of debts at: i) Interest rate of 3 %, Duration of 20 years, Moratorium period of 5 years; ii) Interest rate of 13 %, Duration of 12 years, Moratorium period of 1 year. The following assumptions have been made for calculation of tariffs at an internal rate of return of 18 %: i) Plant utilization factor as 90 %, ii) Default rate as 10 %, iii) Depreciation rate is 13.90 %, iv) Residual Value as 10 %, v) Tax rate as 30 %, vi) Price escalation of tariff rates and Opex as 5 %, vii) Debt service reserve account (DSRA) as 50 % of average principal payment, and viii) Interest on DSRA as 1.5 % . The construction of the project is assumed to be completed in one year.

Also a policy change of pricing the freshwater for industrial use at 1.5 times the tariff will incentivise the use of recycled water. The current tariff of freshwater is excessively under-priced at ₹ 2 per KL.

The tariffs for 32 MLD, 64 MLD, 19.2 MLD and 38.4 MLD CETP facilities were estimated as ₹ per KL of recycled water. However the tariff for CBHF for 12.8 MLD and 25.6 MLD CBHF facilities were estimated as ₹ per sq. m. and ₹ per sq. ft. for hides as well as ₹ per KL of recycled water.

4.5. Estimation of Land and Energy Foot Print

Estimation of land footprint has been done considering areal requirements for pumping station, primary treatment, secondary treatment, tertiary treatment, CBHF operations, management of RO reject and distribution of treated effluent. In addition, 100 % of the primary, secondary and tertiary treatment is considered for the construction of offices, control rooms, etc.

Estimation of energy footprint has been done considering the energy requirements for pumping station, primary treatment, secondary treatment, tertiary treatment, CBHF operations, management of RO reject and distribution of treated effluent.

Much of the information used for land and energy footprint estimation is adopted from the report prepared by Tirubala Tri Environment Pvt. Ltd. submitted to IIT Kanpur (Tannery Zero Liquid Discharge Report, 2014).

5. Results and Discussion

5.1. General

An appropriate frame work is a prerequisite to provide solutions for effluent generated in leather tanning industries. The treatment of effluent up to secondary level alone and subsequent use for irrigation and disposal in Ganga River may appear to be a low cost solution, but the secondary treatment does not ensure removal of dissolved solids and total chromium up to CPCB standards and thus can have detrimental effects on crops and aquatic life. So having a plan for complete treatment and reuse with near zero discharge policy is the need of the hour. It ensures a complete treatment up to a tertiary level by interlinking the interests of the polluter and end user of treated effluent, as well as reduces the pressure on scarce ground water resources.

The first and foremost step towards this is to have an assessment of the management plan in economic sense. The present study aims at estimating the expenditure on treatment of tannery effluent with provision of segregation and conveyance of different type of effluents, their treatment, and distribution of treated effluent for reuse and management of the reverse osmosis concentrate. The practical feasibility of the management of the concentrate by discharging in high flow periods of the river has also been explored. Since the establishment of treatment facilities incurs huge capital and operational investments, a Public Private Partnership model to run the facility is proposed. Different options of financing through loans at varied interests, moratorium period and loan period, and equity to estimate tariffs are also explored as a part of this study. The model also proposes a way of cross subsidizing the treatment of city sewage in lieu of the support provided by the local body to the tannery cluster in terms of land acquisition and other administrative support. Energy consumption and land footprint are also important along with the expenditure incurred, and hence are separately estimated.

5.2. Effluent Management

Effluent management includes i) Effluent Collection and Conveyance, ii) Effluent Treatment and Concentrate Treatment/ Disposal, iii) Common Beam-House Facility, iv) Make-up Water Treatment and Concentrate Treatment/ Disposal, and v) Distribution of Treated Wastewater (Tannery Effluent and Sewage for recycling in Tanneries). An attempt has been made to arrive at

ballpark estimates of total annualized costs with percentage share of Capex and Opex for all these components. Sections 5.2 to 5.5 describe and discuss the outcome of such an attempt based on approach and methods described in Chapter 4. All the costs in these sections are obtained by adding the annualized Capex (at 12 % interest rate for 20 years) and Opex for each process.

5.2.1. Effluent Collection and Conveyance

Cost estimations for effluent collection requires costs of conveyance lines of separate chrome and composite stream, cost of pumps and pumping, and cost of maintenance of the conveyance lines and pumping station.

The costs of conveyance of chrome stream for 32 or 19.2 MLD and 64 or 38.4 MLD CETP Facilities are ₹ 28.69 per KL and ₹ 15.13 per KL respectively. A typical pattern of distribution of expenditure on chrome stream collection and conveyance adopting the methodology in Section 4.2.1 and 4.2.2 is presented in Figure 5.01 to 5.02.

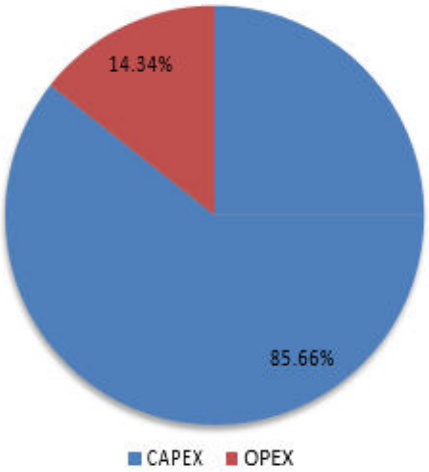


Figure 5.01: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Chrome Stream Collection and Conveyance of 32 or 19.2 MLD CETP Facility

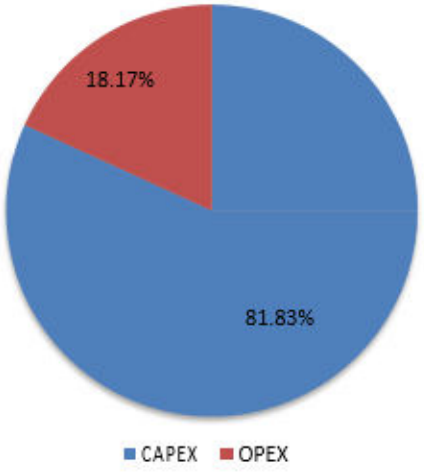


Figure 5.02: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Chrome Stream Collection and Conveyance of 64 or 38.4 MLD CETP Facility

The costs of conveyance of composite stream for 32 MLD and 64 MLD CETP Facilities are ₹ 3.62 per KL and ₹ 2.59 per KL respectively. The costs of conveyance of composite stream for 19.2 MLD and 38.4 MLD CETP Facilities with CBHF are ₹ 3.90 per KL and ₹ 2.34 per KL respectively. A typical pattern of distribution of expenditure on composite stream collection and conveyance adopting the methodology in Section 4.2.1 and 4.2.2 is presented in Figure 5.03 to 5.06.

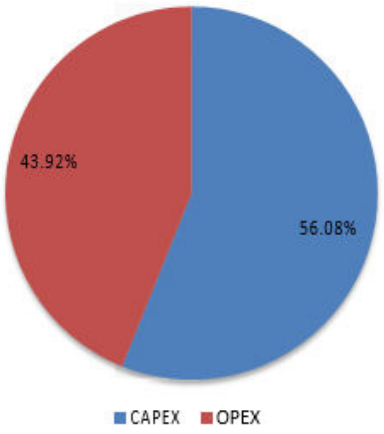


Figure 5.03: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Composite Stream Collection and Conveyance of 32 MLD CETP Facility

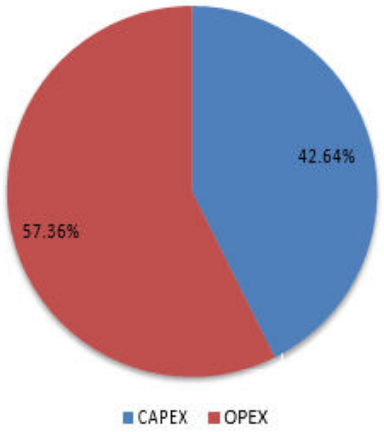


Figure 5.04: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Composite Stream Collection and Conveyance of 64 MLD CETP Facility

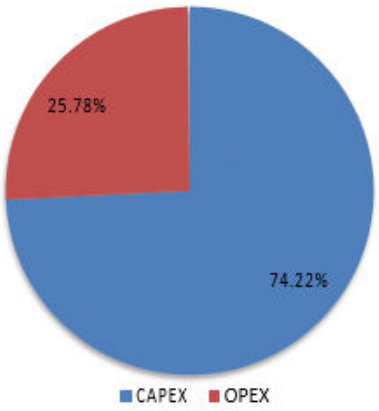


Figure 5.05: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Composite Stream Collection and Conveyance of 19.2 MLD CETP Facility

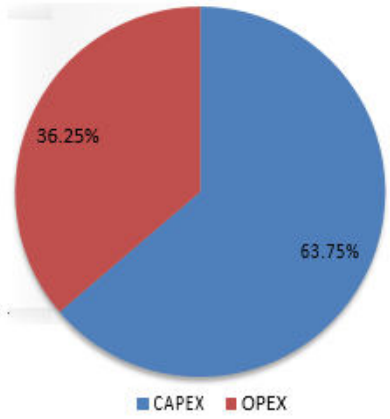


Figure 5.06: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Composite Stream Collection and Conveyance of 38.4 MLD CETP Facility

5.2.2. Effluent Treatment and Concentrate Treatment/ Disposal

Treatment of effluent includes i) Chrome Recovery Plant, ii) Primary Treatment, iii) Secondary Treatment, iv) Tertiary Treatment, v) Reverse Osmosis, and vi) Concentrate Treatment/ Disposal either through MEE or Lagoons. The capital expenditure is inclusive of the costs of the inventory, the cost of installation and the cost of civil works. The operation expenditure is inclusive of the cost of manpower, chemical and electrical energy consumed.

The chrome stream is collected and physico-chemically treated to recover chrome. The recovered chrome has high economic value and can be reused in tanning process. The cost of chrome recovery for all CETP Facilities is ₹ 227.59 per KL. A typical pattern of distribution of expenditure on chrome effluent treatment adopting the methodology in Section 4.2.3 is presented in Figure 5.07.

The cost of primary treatment for all CETP Facilities is ₹ 28.74 per KL. A typical pattern of distribution of expenditure on primary treatment of effluent adopting the methodology in Section 4.2.3 is presented in Figure 5.08.

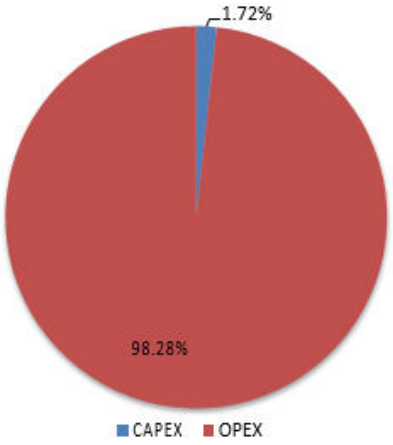


Figure 5.07: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Chrome Recovery Plant

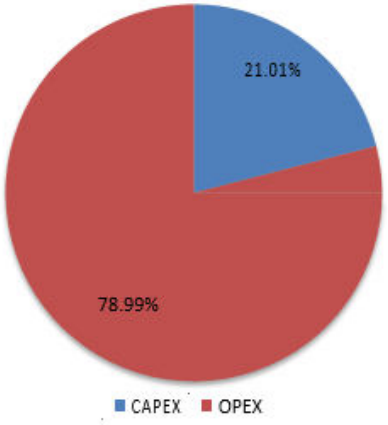
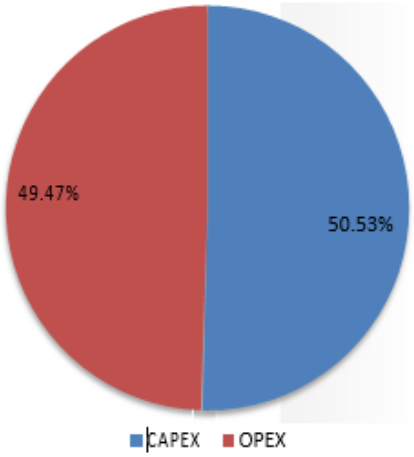


Figure 5.08: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Primary Treatment

The cost of secondary treatment for all CETP Facilities is ₹ 7.07 per KL. A typical pattern of distribution of expenditure on secondary treatment of effluent adopting the methodology in Section 4.2.3 is presented in Figure 5.09.

