Assessment of Some Aspects of Provisioning Sewerage Systems

in Urban Agglomeration of Ganga Basin

By

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Introduction

Consortium of 7 “Indian Institute of Technology”s has been engaged by the Government of India to prepare Ganga River Basin Management Plan (GRBMP). One of the most important challenges of the Consortium is to prepare an action plan for “Un-polluted Flow” or “Nirmal Dhara” in all rivers of the Ganga Basin. 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.

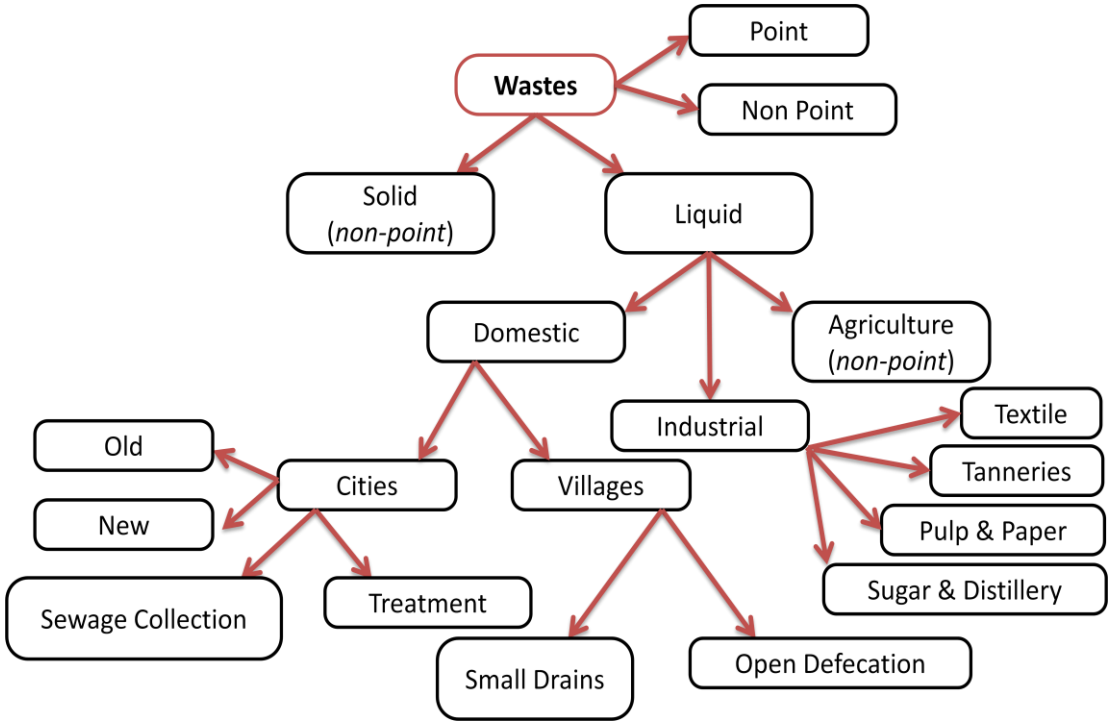

Figure 1.01: Types and Sources of Wastes and Main Identification Tasks
(IIT GRBMP Report, 2013)

Among point sources, urban and industrial wastewaters are the major sources of pollution, needing immediate remediation. In consideration of the magnitudes of domestic wastewater 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 sewerage infrastructure for medium to long term (over the next 25 years) are considered essential.

1. Complete stoppage of the discharge of sewage, either treated or un-treated, from Class I and Class II towns into any river.

2. All sewage generated in Class I and Class II towns of GRB needs to be collected and treated up to tertiary level with treated effluent standards of: Bio-chemical Oxygen Demand (BOD) < 10 mg/L; Suspended Solids (SS) < 5 mg/L; fully nitrified effluent; Phosphorous < 0.5 mg/L; Fecal Coliform (FC) < 230/100 mL.

3. The tertiary treated water should be reused for various non-potable purposes, such as industrial, irrigation, horticultural, and non-contact/non-potable domestic use. Unused treated water may be utilized for groundwater recharge but only via surface storages and subsequent infiltration and percolation through soil.

The above measures are essential to overcome the declining state of urban wastewater management 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. This attitudinal blockade is illustrated in Figure 1.02.

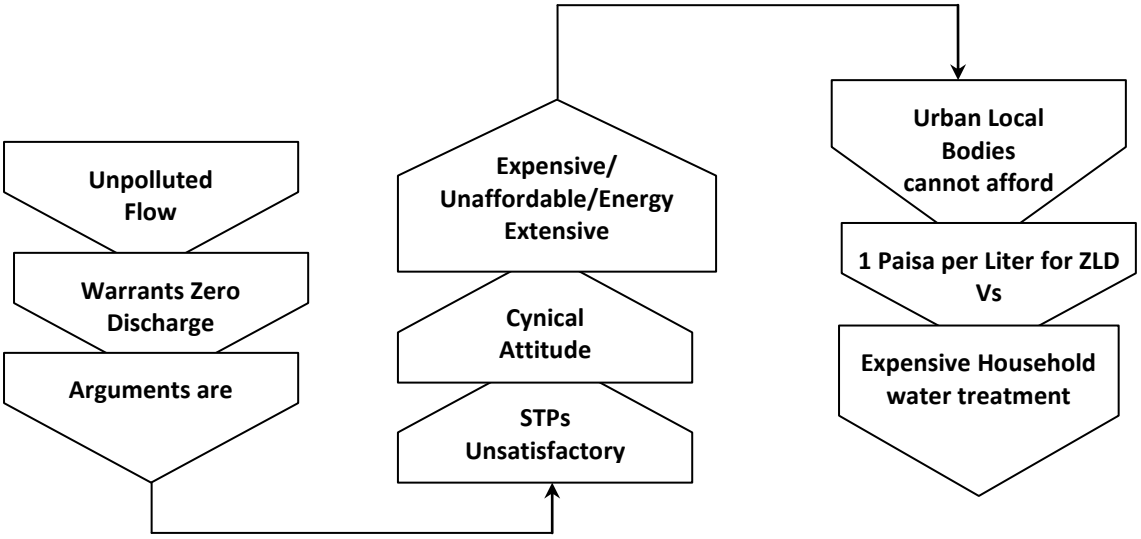

Figure 1.02: Schematic Representation of Attitudinal Blockade in Managing Urban Sewerage Infrastructure

But such despondency and cynicism can be easily overcome if water is considered as a "resource" rather than as "dirt". By adequately treating wastewater and re-using it instead of dumping the untreated or partially treated wastewater to sully the environment, 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 convince the policy makers. It is to satisfy this end that the present study was initiated.

1. Background and Review of Literature

1.1. General

The genesis of this study has been the recommendations of the Environmental Quality and Pollution (EQP) Group of the Consortium of 7 IITs preparing the Ganga River Basin Management Plan to have full coverage of sewerage systems in all urban agglomerations in the basin. It is important to have appropriate ballpark estimates of expenditure on provisioning sewerage systems, and the tangible and intangible benefits that would accrue. A complete sewerage system includes sewerage network, sewage pumping/lifting and sewage treatment. A study about the urban centers in India based on population estimates of 2008 from 2001 census by the Central Pollution Control Board (CPCB), New Delhi reports that capacity to partially treat only 11,787 MLD sewage (out of 38,524 MLD generated) exists in the country (CPCB, 2009). Most of these sewage treatment plants (STPs) do not perform satisfactorily for various reasons including grossly inadequate sewerage network and sewage pumping, and a very small fraction of sewage gets treated to the regulatory standards while most of the sewage finds its way directly or indirectly into the water bodies. Thus it would not be an exaggerated statement to say that most water supplies in the country are through highly polluted water bodies including rivers. As such it is necessary to have an estimate of expenditure on sewerage infrastructure for full coverage of urban agglomerations in the country, in general, and Ganga River Basin (GRB) in particular.

1.2. Cost Estimates of Sewerage Systems: Conventional Approach

The Central Public Health and Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development (CPHEEO Manual, 2013) provides following for cost estimates of sewerage systems.

a) Capital costs shall include all the cost such as civil construction, equipment supply and erection costs, land purchase 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.

According to the manual, the planning should start with the preparation of City Master Plan (CMP) and City Sanitation Plan (CSP) which should form the base of the sewerage system project. Presently very few towns have prepared CMPs and CSPs. And most CSPs are based on inadequate data and information. Use of GIS based information systems is rare.

1.2.1. Collection of Information

To calculate the cost of the sewerage systems, all the basic information is required to be collected. Some of the essential information/data includes

a) Topography of the area to be covered for design of sewers and location of sewage treatment works, outfall and disposal works

b) Subsoil conditions, such as the strata likely to be found, ground water table level.

c) Structures like storm drain and appurtenances, house connections for water supply and sewerage, electricity supply lines and telephone cables, gas pipelines, etc.

d) Sewerage 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.

e) Population data and quantification of sewer generation, water supply data, etc.

After collection of aforementioned information several reports like feasibility reports, pre-feasibility reports, and identification reports are to be made. This kind of work generally ends with the executive summary report which covers the project's essential features, basic strategy, approach adopted in developing the project, and the salient features of financial and administrative aspects.

1.2.2. Methodology

CPHEEO Manual (2013) recommends that cost estimation of each component of the project is prepared and annual requirement of funds for each year is worked out, due allowance should be made for physical contingencies and annual inflation. This exercise results in arriving at total funds required annually for the execution of the project. Further it is required to prepare recurring annual costs of the project for the next few years (say 10years) 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 unit of sewage treated and disposed, and comparing these with the government norms, if any.

Once the estimation of cost of sewerage systems is completed, 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.

1.3. Cost Estimates of Sewerage Systems: Other Approaches

The conventional approach followed is to 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. In most cases at the planning stage it is not possible to prepare BOQs. Mostly thumb rules and past experiences are used. Most of these thumb rules are not available in any published literature but are available with organisations involved in planning and execution of sewerage systems.