The cost of tertiary treatment for all CETP Facilities is ₹ 7.83 per KL. A typical pattern of distribution of expenditure on tertiary treatment of effluent adopting the methodology in Section 4.2.3 is presented in Figure 5.10.



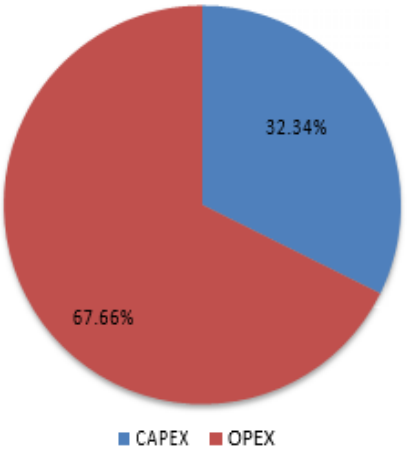


Figure 5.09: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Secondary Treatment

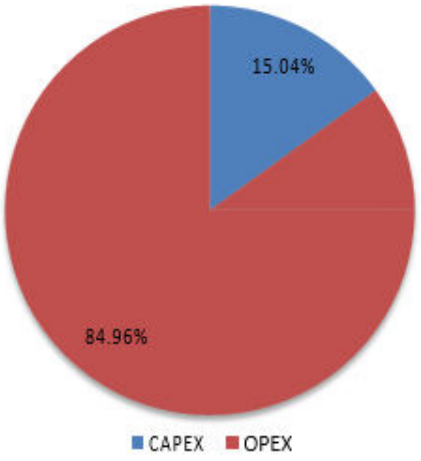
Figure 5.10: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Tertiary Treatment

The cost of reverse osmosis treatment for all CETP Facilities is ₹ 32.96 per KL. A typical pattern of distribution of expenditure on reverse osmosis treatment of effluent adopting the methodology in Section 4.2.3 is presented in Figure 5.11.

The concentrate of the reverse osmosis process can be condensed to get crystallized salts using energy intensive multi-effect evaporators or can be safely disposed in Ganga River during the high flow (monsoon) period.

The use of multi-effect evaporators though does not flout any of the current CPCB norm of disposal of effluent in surface water body, it uses large amounts of electrical energy which itself has a high carbon footprint and hence puts a burden on the environment. The cost of concentrate treatment using multi effect evaporators for all CETP Facilities is ₹ 604.63 per KL. A typical pattern of distribution of expenditure on treatment of concentrate using MEE adopting the methodology in Section 4.2.4 is presented in Figure 5.12.

The other option uses lagoons to store the concentrate through the lean flow period and discharges safely into the Ganga River during the high flow (monsoon) period. The period considered for discharge is decided by the increase in order of magnitude of 90 per cent Dependable Flow (90 % DF) from 15 July to 15 October from the hydrograph generated based on daily discharge measurements by Central Water Commission (CWC) at Bithoor Observation Station. This increase in flow in river offers a great assimilation and dilution capacity. Figure 5.13 shows the hydrograph generated based on Daily Discharge Measurements by CWC at Bithoor observation station during the period 1980-2009. The x- axis represents the date and y-axis represents the discharge value in cumecs.



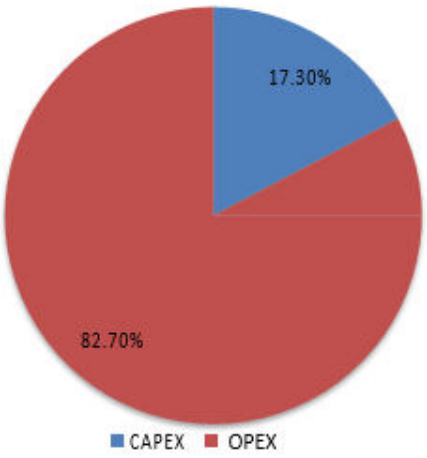


Figure 5.11: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Reverse Osmosis

Figure 5.12: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Concentrate Treatment

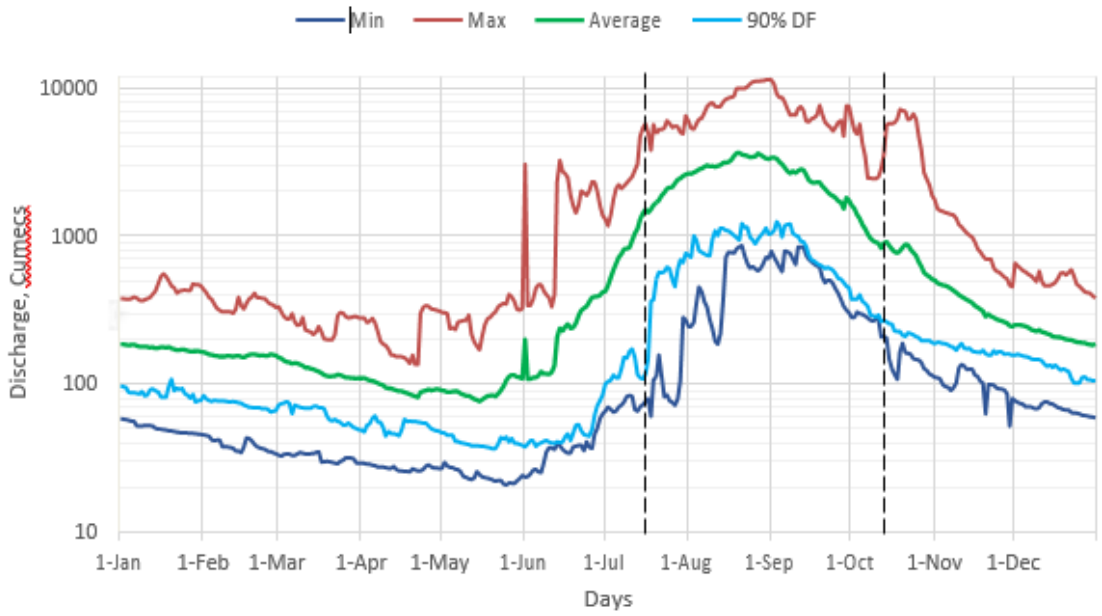


Figure 5.13: Representation of Hydrograph generated based on Daily Discharge Measurements by CWC during the period 1980-2009 at Bithoor Observation Station. The region between the dashed lines represent the period (15 July to 15 October) in which the concentrate will be discharged into the Ganga River.

The expected quality of tertiary treated effluent (prior to RO), RO concentrate (with 80 % permeate recovery and 100 % rejection of dissolved solids) and the current CPCB discharge standards in inland water bodies is presented in Table 5.01.

Table 5.01: Expected Quality of Tertiary Treated Effluent (Prior to RO), RO Concentrate and Current CPCB Discharge Standards in Inland Water Bodies

Parameter	Concentration (mg/L)		
	Tertiary Treatment Effluent (Expected)	Reverse Osmosis Concentrate (Expected)	CPCB Discharge Norms in Inland Surface Water
Total Dissolved Solids	10000	50000	2100
BOD_5 at 20^{o} C	10	50	30
Total Chromium	1	5	2

Final concentrations of TDS, BOD and Total Chromium in the Ganga River was calculated throughout the year using expected RO concentrate concentrations and the CPCB discharge standards for their respective discharge periods. The primary data used was i) daily discharge data for 30 years (1980-2009) at CWC Station at Bithoor for computing 90 per-cent dependable

flows, ii) monthly TDS and BOD concentrations for 30 years (1980-2009) at CWC station at Bithoor. Since no data for Total Chromium concentrations in the Ganga River was available, it was assumed to be zero.

The final concentrations with disposal of stored RO concentrate were compared with average concentrations of thirty years and were found significantly low in the monsoon period than the average concentrations of lean flow period. Similarly the final concentrations with CPCB discharge standards further increase the concentrations in lean flow period. Another advantage in the use of lagoons is that it aids the completion of the salt-cycle by carrying away the excess salt into the oceans instead of accumulating in the terrestrial (agricultural fields) environment. Figure 5.14, 5.15 and 5.16 show the variation of monthly average concentrations of TDS, BOD and Total Chromium respectively in the following scenarios: i) background concentration of Ganga River, ii) concentration when RO concentrate is discharged in the high flow period, and iii) concentration if the treated effluent is discharged daily as per current CPCB discharge standards.

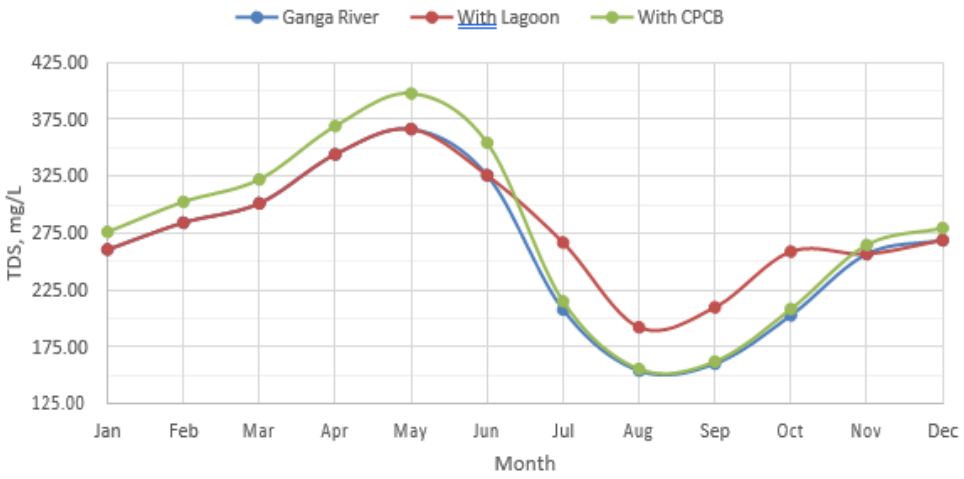


Figure 5.14: Monthly Average Concentrations in River Ganga, Post Discharge from Lagoon and Post Discharge as per CPCB Discharge Standards of Total Dissolved Solids in mg/L at Kanpur

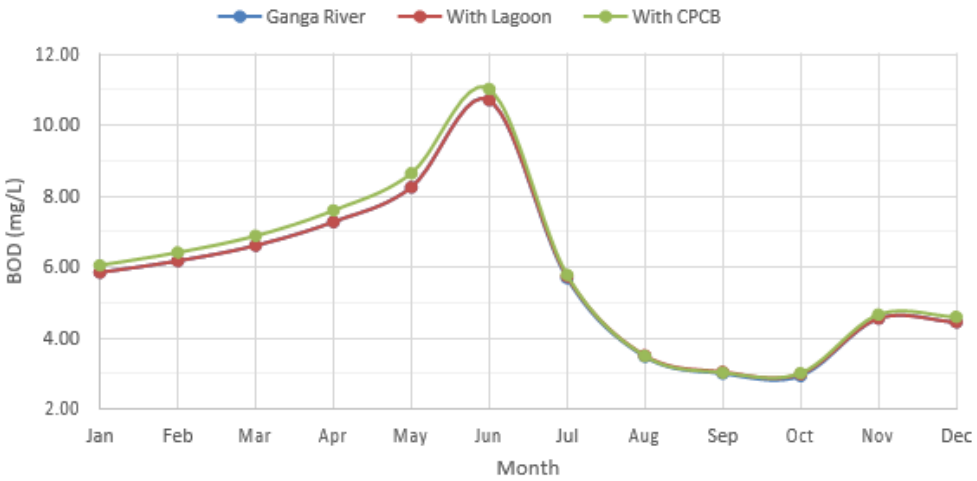


Figure 5.15: Monthly Average Concentrations in River Ganga, Post Discharge from Lagoon