1.3.1. Sewerage Network

Sewerage network includes sewers and manholes. In order to have cost estimate, the first step is to compile information on lengths of various sizes of sewers, number and sizes of manholes, and unit costs. Generally the unit costs can be easily worked out for different settings. However, the other information is generally not available. Thus other approaches are necessary. For example, in estimation of sewerage network costs it is assumed that cost of pipes is about 15 % of the total network cost. But the use of this approach requires that total length of various diameter pipes be known. Again, as a thumb rule, it is assumed that 70 to 80 percent of total sewer length is of 150 and 200 mm diameter sewers. It is not possible to estimate the total length unless the detailed plan of the town is available. Essentially no published information could be found on this. Thus it is necessary to develop methods for estimating lengths of various sizes of sewers contributing to sewerage network. Similarlyoperation and maintenance costs are estimated based on thumb rules and taken as 1.5 % of the capital expenditure as per the survey conducted by Water and Sanitation Program (WSP Flagship Report, 2011)

1.3.2. Sewage Pumping

The major components of sewage pumping stations include pumps, civil works and miscellaneous material supplies such as inlet and outlet pipes, fittings such as valves, connectors, pipes, etc. In order to estimate pump sizes it is necessary to get the information on quantity of sewage to be pumped and the pumping head. No published literature could be found to arrive at the pump sizes without detailed design of sewer networks. For other items thumb rules are used by the practicing engineers and professionals. For example it is

assumed that civil construction cost of pumping stations is about 10 % of the cost of the pumps. Similarly, for the cost of miscellaneous material supplies is assumed as 1-2 % of the cost of pumps.

The operation and maintenance costs of pumping stations are essentially those of energy consumptions. Other costs are minor costs and are assumed to be 1 % of the energy bill.

1.3.3. Sewage Treatment

Estimation of sewage treatment costs requires information on treatment technology, unit costs and quantity of sewage to be treated. This can generally be done without detailed design as unit costs of various treatment technologies with their performance are available (Tare and Bose, 2009; IIT_GRB Report: 003_GBP_IIT_EQP_S&R_02_Ver 1_2010). Also estimation of quantity of sewage can be done based on population and water supply rates (CPHEEO Manual, 2013). Similarly operation and maintenance costs for various types of treatment technologies are also available (IIT_GRB Report: 003_GBP_IIT_EQP_S&R_02_Ver 1_2010).

1.4. Concluding Remarks

The conventional approach for estimation of expenditure on provisioning sewerage systems calls for detailed specifications of sewerage network, sewage pumping stations and sewage treatment plants. Requisite information to arrive at such information is often not available at the planning stage. This warrants exploring other approaches for ballpark estimates of sewerage systems at the planning stage which do not depend on detailed specifications. Essentially no published literature is available on such approaches although practicing engineers, professionals and consulting organisations engaged in planning and developing proposals adopt thumb rules based on past experiences and the data available from various detailed project reports. Such data are generally not accessible to all. It is plausible to develop approaches based on huge amount of information available on sewerage systems in India with urban local bodies, consulting firms and practicing engineers and professionals for ballpark estimates of sewerage systems with some reasonable assumptions.

2. Objective and Scope

State of sewerage infrastructure in India in general, and in Ganga River Basin in particular is very poor. This is believed to be due to lack of adequate resources required to develop such infrastructure. In the past few decades Government of India launched several large programmes such as Ganga Action Plan (GAP), Yamuna Action Plan (YAP), Jawaharlal Nehru National Urban Renewal Mission (JNNURM), etc. to pump in huge funds. However, this has been done without systemic assessment of the actual resources required, and to a large extent on an ad hoc planning. Also, very little planning has been done to fill the huge gap,

and for operation and maintenance of the assets created. As a result not much benefit has been seen on ground and no sustainable model is in the sight. It is very important that an appropriate techno-commercial frame work is developed for sustainable sewerage system for the urban centers.

The first and foremost requirement is to have an assessment of provisioning sewerage systems in economic sense. This need has been the genesis of the present study. Provisioning of sewerage systems yields certain benefits depending upon the choice of technologies and components, their designs, and efforts and investments made. Based on past experience of implementing aforementioned programmes and their wide spread criticism due to insignificant improvement in the pollution status of most water bodies, Consortium of 7 IITs preparing the Ganga River Basin Management Plan (GRBMP) is considering full coverage of sewage collection and treatment of sewage up to tertiary level so that treated sewage could be recycled and/or reused instead of disposal in water bodies or application on land in all urban agglomerations in the basin.

The present study is a part of this larger framework and aims at estimating the financial layout for provisioning sewerage infrastructure in all Class I and Class II towns of the Ganga River Basin (GRB) with the objective of recycling and reuse of sewage alongwith assessment of fresh water savings that could facilitate in management of Environmental Flows (E-Flows) in the rivers. Following specific objectives are set for this study to achieve this goal.

1. Develop suitable methodology for obtaining ballpark estimates for full coverage of sewerage network in Class I and Class II towns of GRB.
2. Develop suitable framework for obtaining ballpark estimates for sewage pumping and sewage treatment up to tertiary level.
3. Obtain ballpark estimates of capital investments for provisioning sewerage infrastructure 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 sewerage infrastructure on individuals residing in the urban agglomerations of GRB.
5. Assessment of fresh water savings that can assist in managing Environmental Flows (E-Flows) in the rivers.

The scope of the study is restricted to availability of secondary data on (i) design and cost estimation of sewerage network for various urban centers in India from urban local bodies, consultants and practitioners, (ii) empirical practices used in design and cost of estimation of sewage pumping stations, (iii) sewage treatment plant design and cost estimation available with Consortium of 7 IITs, and (iv) population from 2011 census and areas of Class I and Class II towns of GRB as collected from various urban local bodies.

3. Methodology

3.1. General

Sewerage infrastructure includes (i) sewer network, (ii) sewage pumping and (iii) sewage treatment plants. 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.

3.2. Estimation of Capex and Opex of Sewerage Network

This involves estimation of length of sewer 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 sewer lines, surface relaying, costs of manholes, labors, dewatering, etc.

An empirical approach is followed to arrive at these costs. Data from approximately 45 different urban locations where sewer networks have been laid or designed is 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.

Several approaches, outlined as follows by which unit costs could be worked out, were attempted.

Approach I: 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 INR 4,000 to 5,500 per meter of the sewer length. This is the cost of laying the fresh sewer lines with minimal hindrances as it includes only, the supply of materials, barricading the area, timbering in trenches, excavation of earth, laying, jointing of sewer lines, surface relaying, costs of manholes, labors, dewatering etc. 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 INR 6,500 -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. The unit costs considered in this study are as follows.

- INR 5,000 for green field sites.
- INR 8,000 for sties involving few hindrances and moderate degree of congestion.
- INR 10,000 for sties involving many hindrances and high degree of congestion.

Approach II: Unit cost of the sewer pipes can be estimated with high degree of confidence and does not vary much from one site to the others. Thus for various projects cost estimates were made based on BOQs of various items and percentage of the cost incurred in supply of sewer pipes was computed. The cost of supply of sewer pipes ranged between 12 to 15 percent of the total amount of the sewer line laying, jointing, labors, excavation of soil, manholes, etc. Based on this the total cost of sewerage network can be taken as x/0.15, where x is the cost of supply of sewer pipes. In this study this is only used for cross validation of the costs estimated using Approach I described earlier.

Approach III: In this approach unit cost of various sizes of pipes is calculated based on BOQs and keeping provision for some exigencies based on tips received from practicing engineers. The average unit cost is worked out through weighted average based on percentage lengths of various size pipes in the total sewer network length. This approach is also used for cross validation of the costs estimated using Approach I described earlier.

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)

3.3. Estimation of Capex and Opex of Sewerage Pumping

Sewage 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 sewage flow, (ii) average 12 hour pumping in a day, (iii) pumping head assuming 1 in 80 slope of the trunk sewer and length of the trunk sewer as diagonal of area served by sewerage network assuming shape of town to be a square. Cost of the pumps is estimated based on market survey and information provided by practicing engineers as INR 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 sewage pumping is computed based on energy consumption for running the pumps considering prevailing average electricity tariff (INR 6 per KW-h or a unit of electricity consumed). In addition, 1 % of energy bill for running the pumps is considered as other miscellaneous opex for sewage pumping based on thumb rule generally used by practicing engineers and consulting firms.

3.4. Estimation of Capex and Opex of Sewage Treatment Plant

Estimation of cost of sewage treatment has been done considering that the sewage treatment plants will use sewage as source of water and produce water that would be suitable for reuse for many purposes including that for non-human contact domestic activities such as toilet flushing, car/floor washing, air conditioning, other bulk commercial uses, horticulture and gardening, and maintaining surface water bodies for recreation and ground water recharging. Typically the treatment would be done in three stages, namely primary, secondary and tertiary. For cost estimations, most widely used and time tested conventional activated sludge process (ASP) is considered at the secondary level with sludge dewatering adopting filter press or centrifuge instead of sludge drying beds. At the tertiary level, coagulation-flocculation followed by filtration is considered for cost estimation purposes.

Much of the information used for cost estimation is adopted from the report prepared by Consortium of 7 IITs preparing GRBMP (IIT_GRB Report, 2010). However, cost estimates have been revised for the current year i.e. 2013. Relevant information is presented in Table 4.1.

Table 4.01: Details of Information Used in Cost Estimation of Sewage Treatment

Item Number	Item	Value	Range
1.0	**Expected Outlet Parameters after Secondary Treatment**		
1.1	Effluent BOD, mg/L	<20	
1.2	Effluent SS, *mg/L*	<30	
1.3	Faecal coliform removal, *log unit*	2 - 3	
1.4	T-N Removal Efficiency, *%*	10-20	
1.5	Nitrification	> 95 %	
2.0	**Expected Outlet Parameters after Tertiary Treatment**		
2.1	Effluent BOD, *mg/L*	< 10	
2.2	Effluent SS, *mg/L*	< 5	
2.3	Effluent NH_3-N, *mg/L*	< 1	
2.4	Effluent TP, *mg/L*	< 0.5	
2.5	Effluent Total Coliforms, *MPN/100 mL*	10	
3.0	**Capital Cost, Millions of INR/MLD**		
3.1	Total Capital Cost (Secondary + Tertiary)	11	10 - 12.5
3.2	Civil Works, *% of total capital costs*	60	
3.3	E & M Works, *% of total capital costs*	40	

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Item Number	Item	Value	Range
4.0	**Land Requirement, ha/MLD**		
4.1	Average Area, *ha/MLD* *Secondary Treatment + Secondary Sludge Handling*	0.09	
4.2	Average Area, *ha/MLD* *Tertiary Treatment + Tertiary Sludge Handling*	0.01	
4.3	Total Area, *ha/MLD* *Secondary + Tertiary Treatment*	0.10	0.08-0.1
5.0	**Operation and Maintenance Cost, Millions of INR/MLD/Year**		
5.1	**Cost of Energy**		
5.1.1	Avg. Technology Power Requirement, *kWh/d/MLDSecondary Treatment + Secondary Sludge Handling*	200	180 - 220
5.1.2	Avg. Technology Power Requirement, *kWh/d/MLD* *Tertiary Treatment + Tertiary Sludge Handling*	1	
5.1.3	Avg. Non-Technology Power Req., *kWh/d/MLD* *Secondary Treatment*	7	5 - 7.5
5.1.4	Avg. Non-Technology Power Req., *kWh/d /MLD* *Tertiary Treatment*	0.2	
5.1.5	Total Daily Power Requirement (avg.), *kWh/d /MLD*	208.2	
5.1.6	Daily Power Cost (@*Rs.*6.0 per KWh), *INR /MLD/h* *(Including Standby power cost)*	52.05	
5.1.7	Yearly Power Cost, Millions of INR/MLD/Year	4.56	
5.2	**Cost of Repairs**		
5.2.1	Civil Works per Annum, *as % of Civil Works Cost*	3	
5.2.2	E&M Works, *as % of E&M Works Cost*	1	
5.2.3	Civil Works Maintenance, Millions of INR/MLD/Year	0.2	
5.2.4	E & M Works Maintenance, Millions of INR/MLD/Year	0.04	
5.2.5	Annual repairs costs, Millions of INR/MLD/Year	0.24	
5.3	**Cost of Chemicals**		
5.3.1	Total Chemical Cost, Millions of INR/MLD/Year	0.61	
5.4	**Manpower Cost**		
5.4.1	Manager, *Millions of INR. pa* (1 No.)	0.42	
5.4.2	Chemist/Engineer, *Millions of INR pa (1 No.)*	0.42	
5.4.3	Operators, *Millions of INR pa (6@ INR 15000 pm)*	1.08	
5.4.4	Skilled technicians, *Millions of INR pa (6@ INR 12000 pm)*	0.864	
5.4.5	Unskilled personnel, *Millions of INR pa (6@ INR 10000 pm)*	0.72	
5.4.6	Total Salary Costs, Millions of INR/MLD/Year	3.5	
5.4.7	Benefits (50% of total salary), Millions of INR/MLD/Year	1.76	
5.4.8	Salary + Benefits, Millions of INR/MLD/Year	5.26	
5.4.9	Total annual O&M costs, Millions of INR/MLD/Year	1.40	
6.0	**NPV (2013) of Capital + O&M Cost for 30 years, Millions of INR/MLD/Year**	**22.34**	
Total Treatment Cost, INR/KL		**7.90**	

4. Results and Discussion

4.1. General

An appropriate techno-commercial frame work is a prerequisite for sustainable sanitation solutions in urban centers. The first step towards developing such a framework is to have an assessment of provisioning sanitation systems in economic sense. Provisioning of sanitation systems yields certain benefits depending upon the choice of technologies and components, their designs, and efforts and investments made. For example onsite sanitation systems like septic tanks, soak pits, etc. may appear to be low cost, less energy consuming, and simple, but may also pose serious concerns such as pollution of surface and ground waters. On the other hand sewerage system with provision of treating sewage up to tertiary level and using treated sewage for various beneficial uses may be considered very complex and unaffordable. Making a right decision is greatly facilitated if costs and benefits can be assessed.

The present study aims at estimating the per capita expenditure on sewerage system with provision of reuse and recycle of water which can subsequently be compared with other options. It is also important to note that energy consumption and footprint are also important alongwith expenditure incurred and hence are also estimated separately. The study also aims at estimating the financial layout for provisioning sewerage infrastructure in all Class I and Class II towns of the Ganga River Basin (GRB) with the objective of recycling and reuse of sewage alongwith assessment of fresh water savings that could facilitate in management of Environmental Flows (E-Flows) in the rivers.

Sewerage infrastructure includes (i) sewer network, (ii) sewage pumping and (iii) sewage treatment plants. 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.

4.2. Sewerage Network

Estimation of costs of sewerage network calls for complete layout including lengths of sewers of various diameters, number and sizes of manholes, ground conditions (type of soil/rock, water table, present usage, etc.), depth of sewers, etc. Gathering such type of information is a humungous task and is generally not available prior to preparation of detailed project report (DPR). Hence, an empirical approach is followed to arrive at ballpark estimates.

4.2.1. Estimation of Sewer Lengths

Data from 45 different Indian urban locations where sewer networks have been laid or designed is gathered from various local bodies, consulting firms and practicing engineers. Based on these data empirical correlations are examined to first estimate the lengths of various diameter sewers as a function of area covered and population served. The outcome of such correlations is presented in Table 5.01 and Figures 5.01 to 5.03.

Table 5.01: Outcome of Empirical Correlations to Estimate Lengths of Various Diameters of Sewers as a Function of Area Covered and Population Served

S No	Diameter of Sewer in mm	Length of Sewer in Km as a Function of Area Covered in km^2 and Population Served in Thousands	Number of Data Points	Coefficient of Correlation, (R)	Value of R for Statistically Significant Correlation at 95 % Confidence Level
01	150	$5.045 * (A^{0.284}) * (P^{0.632})$	45	0.828	0.294
02	200	$4.420 * (A^{0.523}) * (P^{0.485})$	45	0.916	0.294
03	250	$0.116 * (A^{0.533}) * (P^{0.209})$	45	0.743	0.294
04	300	$0.182 * (A^{0.481}) * (P^{0.358})$	45	0.807	0.294
05	350	$0.817 * (A^{0.185}) * (P^{0.336})$	39	0.260	0.316
06	400	$0.167 * (A^{0.426}) * (P^{0.228})$	41	0.554	0.308
07	450	$0.480 * (A^{0.299}) * (P^{0.326})$	44	0.571	0.297
08	500	$0.005 * (A^{0.850}) * (P^{-0.263})$	33	0.755	0.344
09	600	$0.041 * (A^{0.650}) * (P^{0.021})$	42	0.628	0.304
10	700	$0.007 * (A^{0.803}) * (P^{-0.087})$	25	0.742	0.396
11	750	$0.407 * (A^{0.305}) * (P^{0.170})$	33	0.600	0.344
12	800	$0.190 * (A^{0.404}) * (P^{0.141})$	31	0.438	0.355
13	900	$0.012 * (A^{0.809}) * (P^{0.134})$	35	0.666	0.334
14	1000	$0.142 * (A^{0.526}) * (P^{0.530})$	29	0.841	0.367
15	1100	$1.487 * (A^{0.319}) * (P^{0.797})$	33	0.811	0.355
16	1200	$0.636 * (A^{0.201}) * (P^{-0.552})$	11	0.394	0.602
17	1400	$0.456 * (A^{0.386}) * (P^{0.309})$	11	0.721	0.602
18	1600	$0.611 * (A^{0.414}) * (P^{0.416})$	12	0.726	0.576

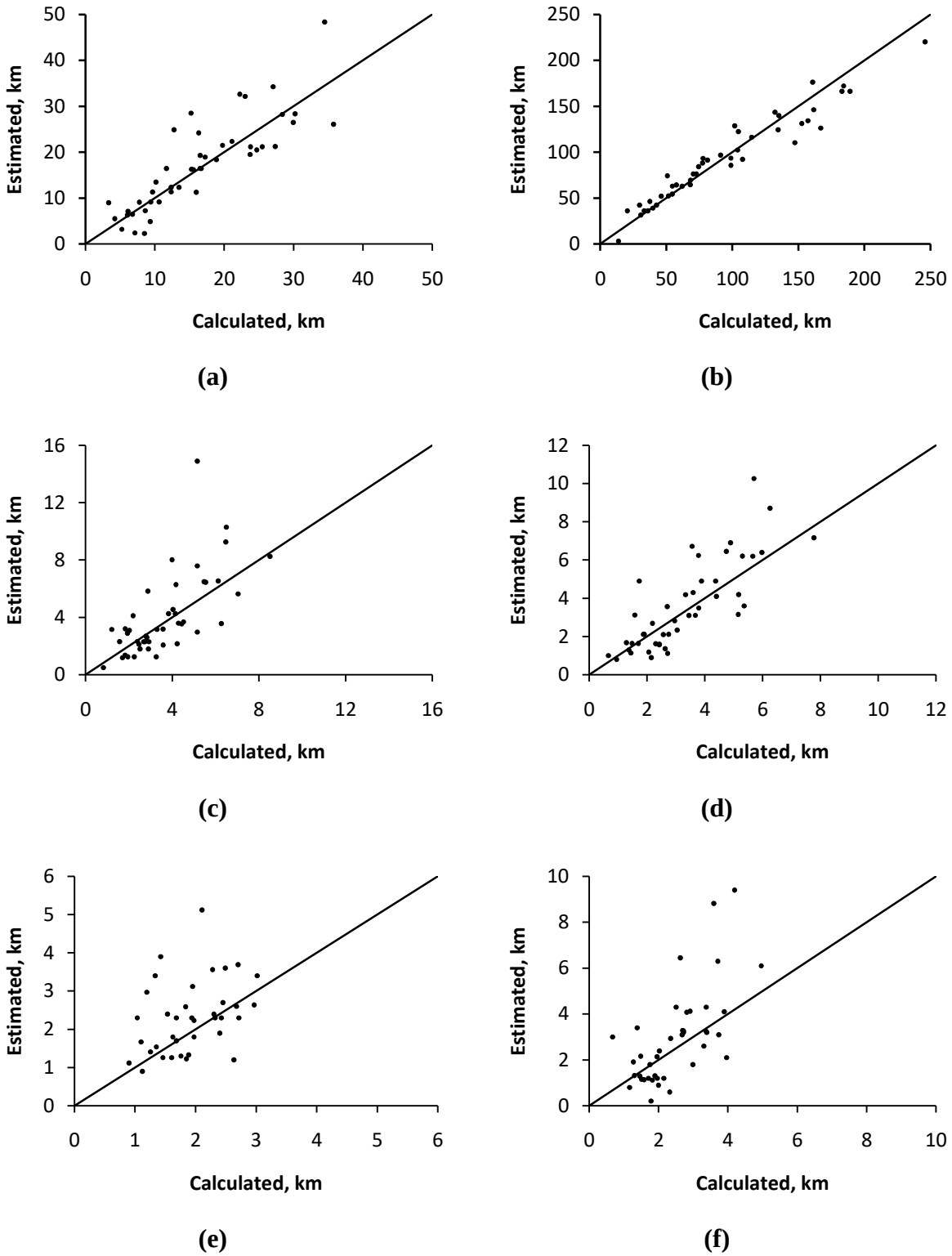

Figure 5.01: Representation of Estimated Versus Calculated Lengths of (a) 150, (b) 200, (c) 250, (d) 300, (e) 350, and (f) 400 mm Diameter Sewers