and Post Discharge as per CPCB Discharge Standards of BOD in mg/L at Kanpur

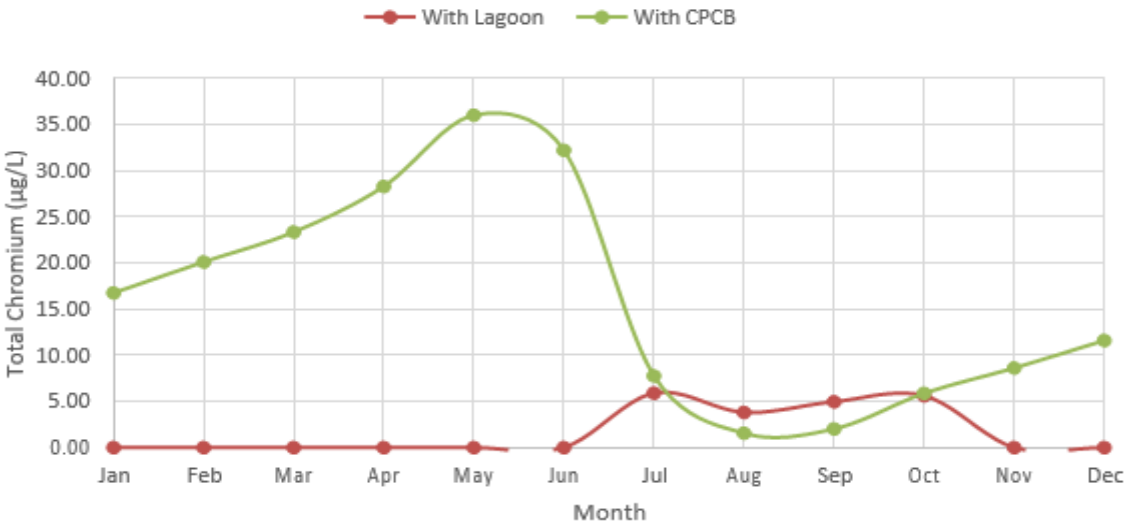


Figure 5.16: Monthly Average Concentrations in River Ganga, Post Discharge from Lagoon and Post Discharge as per CPCB Discharge Standards of Total Chromium in µg/L at Kanpur

The cost of concentrate disposal using lagoons for 32 or 19.2 MLD and 64 or 38.4 MLD Facilities with or without CBHF is ₹ 75.35 per KL and ₹ 75.25 per KL respectively. A typical pattern of distribution of expenditure on disposal of concentrate using lagoon adopting the methodology in Section 4.2.4 is presented in Figure 5.17 and 5.18.

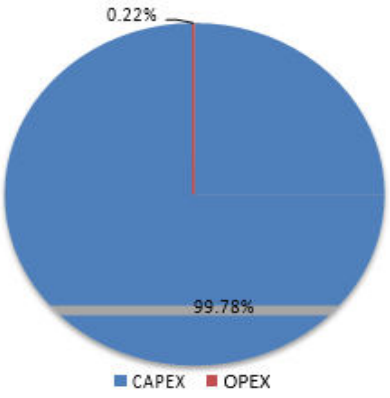


Figure 5.17: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Concentrate Disposal through Lagoon of 32 MLD and 19.2 MLD CETP Facilities

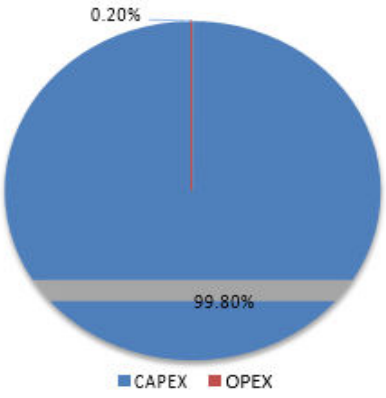


Figure 5.18: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Concentrate Disposal through Lagoon of 64 MLD and 38.4 MLD CETP Facilities

5.2.3. Common Beam-House Facility

The common beam house facility includes i) Common Beam-House Operations, ii) Primary Treatment, iii) Secondary Treatment, iv) Tertiary Treatment, v) Reverse Osmosis, vi) Concentrate Treatment/ Disposal either through MEE or Lagoons, and vii) Sewage (as make- up Water) Treatment and Concentrate Treatment/ Disposal. The capital expenditure is inclusive of the costs of the inventory, the cost of installation and the cost of civil works. The operation expenditure is inclusive of the cost of manpower, chemical and electrical energy consumed.

The cost of common beam-house operations for 12.8 MLD and 25.6 MLD CBHF facilities is ₹ 502.43 per KL or ₹ 36.06 per sq m (₹ 3.35 per sq ft) of hide processed. A typical pattern of distribution of expenditure on common beam-house operations adopting the methodology in Section 4.3 is presented in Figure 5.19.

The costs of all primary treatment, secondary treatment, tertiary treatment and concentrate treatment/ disposal are similar to the costs given in Section 5.3. The difference in costs of reverse osmosis treatment is due to use of sea water membranes and high pressure pumps. The cost of reverse osmosis treatment for 12.8 MLD and 25.6 MLD CBHF facilities is ₹ 51.91 per KL respectively. A typical pattern of distribution of expenditure on RO treatment in CBHF Facility adopting the methodology in Section 4.3 is presented in Figure 5.20.The cost of make-up water is as explained in Section 5.2.4

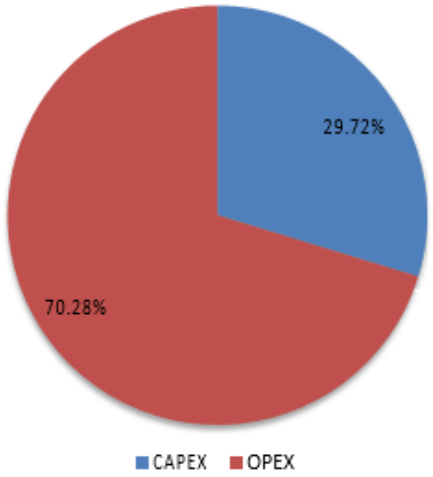


Figure 5.19: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Common Beam House Operations

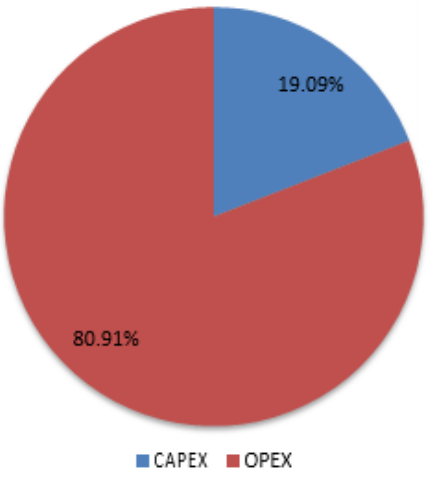


Figure 5.20: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Reverse Osmosis Treatment of CBHF Effluent

5.2.4. Make-up Water Treatment and Concentrate Treatment/ Disposal

The loss as concentrate of RO treatment will be made up by supplying the treated domestic wastewater from local sewage treatment plants at the same tariff as that of recycled water.

The treatment of domestic wastewater to produce water of similar grade as that of effluent treatment plant includes i) Primary Treatment, ii) Secondary Treatment, iii) Tertiary Treatment, iv) Reverse Osmosis Treatment, and v) Concentrate Disposal/ Treatment.

The Capex and Opex for treatment of domestic wastewater up to tertiary treatment has been taken as ₹ 11 Million/ MLD and ₹ 1.4 Million/MLD/Year respectively. These values are adopted from the report prepared by Consortium of 7 IITs preparing GRBMP (IIT_GRB Report, 2010). The total cost for primary, secondary and tertiary treatment is ₹ 7.87 per KL. A typical pattern of distribution of expenditure on primary, secondary and tertiary treatment of sewage is presented in Figure 5.21.

However for cost estimation purposes the total expenditure of all stages except conveyance and distribution has been over-estimated such that the goal of 100 percent recycling of water is achieved. The cost estimates are hence similar to those described in the Section 5.2.2.

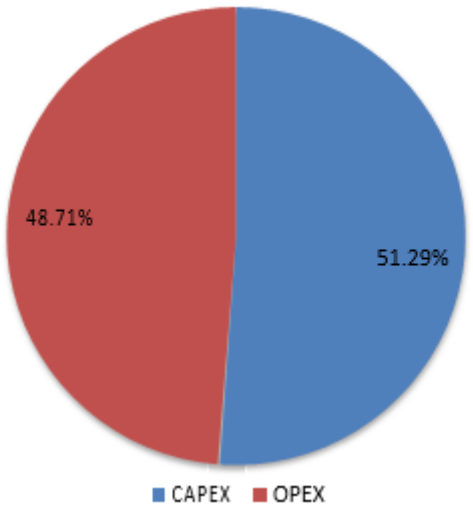


Figure 5.21: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Primary, Secondary and Tertiary Treatment of Make-Up Water

5.2.5. Distribution of Recycled Water

The cost of storage and distribution of recycled water for 32 MLD and 64 MLD CETP Facility is ₹ 5.50 per KL and ₹ 5.20 per KL respectively. The cost of storage and distribution of recycled water for 19.2 MLD and 38.4 MLD CETP Facility is ₹ 5.81 per KL and ₹ 5.41 per KL respectively. A typical pattern of distribution of expenditure on storage and distribution of treated effluent adopting the methodology in Section 4.2.5 is presented in Figure 5.22 to 5.25.

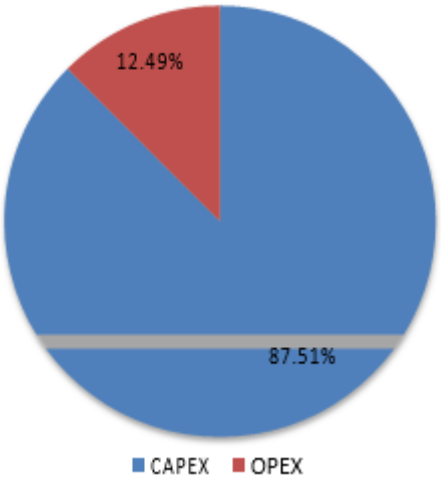


Figure 5.22: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Distribution of Recycled Water of 32 MLD CETP Facility

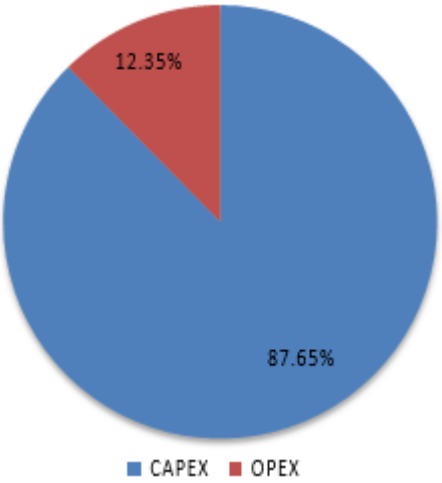


Figure 5.23: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Distribution of Recycled Water of 64 MLD CETP Facility

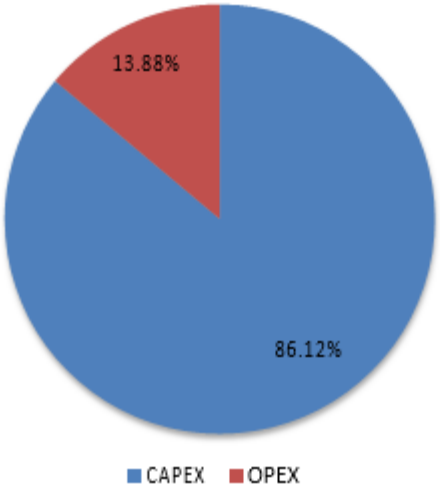


Figure 5.24: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Distribution of Recycled Water of 19.2 MLD CETP Facility

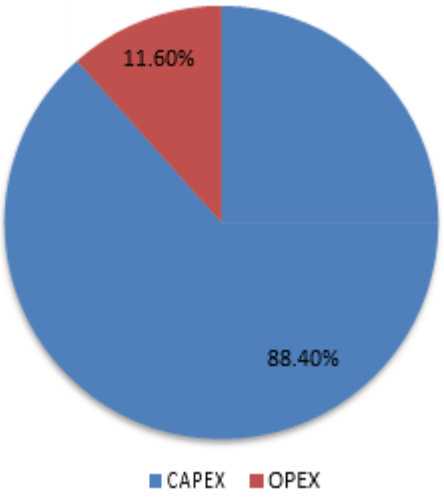


Figure 5.25: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Distribution of Recycled Water of 38.4 MLD CETP Facility

5.2.6. Total Annualized Costs

The total annualized costs of 64 MLD CETP Facility with MEE and Lagoon is ₹ 269.71 per KL and ₹ 137.37 per KL respectively. A typical pattern of distribution of total expenditure on individual operations of 64 MLD CETP Facility is presented in Figure 5.26 and 5.27.

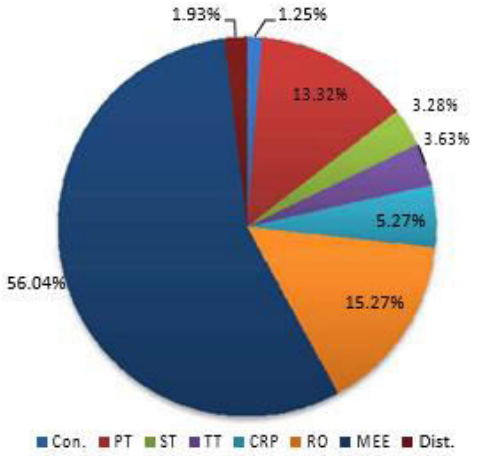


Figure 5.26: Typical Distribution of Estimated Total Annualized Expenditure of 64 MLD CETP Facility with MEE

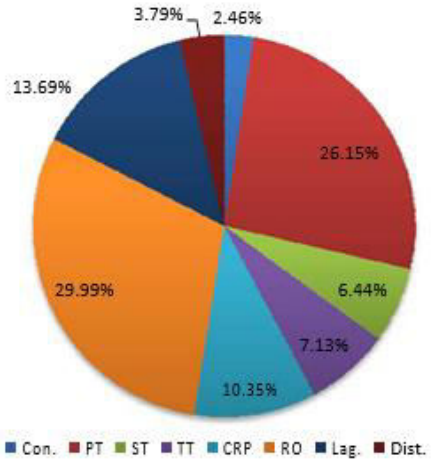


Figure 5.27: Typical Distribution of Estimated Total Annualized Expenditure of 64 MLD CETP Facility with Lagoon

The total annualized costs for 25.6 MLD CBHF Facility with MEE and Lagoon is ₹ 777.03 per KL or ₹ 55.22 per sq. m. (₹ 5.13 per sq. ft.) and ₹ 640.69 per KL or ₹ 45.96 per sq. m. (₹ 4.27 per sq. ft.) A typical pattern of distribution of total expenditure on individual operations of 25.6 MLD CBHF Facility is presented in Figure 5.28 and 5.29.

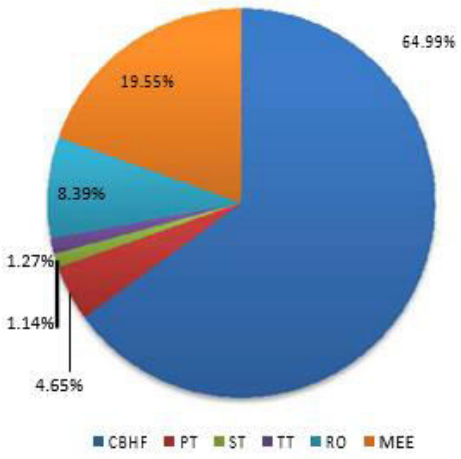


Figure 5.28 Typical Distribution of Estimated Total Annualized Expenditure of 25.6 MLD CBHF Facility with MEE

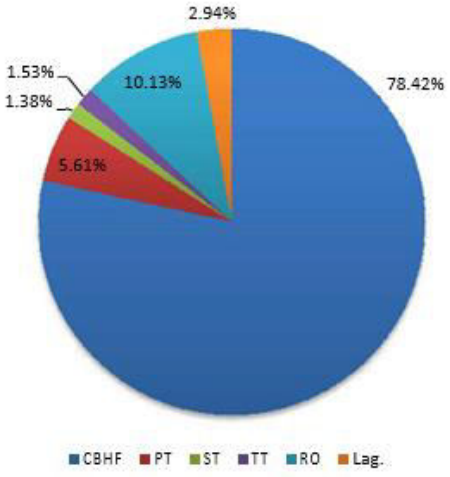


Figure 5.29: Typical Distribution of Estimated Total Annualized Expenditure of 25.6 MLD CBHF Facility with Lagoon

The total annualized costs of 38.4 MLD CETP Facility with MEE and Lagoon is ₹ 279.94 per KL and ₹ 147.60 per KL respectively. A typical pattern of distribution of total expenditure on individual operations of 38.4 MLD CETP Facility is presented in Figure 5.30 and 5.31.

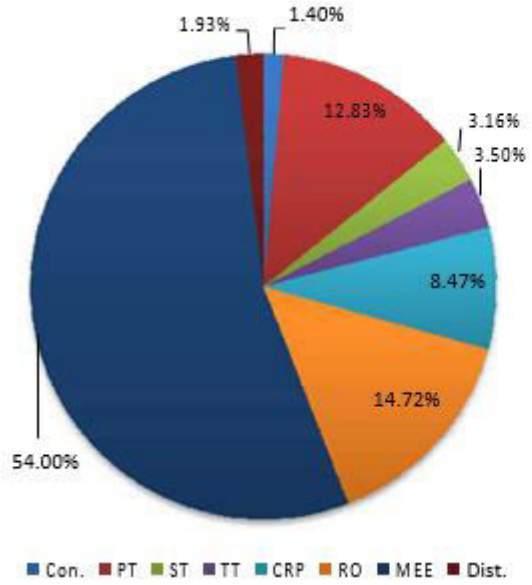


Figure 5.30: Typical Distribution of Estimated Total Annualized Expenditure of 38.4 MLD CETP Facility with MEE

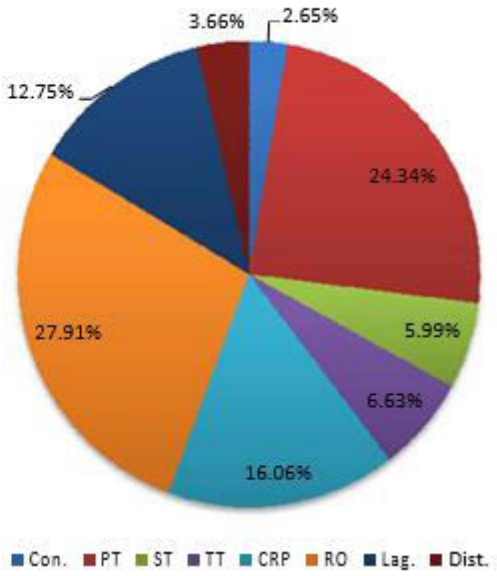


Figure 5.31: Typical Distribution of Estimated Total Annualized Expenditure of 38.4 MLD CETP Facility with Lagoon

5.3 Tariff Estimation

The tariffs have been estimated for all CETP and CBHF facilities with the following debt options.

i) Scenario 1-Equity: 30 %, Debt 1: 70 % at interest rate of 3 %, 20 year duration, 5 year moratorium period
ii) Scenario 2- Equity: 30 %; Debt 1: 50 % at interest rate of 3 %, 20 year duration, 5 year moratorium period; Debt 2: 20 % at interest rate of 13 %, 12 years duration, 1 year moratorium period
iii) Scenario 3-Equity: 30 %; Debt 1: 70 % at interest rate of 13 %, 12 year duration, 1 year moratorium period

The recycled water and hides will be charged at the estimated tariffs for the tanneries. The make-up water purchased from local STPs will also be at the same tariff. The cost of any fresh water source should be priced at 1.5 times the tariff of recycled water.

A typical pattern of distribution of expenditure of Capex and Opex of 32 MLD CETP facility with MEE and Lagoons on individual operations is presented in Figures 5.32 to 5.35. The Capex (per MLD), Opex (per KL) and Tariffs in the three scenarios (per KL) for the same are given in Table 5.02.

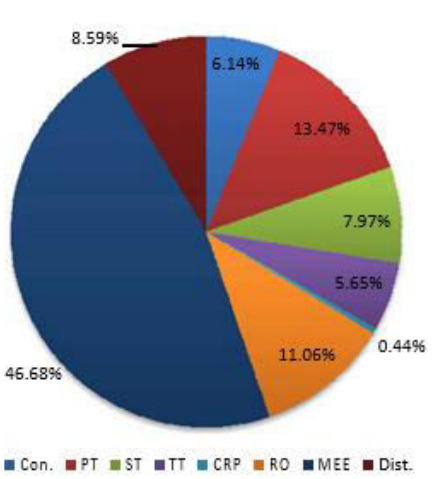


Figure 5.32: Typical Distribution of Total Capex of 32 MLD CETP Facility with MEE

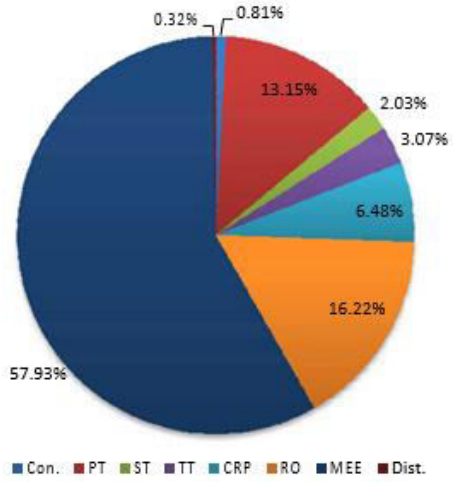


Figure 5.33: Typical Distribution of Total Opex of 32 MLD CETP Facility with MEE

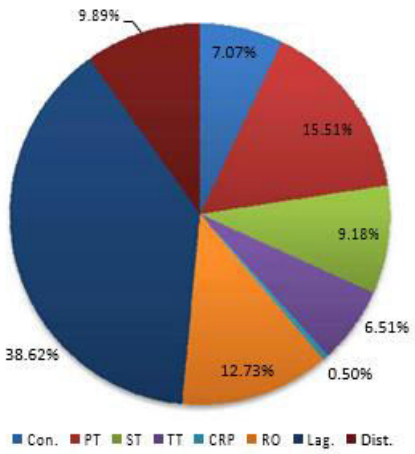
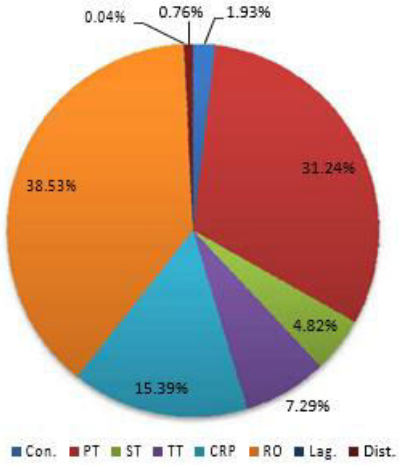


Figure 5.34: Typical Distribution of Total Capex of 32 MLD CETP Facility with Lagoon



5.35: Typical Distribution of Total Opex of 32 MLD CETP Facility with Lagoon

Table 5.02: Estimated Capex, Opex and Tariffs in Three Scenarios for 32 MLD CETP Facility

Concentrate Handling Option	CAPEX	OPEX	Scenario 1	Scenario 2	Scenario 3
	₹ Cr./MLD	₹/KL	₹/KL	₹/KL	₹/KL
MEE	15.26	215.79	284.27	296.48	327.42
Lagoon	13.26	90.83	139.57	150.20	177.07

A typical pattern of distribution of expenditure of Capex and Opex of 64 MLD CETP Facility with MEE and Lagoons on individual operations is presented in Figure 5.36

to 5.39. The Capex (per MLD), Opex (per KL) and Tariffs in the three scenarios (per KL) for the same are given in Table 5.03.