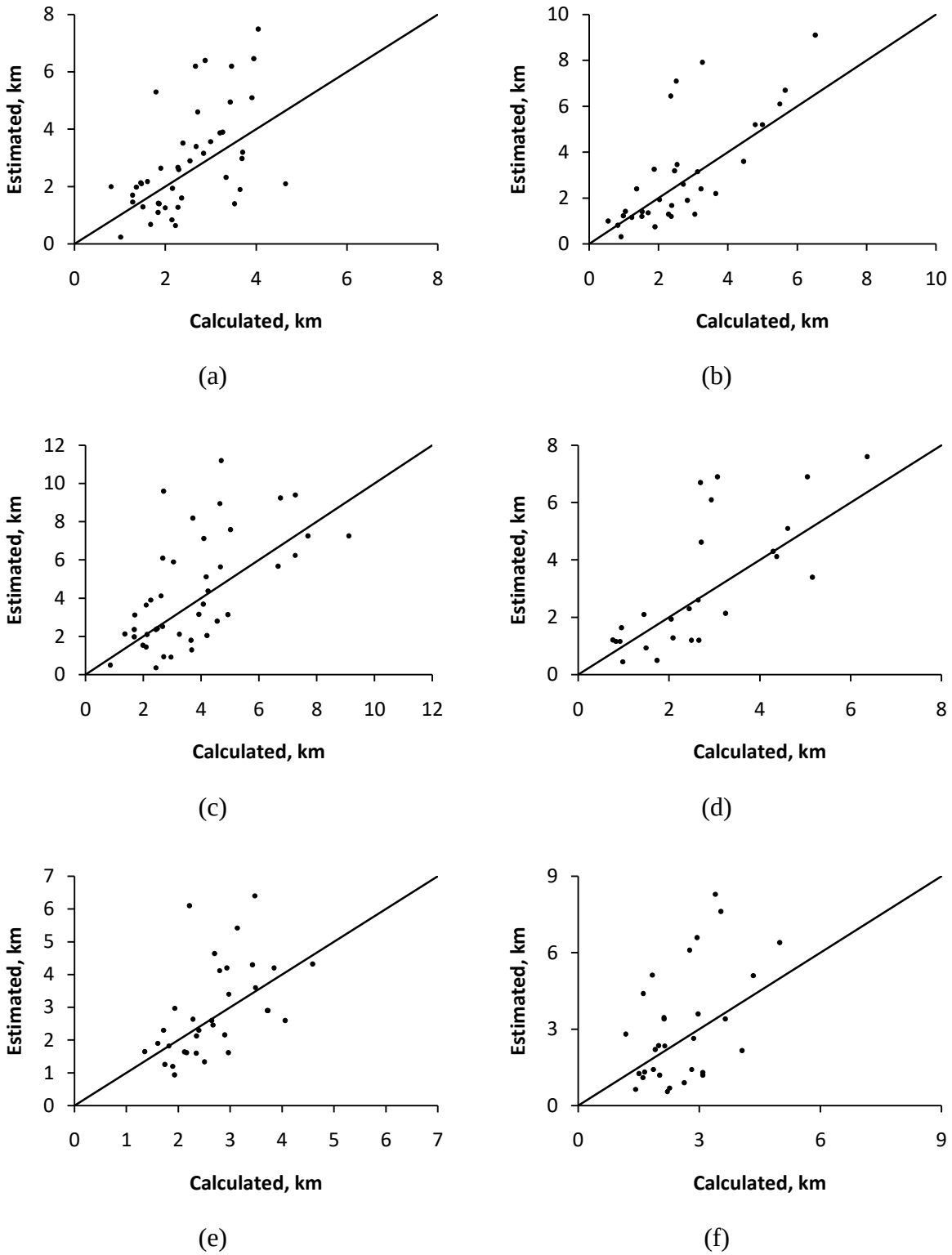

Figure 5.02: Representation of Estimated Versus Calculated Lengths of (a) 450, (b) 500, (c) 650, (d) 700, (e) 750, and (f) 800 mm Diameter Sewers

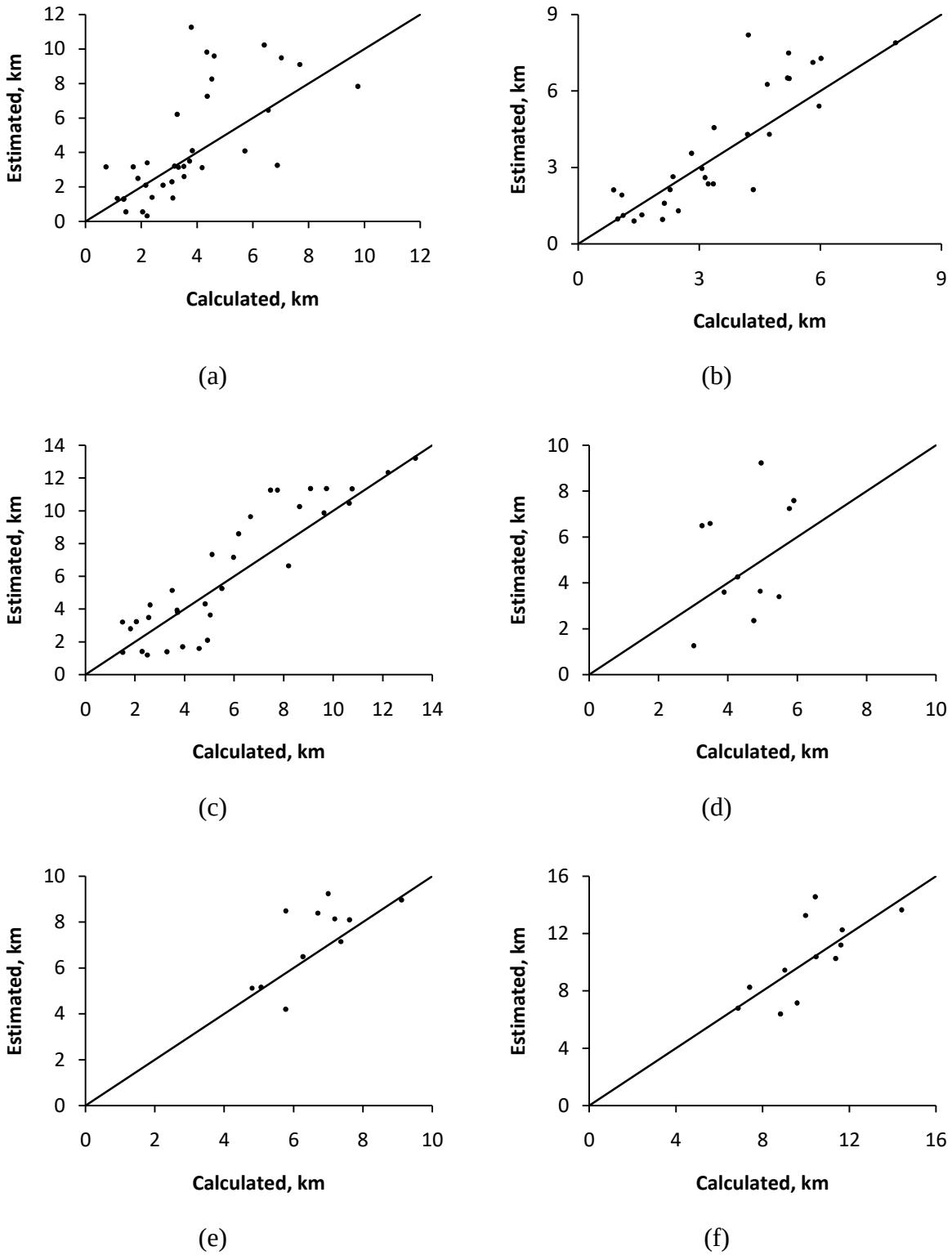

Figure 5.03: Representation of Estimated Versus Calculated Lengths of (a) 900, (b) 1000, (c) 1100, (d) 1200, (e) 1400, and (f) 1600 mm Diameter Sewers

Except for 300 and 1200 mm diameter pipes, the relationships developed are statistically significant at 95 % confidence level. The correlations developed are considered acceptable for arriving at ballpark estimations of lengths of laterals and branch sewers not more than

750 mm diameter. For main or trunk sewers length could be approximately taken as diagonal of the town assuming town area to be square shape. The trunk sewer is designed for (i) total sewage generated from a town, (ii) maximum depth of flow as 3/4th of diameter of sewer, (iii) slope of 1 in 1000, (iv) Manning's Coefficient as 0.01 for HDPE pipe, (v) infiltration at 10 % and (vi) peak factor 2.25 as per CPHEEO Manual (CPHEEO, 2013). Branch sewers are considered to be of maximum 750 mm diameter or one available size lower than the size of the trunk sewer, whichever is lower. Population of Cass I and Class II towns has been taken from Census 2011 data. Water supply rate is taken as 135 lpd (CPHEEO, 2013) and sewage generation is assumed to be 80 % of water supply. Information on area of towns is obtained from local bodies and/or information available on internet such as Google earth. With the information given here and empirical equations reported in Table 5.01, lengths of various diameter pipes were calculated for Class I and Class II towns of GRB to arrive at ballpark estimates of total length of sewerage network. Information on population, area, estimated total length of sewers, percentage distribution of various size of primary, lateral, branch sewers, and trunk sewers is presented state wise for Class I and Class II towns of GRB in Appendix I (Tables A1.01 to A1.22).

A comparison of the estimated percentage distribution of lengths of various diameter sewers for a typical Class I town whose actual data was available is presented in Figure 5.04. Results suggest that the estimated and actual distribution match reasonably well for the purpose of arriving at ballpark estimates.

The correlations could be substantially improved if actual data on road lengths is also made available so that lengths of sewers are considered as function of road length and population density. It is to be noted that this approach is not to be used for obtaining actual lengths of sewers in a town.

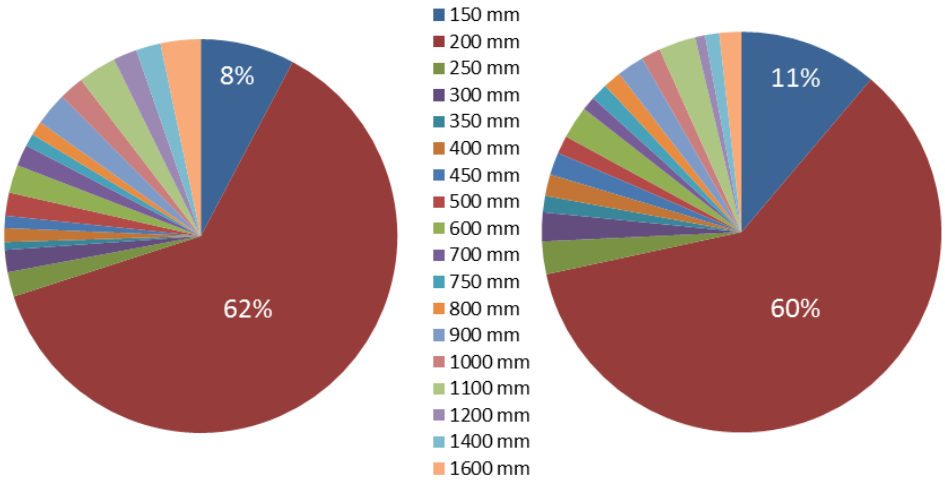

Figure 5.04: Comparison of the Estimated and Actual Percentage Distribution of Lengths of Various Diameter Sewers for a Typical Class I Town

4.2.2. Estimation of Costs

Sewerage network costs have been estimated by multiplying the weighted average (based on percentage distribution of various diameter sewers shown in Figure 5.04) unit cost per meter length of sewer laid (including all items in BOQs) multiplied by the total length of sewer network estimated as given in previous section. The details of typical estimated unit costs for various diameter sewers as per BOQ are presented in Table 5.02 and Figures 5.05.

The estimated weighted average unit cost varies from INR 4,000 to 5,000 per meter of the sewer length for various towns. This is the cost of laying the fresh sewer lines with minimal hindrances as it includes only, the supply of materials, barricading the area, timbering in trenches, excavation of earth, laying, jointing of sewer lines, surface relaying, costs of manholes, labors, dewatering etc. Typical breakup of average unit costs as per BOQ amongst major components is presented in Figure 5.06. However, considering low to moderate and moderate levels of hindrances in Class I and Class II towns average unit costs are considered to be INR 7000 and INR 6000 per m length of sewers respectively for estimating the expenditure on sewerage network in GRB based on discussions with practicing engineers and representatives of several consulting firms involved in turnkey projects on sewerage systems such as Tata Consulting Engineers, AECOM, etc.

Table 5.02: Typical Estimated Percentage Contributions of Various Items in Unit Cost of Laying Sewers of Different Diameters

Item	Sewer Diameter, mm												
	150	200	250	300	350	400	450	500	600	700	750	>750	Weighted Average
MS	5.3	4.9	4.5	4.0	3.2	2.9	2.5	2.1	1.6	1.3	1.1	0.6	3.2
Excavation	2.2	4.0	6.5	9.0	10.9	15.5	19.3	23.9	29.2	34.0	36.7	47.7	19.1
Timbering	23.5	24.3	25.2	24.4	21.8	21.5	19.4	18.0	15.3	13.1	12.3	9.0	19.0
Pipe Cost	7.1	8.2	8.5	11.0	19.5	19.3	18.6	16.8	18.5	17.6	17.3	20.4	13.2
Laying	3.6	4.9	4.5	6.6	7.5	6.8	7.4	7.0	5.8	5.5	5.3	6.1	5.4
Sand filling	0.6	0.5	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.3
Dewatering	2.3	2.1	1.9	1.7	1.4	1.3	1.0	0.9	0.7	0.5	0.5	0.3	1.4
CW	2.1	2.6	3.0	3.2	3.0	3.1	2.9	2.8	2.5	2.4	2.3	1.6	2.4
Manholes	53.3	48.6	45.3	39.7	32.3	29.3	28.6	28.2	26.3	25.4	24.5	14.3	36.0

MS: Material Supply; CW: Concrete Work

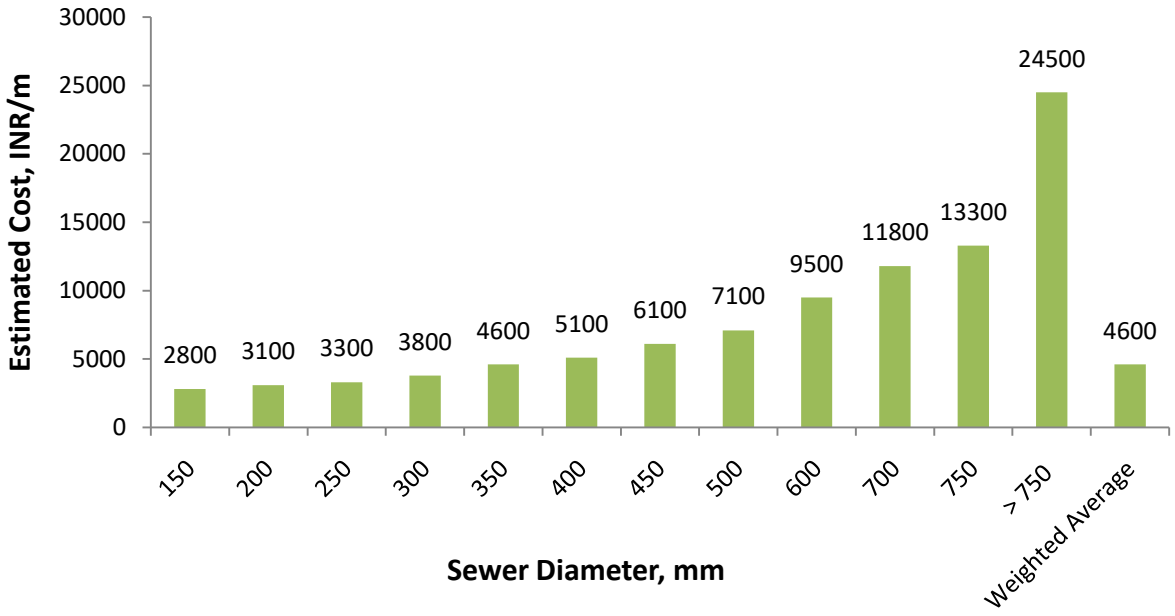

Figure 5.05: Typical Variation in Unit Cost of Laying Sewer of Various Diameters

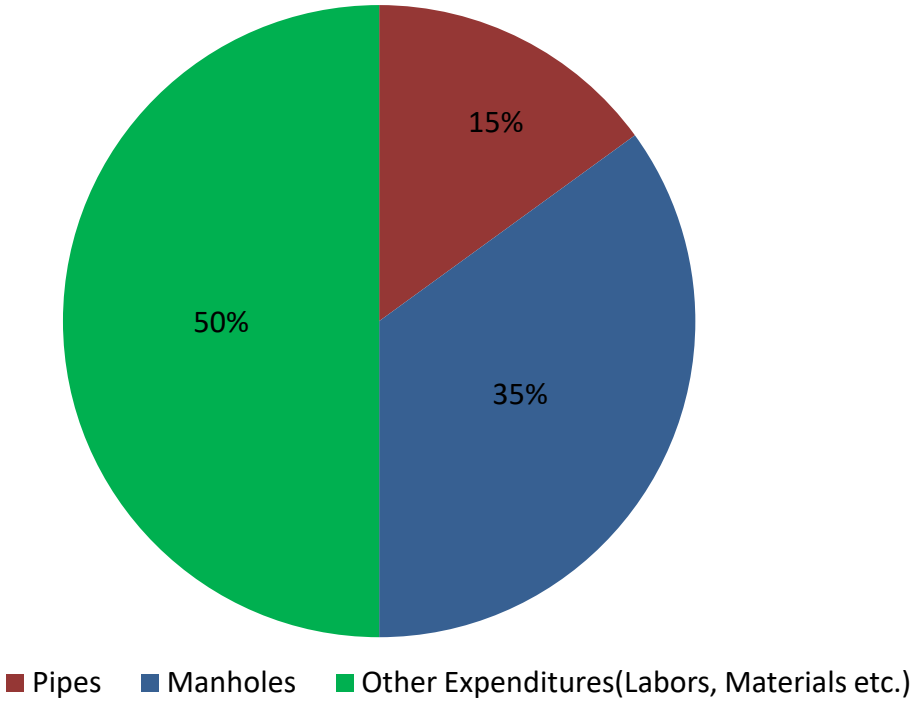

Figure 5.06: Typical Break up of Capital Expenditure (Capex) on Sewerage Network

4.3. Sewage Pumping

A typical pattern of distribution of estimated expenditure on sewage pumping adopting the methodology described in Section 4.3 is presented in Figures 5.07 to 5.09.

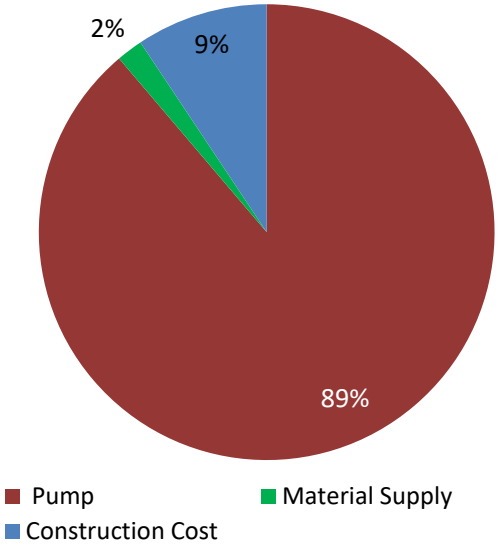

Figure 5.07: Typical Breakup of Estimated Capital Expenditure on Sewage Pumping Stations

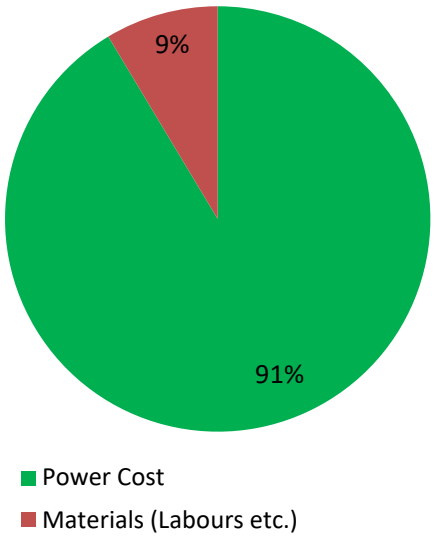

Figure 5.08: Typical Breakup of Operation and Maintenance Expenditure on Sewage Pumping Stations

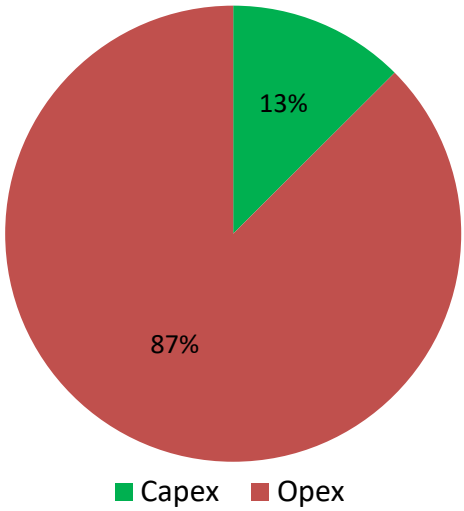

Figure 5.09: Typical Distribution of Estimated Annualized Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Sewage Pumping

It may be noted that in sewage pumping the major expenditure is on Operation and Maintenance (almost 85 – 90 %) in which 90 % is on energy consumption. In the capital expenditure, the major expenditure (almost 85 – 90 %) is on procurement of pumps.