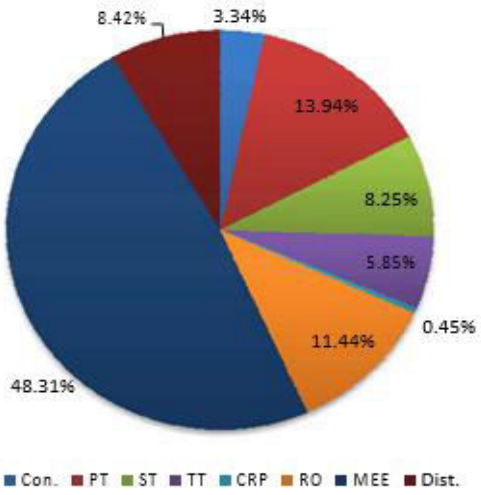


Figure 5.36: Typical Distribution of Total Capex of 64 MLD CETP Facility with MEE

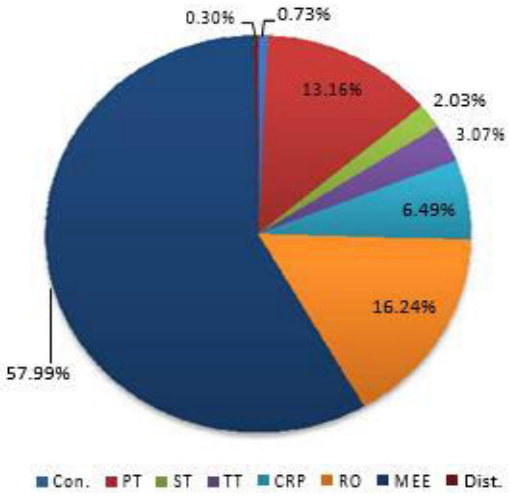


Figure 5.37: Typical Distribution of Total Opex of 64 MLD CETP Facility with MEE

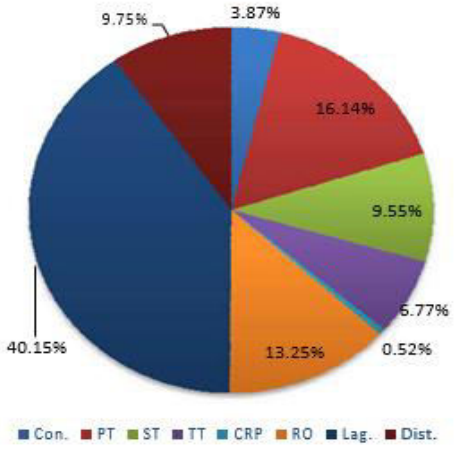


Figure 5.38: Typical Distribution of Total Capex of 64 MLD CETP Facility with Lagoon

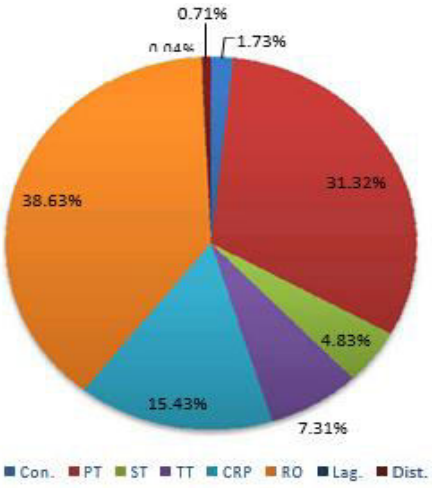


Figure 5.39: Typical Distribution of Total Opex of 64 MLD CETP Facility with Lagoon

Table 5.03: Estimated Capex, Opex and Tariffs in Three Scenarios for 64 MLD CETP Facility

Concentrate Handling Option	CAPEX	OPEX	Scenario 1	Scenario 2	Scenario 3
	₹ Cr /MLD	₹/KL	₹/KL	₹/KL	₹/KL
MEE	14.75	215.56	282.51	294.32	324.22
Lagoon	12.74	90.60	137.80	148.00	173.85

A typical pattern of distribution of expenditure of Capex and Opex of 12.8 or 25.6 MLD CBHF Facility with MEE and Lagoons on individual operations is presented in Figure 5.40 to

5.43. The Capex (per MLD), Opex (per KL) and Tariffs in the three scenarios (per KL and per unit area) for the same are given in Table 5.04.

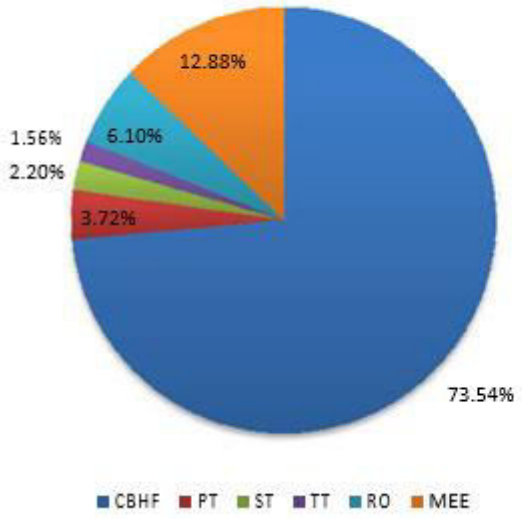


Figure 5.40: Typical Distribution of Total Capex of 12.8 MLD and 25.6 MLD CBHF Facility with MEE

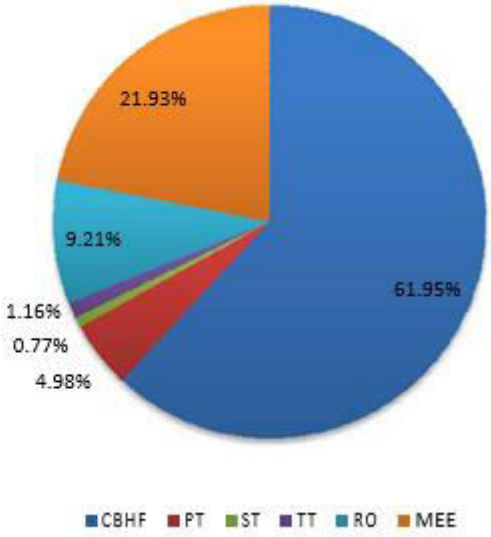


Figure 5.41: Typical Distribution of Total Opex of 12.8 MLD and 25.6 MLD CBHF Facility with MEE

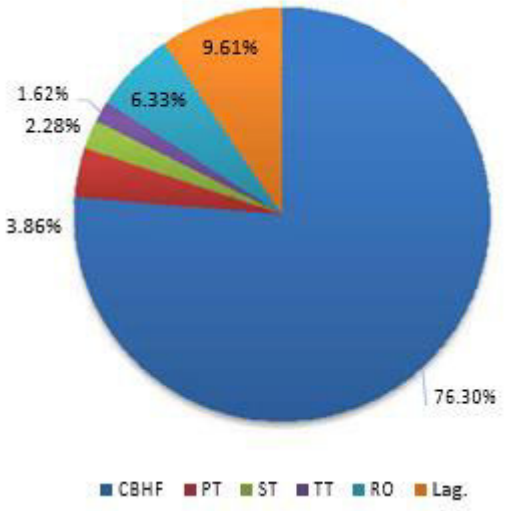


Figure 5.42: Typical Distribution of Total Capex of 12.8 MLD and 25.6 MLD CBHF Facility with Lagoon

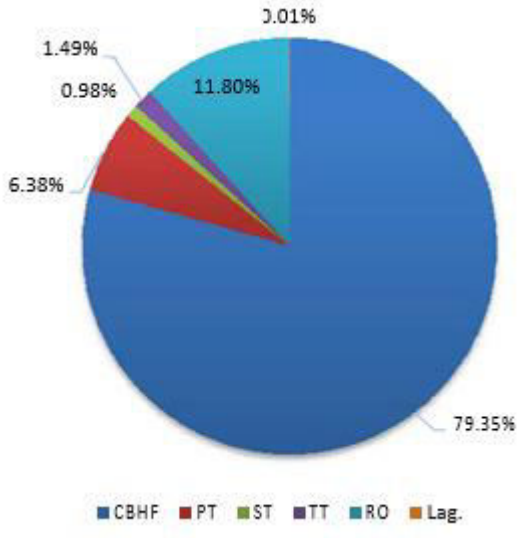


Figure 5.43: Typical Distribution of Total Opex of 12.8 MLD and 25.6 MLD CBHF
Facility with Lagoon

Table 5.04: Estimated Capex, Opex and Tariffs in Three Scenarios for 12.8 MLD and 25.6 MLD CBHF Facility

Concentrate Handling Option	CAPEX	OPEX	Scenario 1		Scenario 2		Scenario 3	
	₹ Cr/ MLD	₹/KL	₹/KL	₹/sq m (sq	₹/KL	₹/sq m (sq	₹/KL	₹/sq m (sq
MEE	55.31	570.00	794.55	57.05 (5.30)	838.85	60.17 (5.59)	951.00	68.24 (6.34)
Lagoon	53.30	445.04	649.90	46.61 (4.33)	692.55	49.73 (4.62)	800.70	57.4 (5.34)

A typical pattern of distribution of expenditure of Capex and Opex of 19.2 MLD CETP Facility with MEE and Lagoons on individual operations is presented in Figure 5.44 to 5.47. The Capex (per MLD), Opex (per KL) and Tariffs in the three scenarios (per KL) for the same are given in Table 5.05.

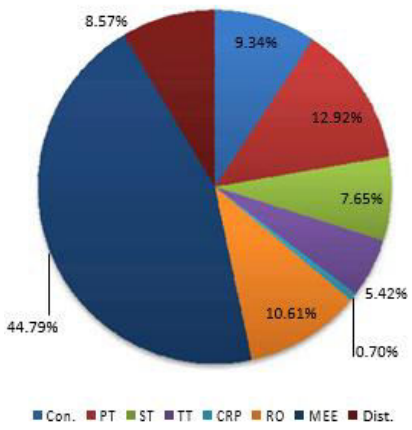


Figure 5.44: Typical Distribution of Total Capex of 19.2 MLD CETP Facility with MEE

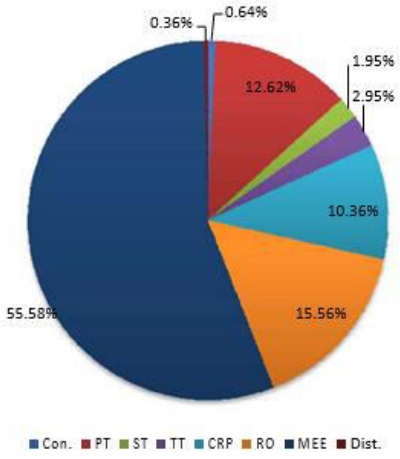


Figure 5.45: Typical Distribution of Total Opex of 19.2 MLD CETP Facility with MEE

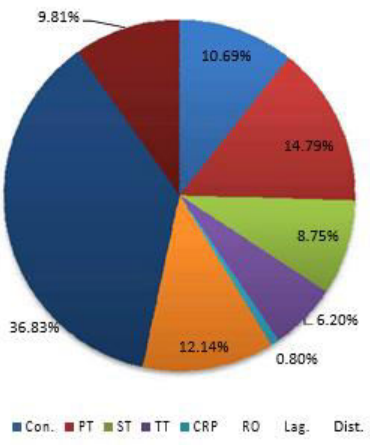


Figure 5.46: Typical Distribution of Total Capex of 19.2 MLD CETP Facility with Lagoon

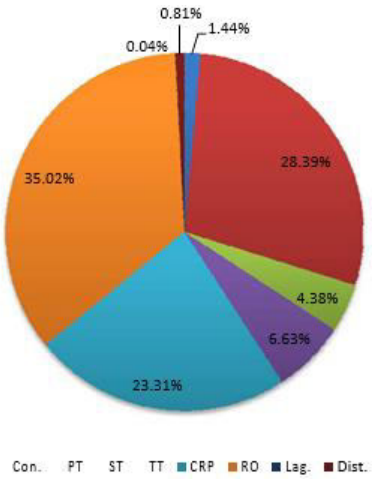


Figure 5.47: Typical Distribution of Total Opex of 19.2 MLD CETP Facility with Lagoon

Table 5.05: Estimated Capex, Opex and Tariffs in Three Scenarios for 19.2 MLD CETP Facility

Concentrate Handling Option	CAPEX	OPEX	Scenario 1	Scenario 2	Scenario 3
	₹ Cr /MLD	₹/KL	₹/KL	₹/KL	₹/KL
MEE	15.91	224.92	296.30	309.00	341.30
Lagoon	13.90	99.96	151.60	162.75	190.92

A typical pattern of distribution of expenditure of Capex and Opex of 38.4 MLD CETP Facility with MEE and Lagoons on individual operations is presented in Figure 5.48 to 5.51. The Capex (per MLD), Opex (per KL) and Tariffs in the three scenarios (per KL) for the same are given in Table 5.06.