4.4. Sewage Treatment

The cost of treating sewage is estimated with the consideration that sewage would be converted into water that could be recommended for use for all domestic, commercial, industrial, horticultural and agricultural purposes except for direct human contact such as drinking, bathing, etc. This is based on the extensive studies conducted by Consortium of 7 IITs for preparing Ganga River Basin Management Plan (GRBMP). For ballpark estimates of such kind of treatment a standard chain of treatment processes involving activated sludge process at the secondary level and coagulation-flocculation followed by rapid sand filtration and disinfection using chlorination at the tertiary level is considered. It is to be noted that this does not imply that other equivalent treatment processes are not acceptable. It is to arrive at most reasonable and conservative estimates for planning processes that such a treatment chain is considered in this study.

The capital investment (Capex) and annual operation and maintenance expenditure (Opex) for such treatment has been worked out as INR 11 and 1.4 million per MLD respectively (refer Section 4.4). Considering 30 year of operation and maintenance (Opex) cost and discounting at 12% per year, a typical net present value (NPV) of expenditure on sewage treatment is estimated at INR 22.34 million/MLD. A typical breakup of capex and opex on sewage treatment is presented in Figure 5.10.

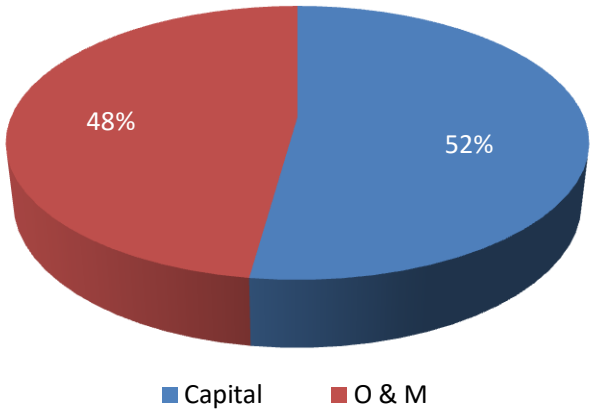

Figure 5.10: Typical Breakup of Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Sewage Treatment

4.5. Sewerage System

The entire sewerage system costs can be arrived at by adding the cost of its three components, namely sewerage network, sewage pumping and sewage treatment. The results are presented in Figures 5.11 and 5.12.

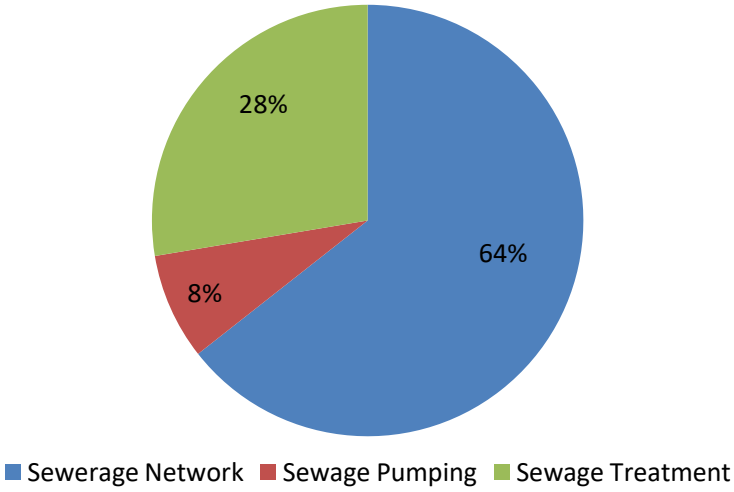

Figure 5.11: Typical Breakup of Estimated Total Annual Expenditure Amongst Three Components of Sewerage Systems

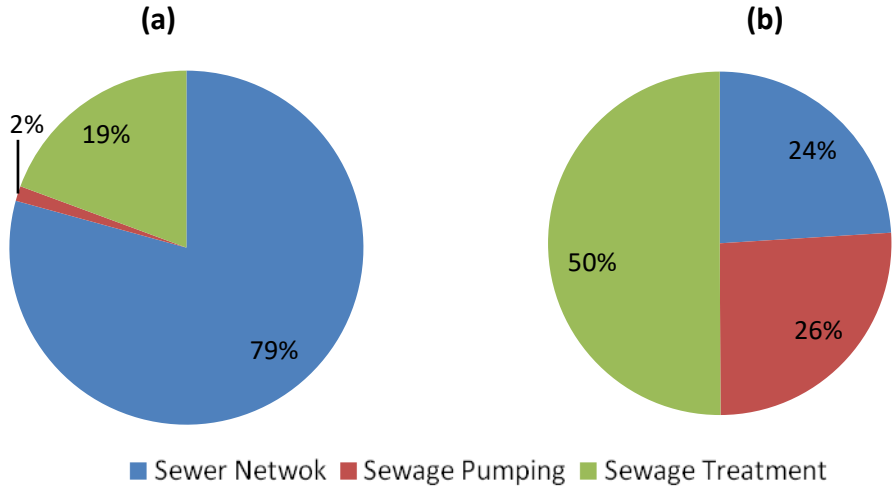

Figure 5.12: Typical Breakup of Estimated (a) Capex and (b) Opex Expenditure Amongst Three Components of Sewerage Systems

It is important to note that major share (64%) of the total annual expenditure is incurred on sewerage network, which is unavoidable if water flush toilets are used and onsite treatment of sewage is not possible. This is generally the case in most urban agglomerations. These costs could be substantially reduced if several small sewerage networks are planned as this would effectively reduce the total area covered while serving the same population as sewerage network cost increases at a much higher rate with increase in coverage area than

the increase in population. This can be inferred from the empirical relations developed for estimating lengths of different diameter sewers (refer Table 5.01). For higher diameter sewers, exponent of area is much higher than that for population, and hence contribution of higher diameter sewers to the sewerage network costs increases. This supports the case of decentralized sewerage systems.

Analysis of opex expenditure on sewerage systems (Figure 5.12 b) reveals that 26 % of the expenditure is incurred on pumping sewage, which again can be substantially reduced if the area covered is reduced. It is important to note that out of the 26 % opex expenditure on sewage pumping approximately 91 % is on energy which increases the carbon footprint. It is also important to note that out of total annual energy consumption on sewerage system, major portion (56 %) is on sewage pumping (Figure 5.13). While energy consumption on sewage pumping can be reduced by adopting decentralized sewerage network, energy consumption on sewage treatment is unlikely to change.

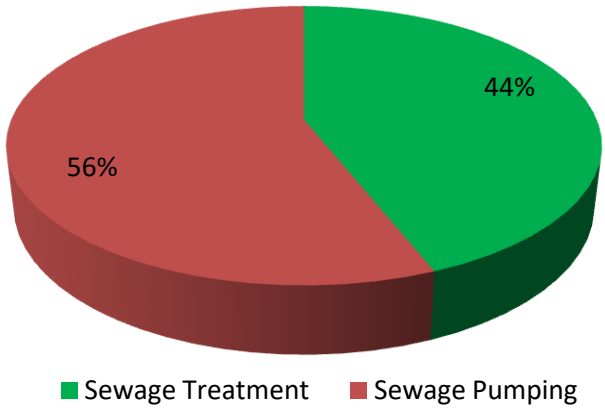

Figure 5.13: Typical Distribution of Energy Consumption between Sewage Treatment and Sewage Pumping in Centralized Sewerage Systems

4.6. Estimated Cost of Provisioning Sewerage Systems in Major Urban Agglomerations in Ganga River Basin

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) an attempt has been made to arrive at ballpark estimates of expenditure on provisioning sewerage infrastructure. 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 A2.01 to A2.22 in Appendix II present (i) population as per Indian Census 2011, (ii) estimated sewage generation as per CPHEEO guidelines (CPHEEO Manual, 2013), (iii) approximate

town area, (iv) estimated total length of sewerage network, (v) capital expenditure on all three components of sewerage system, and (vi) the total estimated capital expenditure on provisioning complete sewerage infrastructure 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 sewerage infrastructure for Class I and Class II towns of each of the GRB states is presented in Tables 5.03 to 5.05 based on information given in aforementioned tables of Appendix II. Provisioning of toilets and connection to the sewerage network are excluded from these estimates as these are considered as part of housing infrastructure.

For each Class I and Class II towns of GRB, annual expenditure on the capital investment (Capex) for all three components of sewerage systems has been worked out by multiplying capital expenditure with capital recovery factor (CRF). The CRF has been calculated as 0.147 using 12 % interest over 15 years period. 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 A3.01 to A3.22 of Appendix III. These tables also include (i) ballpark estimates of total annual expenditure to recover capital investment on entire sewerage system within 15 years, (ii) footprint for sewage treatment, (iii) energy consumption, (iv)per capita energy consumption, and (v) estimates of expenditure per person per day for availing centralized sanitation facility. A summary of these results for each of the GRB states is presented in Tables 5.06to 5.08 for Class I and Class II towns.

Estimates given in the aforementioned tables can serve as significant inputs in preparing Ganga River Basin Management Plan (GRBMP) and formulating strategy for water supply and sanitation in Class I and Class II towns of GRB. The figures of annual investments on provisioning sewerage systems reported in Tables 5.03 to 5.08 may appear to be very high, and the general perception is that such systems require huge land, consume large amount of energy and are very expansive and unaffordable for people in the developing countries like India. Based on this perception other sanitation systems such as septic tanks, soak pits, decentralized wastewater systems using Anaerobic Baffled Reactors followed by root zone treatment, bioremediation techniques, etc. are being advocated. These are perceived to be low energy consuming and low cost technologies. In order to get more clarity and facilitate in making rational decision than taking decisions based on perceptions, estimates on (i) footprint for sewage treatment, (ii) energy consumption, and (iii) per capita daily expenditure on availing the benefits of sewerage infrastructure have been worked out. Footprint for sewerage networks has been excluded as they are underground and do not require separate space. Footprint for sewage pumping is much smaller and negligible compared to the footprint for sewage treatment.