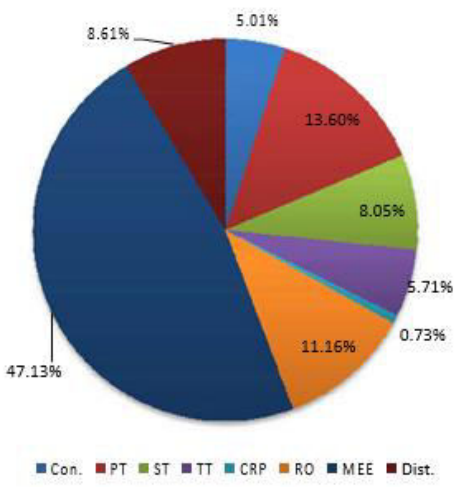


Figure 5.48: Typical Distribution of Total Capex of 38.4 MLD CETP Facility with MEE

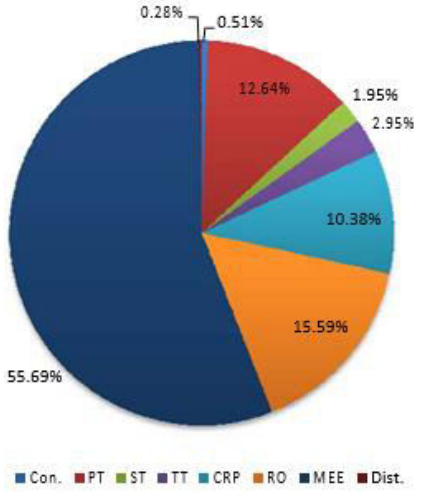


Figure 5.49: Typical Distribution of Total Opex of 38.4 MLD CETP Facility with MEE

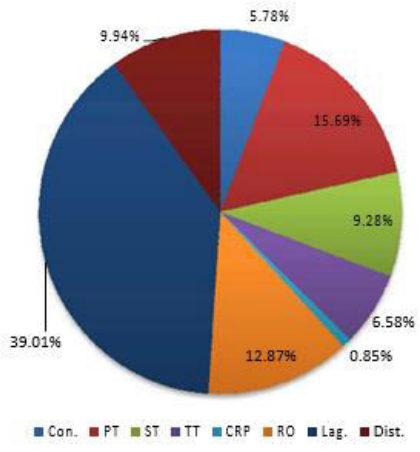


Figure 5.50: Typical Distribution of Total Capex of 38.4 MLD CETP Facility with Lagoon

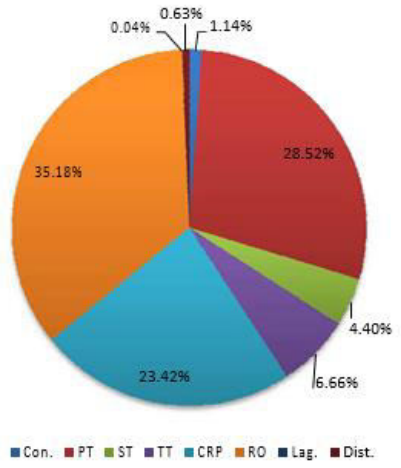


Figure 5.51: Typical Distribution of Total Opex of 38.4 MLD CETP Facility with Lagoon

Table 5.06: Estimated Capex, Opex and Tariffs in Three Scenarios for 38.4 MLD CETP Facility

Concentrate Handling Option	CAPEX	OPEX	Scenario 1	Scenario 2	Scenario 3
	₹/MLD	₹/KL	₹/KL	₹/KL	₹/KL
MEE	15.12	224.44	293.45	305.55	336.23
Lagoon	13.11	99.48	148.75	159.25	185.82

5.4 Land and Energy Footprint

The land and energy footprints of 64 MLD and 38.4 MLD CETP and 25.6 MLD CBHF has been calculated and shown as follows.

The total land footprint of 64 MLD and 38.4 MLD CETP Facility with MEE is 10 hectare and 6 hectare respectively. The daily energy footprint is 1210 Mega Watt hour (MW-h) and 720 MW-h respectively. A typical pattern of distribution of land and energy footprint of individual operations of 64 and 38.4 MLD CETP Facility is presented in Figure 5.52 and 5.53.

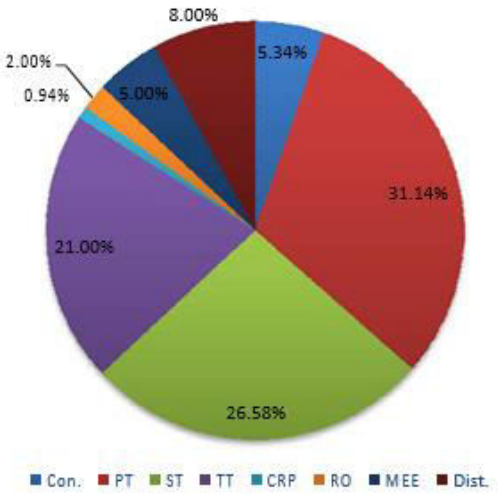


Figure 5.52: Typical Distribution of Total Land footprint 64 MLD and 38.4 MLD CETP Facility with MEE

The total land footprint of 64 MLD and 38.4 MLD CETP Facility with Lagoon is 133 hectare and 80 hectare respectively. The daily energy footprint is 165 MW-h and 94 MW-h respectively. A typical pattern of distribution of land and energy footprint of individual operations of 64 and 38.4 MLD CETP Facility is presented in Figure 5.54 and 5.55.

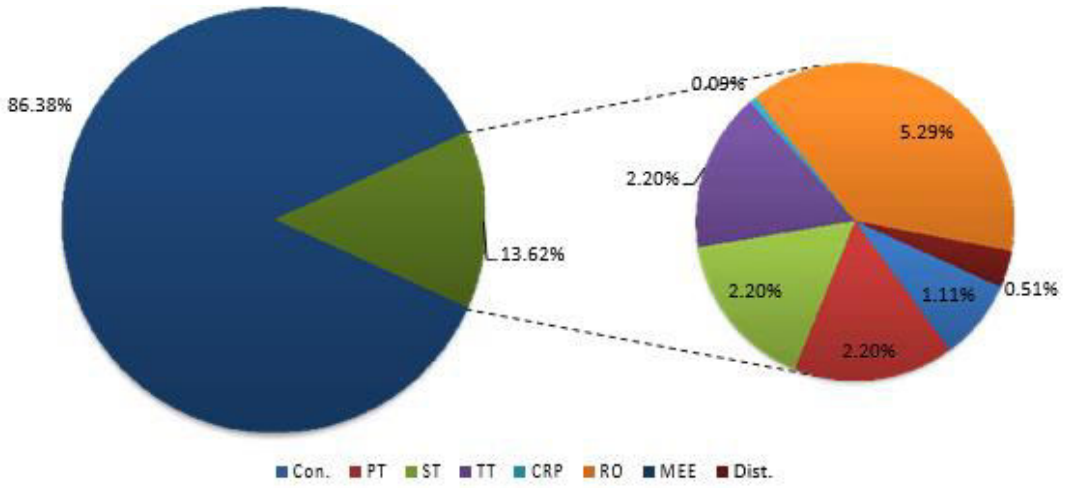


Figure 5.53: Typical Distribution of Total Energy footprint 64 MLD and 38.4 MLD CETP Facility with MEE

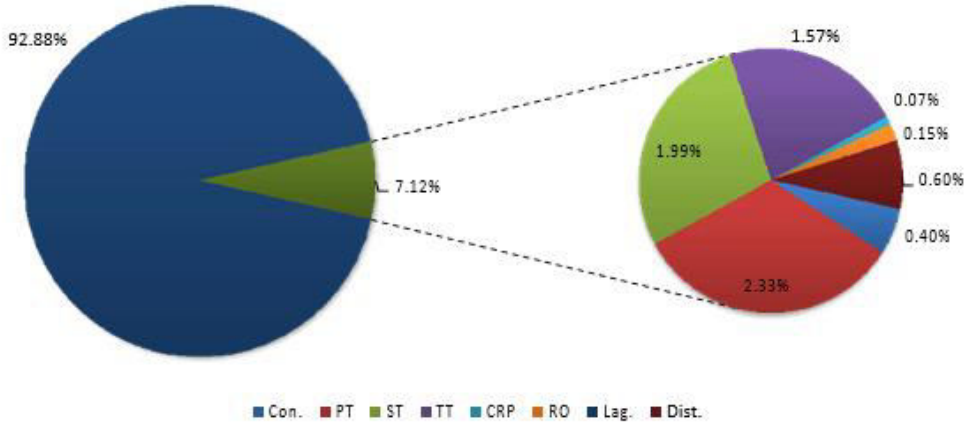


Figure 5.54: Typical Distribution of Total Land footprint 64 MLD and 38.4 MLD CETP Facility with Lagoon

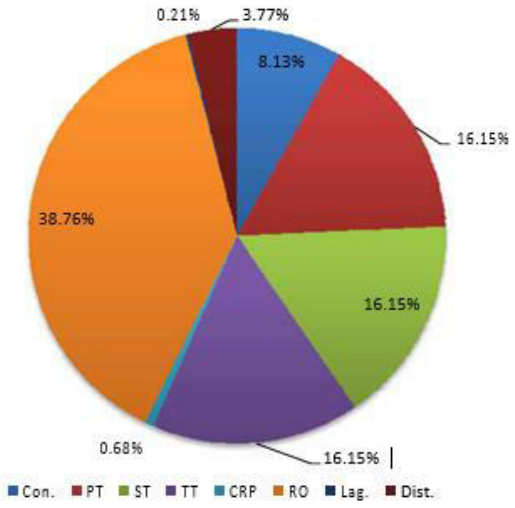


Figure 5.55: Typical Distribution of Total Energy footprint 64 MLD and 38.4 MLD CETP Facility with Lagoon

The total land footprint of 25.6 MLD CBHF Facility with MEE and Lagoon is 6.24 hectare and 55.56 hectare respectively. The daily energy footprint is 664 MW-h and 246 MW-h respectively. A typical pattern of distribution of land and energy footprint of individual operations of 25.6 MLD CBHF Facility is presented in Figure 5.56 to 5.59.

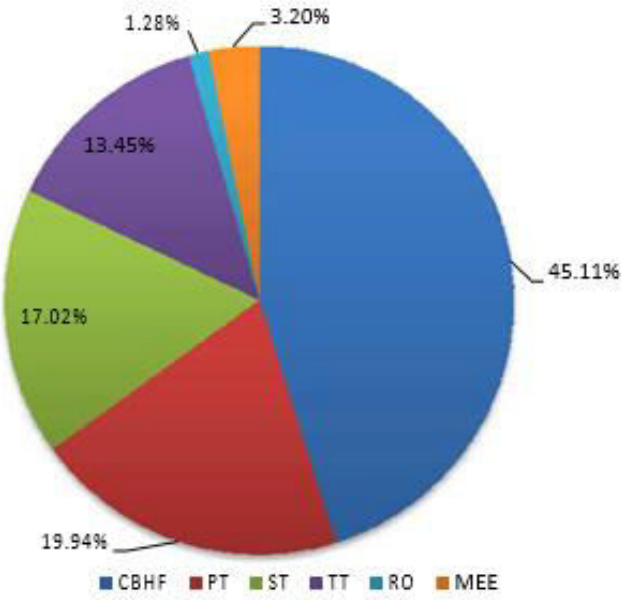


Figure 5.56: Typical Distribution of Total Land footprint of 25.6 MLD CBHF Facility with MEE

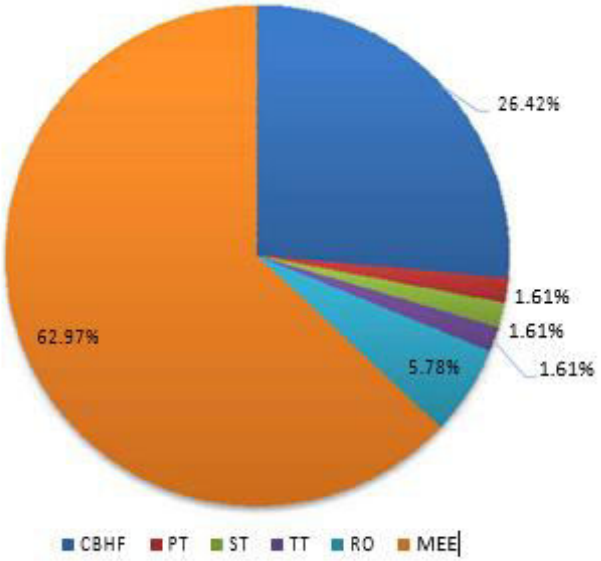


Figure 5.57: Typical Distribution of Total Energy Footprint of 25.6 MLD CBHF Facility with MEE

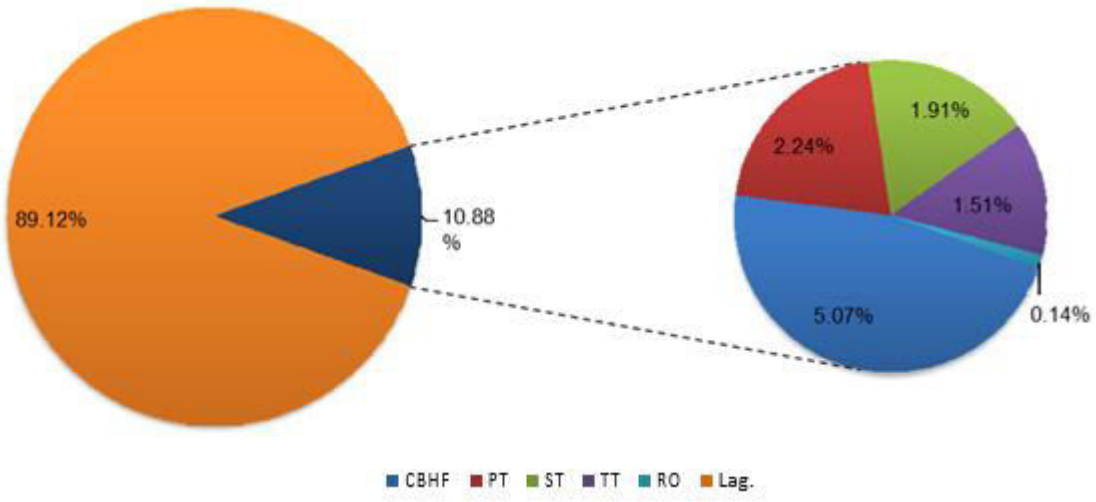


Figure 5.58: Typical Distribution of Total Land footprint of 25.6 MLD CBHF Facility with Lagoon

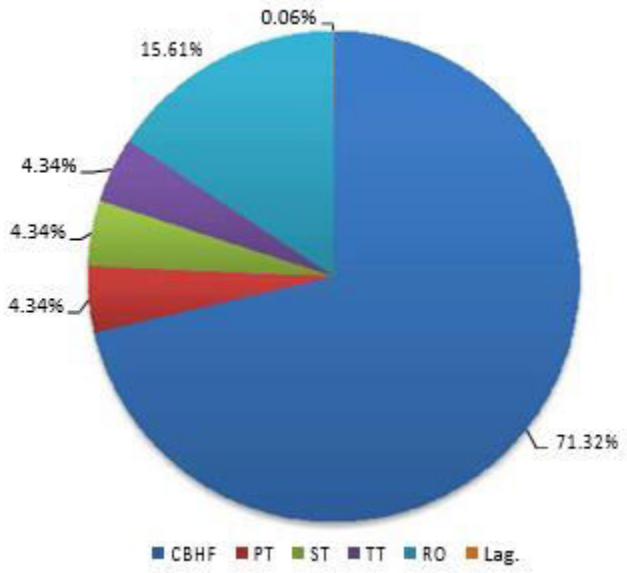


Figure 5.59: Typical Distribution of Total Energy footprint of 25.6 MLD CBHF Facility with Lagoon

6. Conclusions and Recommendations

6.1. Conclusions

Following conclusions may be drawn based on the synthesis of the information available in the literature and the results presented in this thesis.

- Tannery effluent conveyance, treatment and distribution of recycled water being common, the cost of concentrate treatment using MEE is about 800 % of the cost of controlled release of concentrate through lagoons during high flows.
- The controlled discharge of RO Reject during high flows in river Ganga at Kanpur may lead to: i) 28 % increase in the average TDS concentration during the discharge period compared to the background concentration, ii) decrease in average TDS concentration by 28% during the non-discharge period compared to discharge as per current discharge standards, iii) lower maximum monthly TDS concentration during the discharge period by 33% compared to maximum monthly TDS concentration throughout the year if the treated effluent is discharged daily as per current discharge standards, iv) lower monthly average BOD concentration throughout the year in comparison to concentrations if effluent is discharged throughout the year as per current discharge standards, v) lower average Cr concentration even in the discharge period by 77% compared to average Cr concentration in the non-discharge period if the effluent is discharged throughout the year as per current discharge standards, v) lower average Cr concentration even in the discharge period by 77% compared to average Cr concentration in the non-discharge period if the effluent is discharged throughout the year as per current discharge standards, and vi) lower maximum monthly Cr concentration even in the discharge period by 83% compared to the maximum monthly Cr concentration throughout the year if the treated effluent is discharged daily as per current discharge standards.
- The lagoon land required for a 64 MLD CETP is 250 times the land required for MEE. The energy required for condensing the concentrate using MEE is 3000 times the energy required if controlled disposal of accumulated reject through lagoon in Ganga River.
- The use of lagoons to discharge the concentrate can be justified given the savings on capital and operational costs and low energy requirement except in areas where land is unavailable.
- The rates for carrying out beam-house operations in different tanneries have been reported to be varying from ₹ 21.53-64.58 per sq. m. (₹ 2-6 per sq. ft.). The tariffs of

CBHF in the three scenarios, namely i) Equity: 30%, Debt 1: 70% at interest rate of 3 %, ii) Equity: 30 %; Debt 1: 50 % at interest rate of 3 %, Debt 2: 20 % at interest rate of 13 % and iii) Scenario 3-Equity: 30 %; Debt 1: 70 % at interest rate of 13 %, using MEE is ₹ 57.05, 60.17 and 68.24 per sq. m. (₹ 5.30, 5.59 and 6.34 per sq. ft.) respectively and ₹ 46.61, 49.73 and 57.48 per sq. m. (₹ 4.33, 4.62 and 5.34 per sq. ft.) respectively using lagoons. The tariff is inclusive of charges of treatment of water. Thus the CBHF facility is more economic than carrying out the operations at individual facilities. However, the overall feasibility of CBHF needs to be evaluated considering challenges involved in transport of partially processed hides to individual tanneries.

- CBHF provides an opportunity of better house-keeping through better management of solid wastes, and segregation of concentrated effluents of beam-house operation. It also has the distinct advantage of economy of scale. The solid wastes in CBHF operations such as fats, grease, hooves, hairs etc. provide an opportunity of industrial symbiosis.

6.2. Recommendations

Following recommendations are made for logical continuation of the work described in this thesis based on the experience gained in conducting the present study.

- The economic reuse/sale value of regenerated chrome may be included to estimate new reduced tariffs.
- The economic value of useful by-products may be included to estimate new tariffs.
- The cost of disposal of sludge generated may also be included to estimate new tariffs.
- The possibility of mandatory completion of all operations up to production of wet blues at a central facility can be explored.

References

Adriano D.C. (2001), Trace Elements in Terrestrial Environments, Springer-Verlag, 2nd Edition

Annual Reports (2001-2012) Export- Import Bank of India, Mumbai, India

Ates E., Orhon D., and Tunay O. (1997) Characterization of tannery wastewaters for pretreatment selected case studies. Water Science and Technology, Vol 36, pp 217–223

Bhattacharya, P., Roy, A., Sarkar, S., Ghosh, S., Majumdar, S., Chakraborty, S., Mandal, S., Mukhopadhyay, A. and Bandyopadhyay, S. (2013) Combination technology of ceramic microfilltration and reverse osmosis for tannery wastewater recovery, Water Resources and Industry, Vol 3 pp 48-62

Bini, C., Maleci, L. and Romanin A. (2008) The chromium issue in soils of the leather tannery district in Italy, Journal of Geochemical Exploration, Vol 96 pp 194-202

CPCB (2005) Performance Status of Common Effluent Treatment Plants in India, Central Pollution Control Board, New Delhi, India

CPCB (1986) General Standards, The Environment (Protection) Rules, Ministry of Environment & Forests, New Delhi, India

CPCB (1986) Leather Tanneries Standards, The Environment (Protection) Rules, Ministry of Environment & Forests, New Delhi, India

CPCB (1986) Tanneries Standards, The Environment (Protection) Rules, Ministry of Environment & Forests, New Delhi, India

CPCB (1986) Tanneries (After Primary Treatment) Standards, The Environment (Protection) Rules, Ministry of Environment & Forests, New Delhi, India

CWC (2006), Evaporation Control in Reservoirs, Basic Planning and Management Organisation, Central Water Commission, New Delhi, India

Gisi, S. D., Galasso, M. and Feo, G. D. (2009) Treatment of tannery wastewater through the combination of conventional activated sludge process and reverse osmosis with a plane membrane, Desalination, Vol 249, pp 337-342

IL&FS Limited (2011) Detailed Project Report (Revised Draft) for Proposed Up-gradation of CETP Facilities for Tannery Cluster at Jajmau- Kanpur, Infrastructure Leasing & Financial Services Limited, Mumbai, India

Italprogetti Engineering (2014) Tirubala Exports India- Zero Liquid Discharge Project, Italprogetti Engineering, San Romano, Italy

James, B. R., Petura, J. C., Vitale, R. J. and Mussoline, G.R. (1997) Oxidation–reduction chemistry of chromium: relevance to the regulation and remediation of chromate-contaminated soils, Journal of Soil Contamination, Vol 6, pp 569–580

Kabdasli I., Tunay O., and Orhon D. (1999) Wastewater control and management in a leather tanning district, Water Science and Technology, Vol 40, pp 261–267

Lofrano G., Belgiorno V., Gallo M., Raimo A. and Meriç S. (2006) Toxicity reduction in

leather tanning wastewater by improved coagulation flocculation process. Global NEST Journal, Vol 8, pp 151–158

Lofrano, G., Meric, S., Zengin, G. E. and Orhon, D. (2013) Chemical and biological treatment technologies for leather tannery chemicals and wastewaters: A review, Science of the Total Environment, 461-462 (2013) 265-281

Ranganathan K. and Kabadgi S. (2011) Studies on feasibility of reverse osmosis (membrane) technology for treatment of tannery wastewater, Journal of Environmental Protection, Vol 2, pp 37-46

SENES Consultants India (P) Ltd. (2007) Detailed Project Report Vadodara Solid Waste Management, Specialists in Energy, Nuclear and Environmental Sciences Consultants Limited, Mumbai, India

Shukla S. (2013) Assessment of Some Aspects of Provisioning Sewerage Systems in Urban Agglomerations of Ganga River Basin, Department of Civil Engineering, Indian Institute of Technology, Kanpur, India

Song Z., Williams C.J. and Edyvean R. G. J. (2004) Treatment of tannery wastewater by chemical coagulation, Desalination, Vol 164, pp 249–259

Suthantharajan, R., Ravindranath, E., Chitra, K., Umamaheshwari, B., Ramesh, T. and Rajamani, S. (2004) Membrane application for recovery and reuse of water from treated tannery wastewater, Desalination, Vol 164, pp 151-156

Tammaro M., Salluzzo A., Perfetto R. and Lancia A. (2014) A comparative evaluation of biological activated carbon and activated sludge processes for the treatment of tannery wastewater, Journal of Environmental Chemical Engineering, Vol 2, pp 1445-1455

Tare, V., Gupta, S. and Bose, P. (2003) Case Studies on Biological Treatment of Tannery Effluents in India, Journal of the Air & Waste Management Association, Vol 53, pp 976-982