Table 5.03: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Millions) of NRGB

S No	State	Population in Millions	Estimated Sewage Generation, MLD	Estimated Capital Expenditure, Millions of INR			Estimated Total Capital Expenditure, Millions of INR
				Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Uttarakhand	2.121	229.1	9038.3	92.2	2519.9	**11650.4**
02	Uttar Pradesh	29.613	3198.3	146248.7	2494.2	35181.1	**183924.0**
03	Himachal Pradesh	**No Class I town**					
04	Haryana	5.317	574.2	33802.0	384.3	6316.7	**40503.0**
05	Delhi	13.482	1456.1	42641.2	2052.9	16016.7	**60710.8**
06	Rajasthan	7.689	830.4	60368.8	1010.2	9134.6	**70513.6**
07	Madhya Pradesh	11.934	1288.8	72775.7	1051.0	14177.5	**88004.2**
08	Bihar	6.929	748.3	35890.0	364.0	8231.2	**44485.2**
09	Chhattisgarh	3.138	338.9	24319.2	265.2	3727.9	**28312.3**
10	Jharkhand	4.801	518.5	28133.4	321.2	5703.8	**34158.4**
11	West Bengal	17.124	1849.4	83049.3	1046.8	20342.9	**104439.0**
Total		**102.148**	**11032.0**	**536266.6**	**9082.0**	**121352.3**	**666700.9**

Table 5.04: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of NRGB

S No	State	Population in Millions	Estimated Sewage Generation, MLD	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
				Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Uttarakhand	0.212	22.9	1354.1	4.9	252.4	**1611.4**
02	Uttar Pradesh	3.109	335.8	17549.0	79.0	3693.2	**21321.2**
03	Himachal Pradesh	**No Class II towns**					
04	Haryana	0.164	17.7	963.5	3.7	194.3	**1161.5**
05	Delhi	0.862	93.1	2850.2	11.7	1023.7	**3885.6**
06	Rajasthan	0.287	31.0	2640.3	11.9	340.8	**2993.0**
07	Madhya Pradesh	0.654	70.6	4481.4	19.2	777.0	**5277.6**
08	Bihar	1.462	157.9	9834.4	41.0	1736.6	**11612.0**
09	Chhattisgarh	0.448	48.4	6150.8	28.0	532.0	**6710.8**
10	Jharkhand	1.236	133.5	9482.3	42.8	1468.1	**10993.2**
11	West Bengal	1.000	108.0	7523.6	31.7	1188.1	**8743.4**
Total		**9.433**	**1018.9**	**62829.6**	**273.9**	**11206.2**	**74309.7**

Table 5.05: Estimated Capital Expenditure on Sewerage Infrastructure 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 Sewage Generation, MLD	Estimated Capital Expenditure, Millions of INR			Estimated Total Capital Expenditure, Millions of INR
				Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Uttarakhand	2.333	252.0	10392.4	97.1	2772.3	**13261.8**
02	Uttar Pradesh	32.722	3534.1	163797.7	2573.2	38874.3	**205245.2**
03	Himachal Pradesh	**No Class I or II towns**					
04	Haryana	5.481	591.9	34765.5	388.0	6511.0	**41664.5**
05	Delhi	14.344	1549.2	45491.4	2064.6	17040.4	**64596.4**
06	Rajasthan	7.976	861.4	63009.1	1022.1	9475.4	**73506.6**
07	Madhya Pradesh	12.588	1359.4	77257.1	1070.2	14954.5	**93281.8**
08	Bihar	8.391	906.2	45724.4	405.0	9967.8	**56097.2**
09	Chhattisgarh	3.586	387.3	30470.0	293.2	4259.9	**35023.1**
10	Jharkhand	6.037	652.0	37615.7	364.0	7171.9	**45151.6**
11	West Bengal	18.124	1957.4	90572.9	1078.5	21531.0	**113182.4**
Total		**111.582**	**12050.9**	**599096.2**	**9355.9**	**132558.5**	**741010.6**

Table 5.06: Estimated Annual Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Millions) of NRGB

S No	State	Population in Millions	Estimated Sewage Generation, MLD	Estimated Annual Expenditure, Millions of INR						Estimated Total Annual Expenditure, Millions of INR
				Sewerage Network		Sewage Pumping		Sewage Treatment		
				Capex	Opex	Capex	Opex	Capex	Opex	
01	Uttarakhand	2.121	229.1	1328.6	135.6	13.6	86.5	370.4	322.5	**2257.2**
02	Uttar Pradesh	29.613	3198.3	21498.6	2193.7	366.7	2341.2	5171.6	4503.1	**36074.9**
03	Himachal Pradesh	**No Class I town**								
04	Haryana	5.317	574.2	4968.9	507.0	56.5	360.8	928.5	808.5	**7630.2**
05	Delhi	13.482	1456.1	6268.3	639.6	301.8	1926.8	2354.4	2050.1	**13541**
06	Rajasthan	7.689	830.4	8874.2	905.5	148.5	948.0	1342.8	1169.2	**13388.2**
07	Madhya Pradesh	11.934	1288.8	10698.0	1091.6	154.5	986.6	2084.1	1814.7	**16829.5**
08	Bihar	6.929	748.3	5275.8	538.3	53.5	341.7	1210.0	1053.6	**8472.9**
09	Chhattisgarh	3.138	338.9	3574.9	364.8	39.0	248.9	548.0	477.2	**5252.8**
10	Jharkhand	4.801	518.5	4135.6	422.0	47.2	301.4	838.5	730.1	**6474.8**
11	West Bengal	17.124	1849.4	12208.2	1245.7	153.9	982.4	2990.4	2603.9	**20184.5**
Total		**102.148**	**11032.0**	**78831.3**	**8044.0**	**1335.2**	**8524.3**	**17838.7**	**15532.9**	**130106.0**

Table 5.07: Estimated Annual Capital (Capex) and Operation and Maintenance (Opex) Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of NRGB

S No	State	Population in Millions	Estimated Sewage Generation, MLD	Estimated Annual Expenditure, Millions of INR						Estimated Total Annual Expenditure, Millions of INR
				Sewerage Network		Sewage Pumping		Sewage Treatment		
				Capex	Opex	Capex	Opex	Capex	Opex	
01	Uttarakhand	0.212	22.9	199.1	20.3	0.7	4.7	37.1	32.3	**294.2**
02	Uttar Pradesh	3.109	335.8	2579.7	263.2	11.7	74.4	542.9	472.7	**3944.6**
03	Himachal Pradesh	**No Class II town**								
04	Haryana	0.164	17.7	141.6	14.5	0.5	3.5	28.6	24.9	**213.6**
05	Delhi	0.862	93.1	419.0	42.8	1.7	10.9	150.5	131.0	**755.9**
06	Rajasthan	0.287	31.0	388.1	39.6	1.7	11.1	50.1	43.6	**534.2**
07	Madhya Pradesh	0.654	70.6	658.8	67.2	2.8	18.1	114.2	99.4	**960.5**
08	Bihar	1.462	157.9	1445.7	147.5	6.1	38.6	255.3	222.3	**2115.5**
09	Chhattisgarh	0.448	48.4	904.2	92.3	4.1	26.3	78.2	68.1	**1173.2**
10	Jharkhand	1.236	133.5	1393.9	142.2	6.3	40.2	215.8	187.9	**1986.3**
11	West Bengal	1.000	108.0	1106.0	112.9	4.7	29.9	174.6	152.1	**1580.2**
Total		**9.433**	**1018.9**	**9236.1**	**942.5**	**40.3**	**257.7**	**1647.3**	**1434.3**	**13558.2**

Table 5.08: Estimated Annual Expenditure on Sewerage Infrastructure 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 Sewage Generation, MLD	Estimated Annual Expenditure, Millions of INR							
				Sewerage Network		Sewage Pumping		Sewage Treatment		Total	
				Capex	Opex	Capex	Opex	Capex	Opex	Capex	Opex
01	Uttarakhand	1223.2	136.5	1527.7	155.9	14.3	91.2	407.5	354.8	1949.5	601.9
02	Uttar Pradesh	19206.5	2143.5	24078.3	2456.9	378.4	2415.6	5714.5	4975.8	30171.2	9848.3
03	Himachal Pradesh	**No Class I or II town**									
04	Haryana	5.481	570.0	5110.5	521.5	57	364.3	957.1	833.4	**6124.6**	**1719.2**
05	Delhi	14.344	1491.7	6687.3	682.4	303.5	1937.7	2504.9	2181.1	**9495.7**	**4801.2**
06	Rajasthan	7.976	829.5	9262.3	945.1	150.2	959.1	1392.9	1212.8	**10805.4**	**3117**
07	Madhya Pradesh	12.588	1309.1	11356.8	1158.8	157.3	1004.7	2198.3	1914.1	**13712.4**	**4077.6**
08	Bihar	8.391	872.6	6721.5	685.8	59.6	380.3	1465.3	1275.9	**8246.4**	**2342**
09	Chhattisgarh	3.586	372.9	4479.1	457.1	43.1	275.2	626.2	545.3	**5148.4**	**1277.6**
10	Jharkhand	6.037	627.8	5529.5	564.2	53.5	341.6	1054.3	918	**6637.3**	**1823.8**
11	West Bengal	18.124	1884.9	13314.2	1358.6	158.6	1012.3	3165	2756	**16637.8**	**5126.9**
Total		**111.582**	**11604.3**	**88067.2**	**8986.3**	**1375.5**	**8782**	**19486**	**16967.2**	**108928.7**	**34735.5**

However, energy consumption for both sewage pumping and sewage treatment has been considered. Estimated per capita footprint, daily energy consumption and daily expenditure on availing the sewerage infrastructure for each of the Class I and Class II towns in GRB are included in the tables given in Appendix III. Tables 5.09 and 5.10 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 sewage treatment is approximately 0.1 m^2 per person which is one tenth of the size of the toilet. The energy consumption in sewage pumping and treatment ranges from 0.03 to 0.1 KW-h which is equivalent to lighting 30 to 100 watt bulb for 1 h. The total per capita expenditure in availing sewerage infrastructure is estimated to be in the range INR 1.8 to 10.8 with an average of INR 3.93 and standard deviation 1.4. The higher values correspond to towns with very low population density and the lower values correspond to very high population densities. The sewerage network and sewage pumping cost increase with decrease in population density. In cases where habitations are separated by major roads, streams, water bodies, parks, playgrounds, open fields, large commercial establishments, etc., it may be much meaningful to plan for decentralized sewerage treatment systems by dividing the town into number of zones with separate sewerage system for each zone. This may reduce both energy consumption and total per capita expenditure. It is interesting to note from some of the recent studies (Luthra, 2013) that expenditure on some of the perceived to be low cost alternative sanitation systems are also in the same range with much lower quality and substantial adverse impacts on environment.