Tannery Zero Liquid Discharge Project Report (2014), Tirubala Tri Environment Private Limited, Kanpur, India

Toxics Link (2000) Common Effluent Treatment Plant – A solution or a problem in itself, Toxics Link, New Delhi, India

UNIDO (1998) Ultrafiltration Application in Tannery Waste Water Treatment, Regional Programme for pollution control in the tanning industry in South-East Asia, US/RAS/92/120

UNIDO (1998) Multiple Stage Evaporation System to Recover Salt from Tannery Effluent, Regional Programme for pollution control in the tanning industry in South-East Asia, US/RAS/92/120

UNIDO (2011), Introduction to Treatment of Tannery Effluents, United Nations Industrial Development Organization, Vienna

WSP Flagship Report (2011), Economic Impacts of Inadequate Sanitation in India, Water and Sanitation Program

PROJECT MANAGEMENT BOARD [PMB]

Expert Members:

- Sri Swami Avimukteshwaranand Saraswati
- Dr Madhav AChitale
- Dr Bharat Jhunjhunwala

PROJECT IMPLEMENTATION AND COORDINATION COMMITTEE [PICC]

Representatives from IIT Consortium:

- Dr ShyamAsolekar, IIT Bombay
- Dr A K Mittal, IIT Delhi
- Dr Mohammad Jawed, IIT Guwahati
- Dr Vinod Tare, IIT Kanpur
- Dr D J Sen, IIT Kharagpur
- Dr Ligy Philip, IIT Madras
- Dr I M Mishra, IIT Roorkee

Thematic Group Leads:

- Dr Purnendu Bose, Environmental Quality and Pollution (EQP)
- Dr A K Gosain, Water Resources Management (WRM)
- Dr R P Mathur, Ecology and Biodiversity (ENB)
- Dr Rajiv Sinha, Fluvial Geomorphology (FGM)
- Dr Vinod Tare, Environmental Flows (EFL)
- Dr S P Singh, Socio Economic and Cultural (SEC)
- Dr N C Narayanan and Dr Indrajit Dube, Policy Law and Governance (PLG)
- Dr Harish Karnick, Geospatial Database Management (GDM)
- Dr T V Prabhakar, Communication (COM)

COMPOSITION OF

1. Environmental Quality and Pollution (EQP)
Lead: Purnendu Bose, IIT Kanpur

Members: Shyam R Asolekar, Suparna Mukherjee (IIT Bombay); A K Mittal, A K Nema, Arun Kumar, T R Sreekrishanan (IIT Delhi); Ajay Kalmhad (IIT Guwahati); Saumyen Guha, Vinod Tare (IIT Kanpur); A K Gupta, M MGhangrekar, Sudha Goel (IIT Kharagpur); Ligy Philip, Mukesh Doble, R Ravi Krishna, S M Shivnagendra (IIT Madras); A A Kazmi, B R Gurjar, Himanshu Joshi, Indu Mehrotra, I M Mishra, Vivek Kumar (IIT Roorkee); Anirban Gupta (BESU Shibpur); P K Singh (IIT BHU); Rakesh Kumar (NEERI Nagpur); S K Patidar (NIT Kurukshetra); Sanmit Ahuja (ETI Dynamics, New Delhi)

2. Water Resources Management (WRM)
Lead: A K Gosain, IIT Delhi

Members: Rakesh Khosa, R Maheswaran, B R Chahar, C T Dhanya, D R Kaushal (IIT Delhi); Subashisa Dutta, Suresh Kartha (IIT Guwahati); Shivam Tripathi, Gautam Rai, Vinod Tare (IIT Kanpur); Anirban Dhar, D J Sen (IIT Kharagpur); B S Murty, Balaji Narasimhan (IIT Mdras); C S P Ojha, P Perumal (IIT Roorkee); S K Jain (NIH, Roorkee); Pranab Mohapatra (IIT Gandhi Nagar); Sandhya Rao (INRM, New Delhi)

3. Fluvial Geomorphology (FGM)
Lead: Rajiv Sinha, IIT Kanpur

Members: Vinod Tare (IIT Kanpur); Vikrant Jain (IIT Gandhi Nagar); J K Pati (Allahabad University); Kirteshwar Prasad, Ramesh Shukla (Patna University); Parthasarthi Ghosh, Soumendra Nath Sarkar, TapanChakarborty (ISI Kolkata); Kalyan Rudra (WBPCB); S K Tandon, Shashank Shekhar (University of Delhi); Saumitra Mukherjee (JNU Delhi)

4. Ecology and Biodiversity (ENB)
Lead: R P Mathur, IIT Kanpur

Members: A K Thakur, Vinod Tare (IIT Kanpur); Utpal Bora (IIT Guwahati); M D Behera (IIT Kharagpur); Naveen Navania, Partha Roy, Pruthi Vikas, R P Singh, Ramasre Prasad, Ranjana Pathania (IIT Roorkee); Sandeep Behera (WWF-India)

THEMATIC GROUPS

5. Socio Economic and Cultural (SEC)
Lead: S P Singh, IIT Roorkee

Members: Pushpa L Trivedi (IIT Bombay); Seema Sharma, V B Upadhyay (IIT Delhi); P M Prasad, Vinod Tare (IIT Kanpur); Bhagirath Behera, N C Nayak, Pulak Mishra, T N Mazumder (IIT Kharagpur); C Kumar, D K Nauriyal, Rajat Agrawal, Vinay Sharma (IIT Roorkee)

6. Policy Law and Governance (PLG)
Lead: N C Narayanan, IIT Bombay and Indrajit Dube, IIT Kharagpur

Members: ShyamAsolekar, Subodh Wagle (IIT Bombay); Mukesh Khare (IIT Delhi); Vinod Tare (IIT Kanpur); Deepa Dube, Uday Shankar (IIT Kharagpur); G N Kathpalia, Paritosh Tyagi (IDC, New Delhi)

7. Geo-Spatial Database Management (GDM)
Lead: Harish Karnick, IIT Kanpur

Members: N L Sharda, Smriti Sengupta (IIT Bombay); A K Gosain (IIT Delhi); Arnab Bhattacharya, Kritika Venkatramani, Rajiv Sinha, T V Prabhakar, Vinod Tare (IIT Kanpur)

8. Communication (COM)
Lead: T V Prabhakar, IIT Kanpur

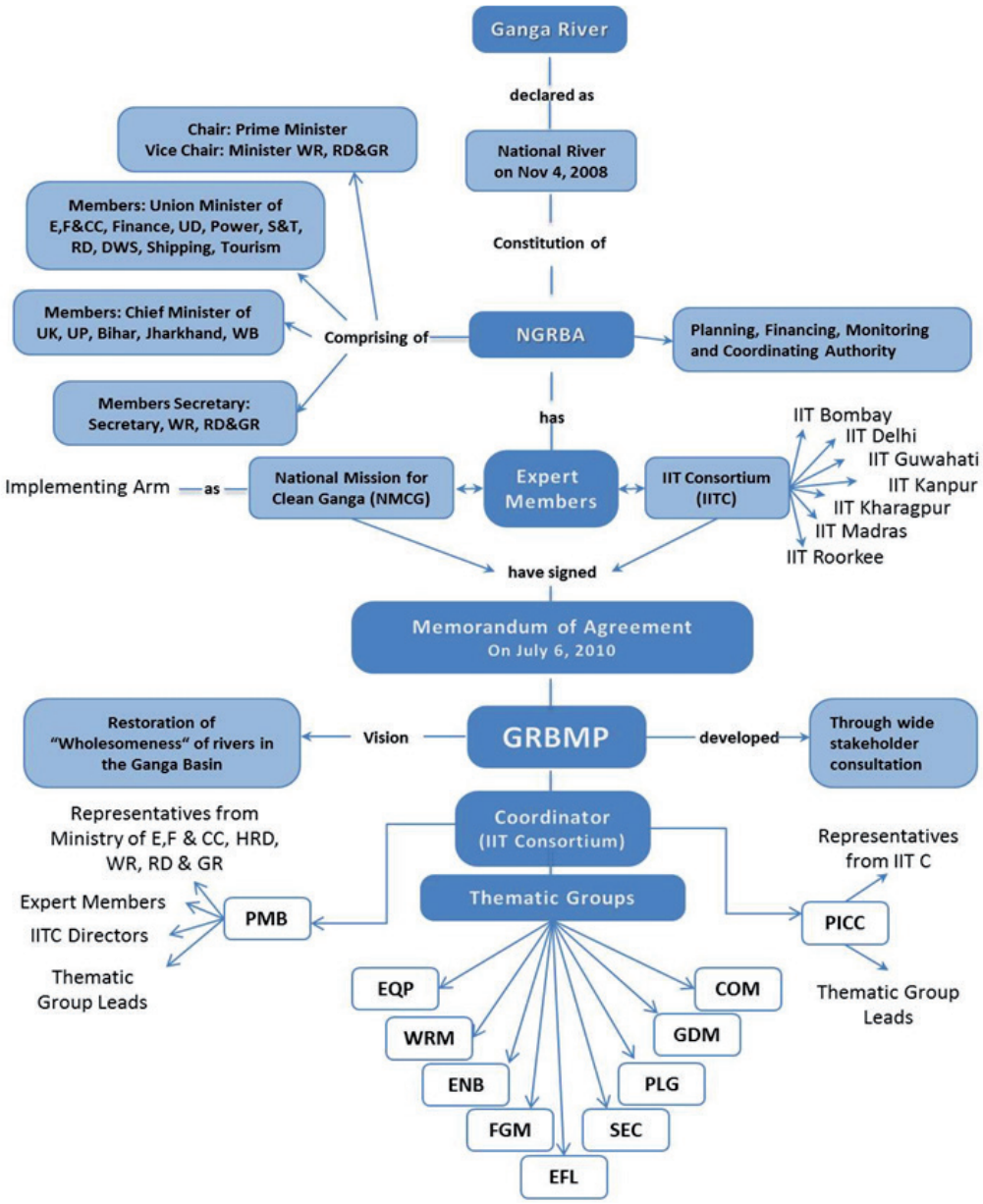
Members: Purnendu Bose, Rajiv Sinha, Vinod Tare (IIT Kanpur)

9. Environmental Flows (EFL)
Lead: Vinod Tare, IIT Kanpur

Members: ShyamAsolekar (IIT Bombay); A K Gosain (IIT Delhi); P M Prasad, R P Mathur, Rajiv Sinha, Shivam Tripathi (IIT Kanpur); M D Behara (IIT Kharagpur); B S Murthy, N Balaji (IIT Madras); Pranab Mohaparta, Vikrant Jain (IIT Gandhinagar); S K Jain (NIH Roorkee); Nitin Kaushal (WWF-India, New Delhi); Sandeep Behera (NMCG, MoWR, RD & GR, New Delhi); A P Sharma K D Joshi (CIFRI, Barrackpore); Ravindra Kumar (SWaRA-UP); Ravi Chopra (PSI, Dehradoon); Paritosh Tyagi, (IDC, New Delhi)

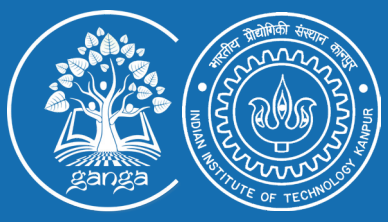
GRBMP WORK STRUCTURE

ORGANIZATIONAL STRUCTURE FOR PREPARING GRBMP



NGRBA: National Ganga River Basin Authority
NMCG: National Mission for Clean Ganga
MoEF: Ministry of Environment and Forests
MHRD: Ministry of Human Resource and Development
MoWR, RD&GR: Ministry of Water Resources, River Development and Ganga Rejuvenation
GRBMP: Ganga River Basin Management Plan
IITC: IIT Consortium
PMB: Project Management Board
PICC: Project Implementation and Coordination Committee

EQP: Environmental Quality and Pollution
WRM: Water Resources Management
ENB: Ecology and Biodiversity
FGM: Fluvial Geomorphology
EFL: Environmental Flows
SEC: Socio Economic and Cultural
PLG: Policy Law and Governance
GDM: Geospatial Database Management
COM: Communication



Centre for Ganga River Basin Management and Studies