4.7. Benefits of Provisioning Sewerage Systems

Provisioning of sewerage systems has many tangible and intangible benefits. The intangible benefits include aesthetically improved towns, much less exposure to infectious diseases thereby substantial savings in expenditure on health, less suffering and higher quality time available for meaningful activities, etc. Some of the tangible benefits include unpolluted water bodies, more water of better quality available for many functions including ecological. Here, an attempt has been made to quantify availability of good quality water through treatment of sewage up to tertiary level and compare it with present day dry weather flows (November through May) at some select locations on some select rivers in the Ganga Basin. Select locations are some of the flow monitoring sites of the Central Water Commission (CWC), Ministry of Water Resources (MoWR), GoI. The sites are shown on the map of Indian part of GRB (Figure 5.13).

Table 5.09: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Millions) of NRGB

S No	State	Number of Class I Towns	Population in Millions	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
						Energy Consumption in GWH	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWH (Unit of Electricity)	Expenditure in INR
01	Uttarakhand	8	2.121	0.1	51.0	0.087	2257.3	0.03-0.05	2.2-4.4
02	Uttar Pradesh	62	29.613	0.1	755.0	1.735	36074.9	0.03-0.09	2.3-5.5
03	Himachal Pradesh	**No Class I town**							
04	Haryana	16	5.317	0.1	133.3	0.284	7630.2	0.03-0.08	2.5-5.8
05	Delhi	15	13.482	0.1	376.5	1.183	13541.0	0.03-0.10	1.8-6.2
06	Rajasthan	19	7.689	0.1	209.0	0.606	13388.3	0.04-0.11	3.2-8.0
07	Madhya Pradesh	27	11.934	0.1	305.9	0.719	16829.5	0.03-0.09	1.8-10.8
08	Bihar	28	6.929	0.1	168.8	0.312	8473.0	0.03-0.06	2.5-5.5
09	Chhattisgarh	9	3.138	0.1	80.0	0.184	5252.7	0.03-0.08	3.3-7.3
10	Jharkhand	15	4.801	0.1	119.4	0.246	6474.8	0.03-0.07	2.0-6.5
11	West Bengal	62	17.124	0.1	422.4	0.834	20184.6	0.03-0.07	1.3-7.2
Total/Range		**261**	**102.148**		**2621.3**	**6.190**	**130106.3**	**0.03-0.11**	**1.3-10.8**

Table 5.10: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of NRGB

S No	State	Number of Class II Towns	Population in Millions	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
						Energy Consumption in GWH	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWH (Unit of Electricity)	Expenditure in INR
01	Uttarakhand	4	0.212	0.1	5.0	0.007	294.2	0.03-0.04	2.2-6.6
02	Uttar Pradesh	43	3.109	0.1	72.7	0.104	3944.7	0.03-0.05	1.8-8.6
03	Himachal Pradesh	**No Class II town**							
04	Haryana	3	0.164	0.1	3.8	0.005	213.6	0.03-0.03	3.3-3.9
05	Delhi	14	0.862	0.1	19.8	0.024	755.9	0.03-0.04	1.8-4.5
06	Rajasthan	4	0.287	0.1	6.9	0.011	534.3	0.04-0.04	4.2-5.9
07	Madhya Pradesh	10	0.654	0.1	15.4	0.023	960.6	0.03-0.04	2.9-5.2
08	Bihar	23	1.462	0.1	34.3	0.051	2115.5	0.03-0.04	2.6-6.6
09	Chhattisgarh	6	0.448	0.1	11.1	0.022	1173.1	0.04-0.07	4.8-10.7
10	Jharkhand	17	1.236	0.1	29.3	0.046	1986.3	0.03-0.05	2.8-7.0
11	West Bengal	15	1.000	0.1	23.6	0.036	1580.2	0.03-0.04	2.7-6.4
Total/Range		**139**	**9.433**		**221.9**	**0.329**	**13558.4**	**0.03-0.07**	**1.8-10.7**

The map also shows some Class I and Class II towns immediate upstream of the monitoring sites whose treated or untreated sewage, directly or indirectly, likely to contribute to the river flows. Comparison of the ninety percent dependable dry weather flows with the treated water available from sewage of the Class I and Class II towns located immediately upstream of the selected CWC monitoring sites is presented in Table 5.11.

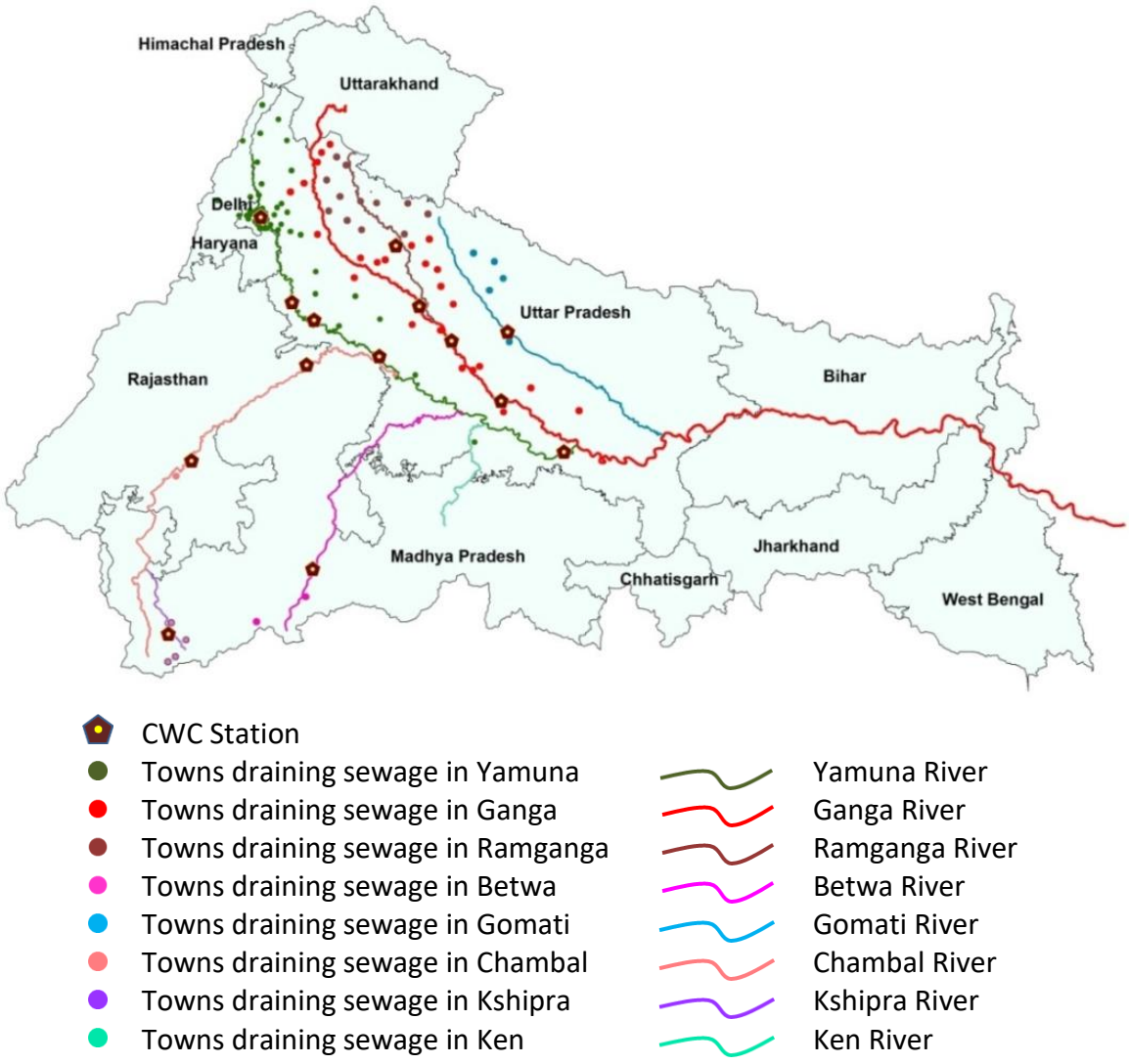

Figure 5.13: Schematic Representation of GRB showing a Few Rivers of the Basin, and Class I and Class II Towns in the Immediate Upstream of Selected Flow Measuring Sites of CWC

Table 5.11: Comparison of Dry Weather Flow with Estimated Available Water from Treated Sewage at Select Locations in Ganga River Basin

River	CWC Monitoring Station			Nearby Town	Dry Weather (November 1 – May 31) 90 % Dependable Flow, m^3/s	Estimated Available Water from Treated Sewage, m^3/s	Percent of Dry Weather Flow, %	Group of Class I and Class II Towns Immediate Upstream of the Monitoring Station
	Name	Latitude, N	Longitude, E					
Yamuna	Delhi Railway Bridge	28°39'43.95"	77°14'44.88"	Delhi	16.24	1.24	7.64	1
Yamuna	Mathura	27°30'04.88"	77°41'45.73"	Delhi	14.24	12.61	88.55	2
Yamuna	Mathura	27°30'04.88"	77°41'45.73"	Mathura	14.24	7.26	50.98	3
Yamuna	Agra Poiyghat	27°15'26.47"	78° 1'24.52"	Agra	11.27	6.86	60.87	4
Yamuna	Etawah	26°44'41.96"	78°59'19.46"	Etawah	12.20	2.17	17.79	5
Yamuna	Pratappur	25°21'27.78"	81°40'52.82"	Allahabad	147.95	0.33	0.22	6
Kshipra	Ujjain	23°10'10.57"	75°46'15.61"	Ujjain	0.00	2.72	-	7
Betwa	Basoda	23°54'04.99"	77°55'19.80"	Basoda	0.00	2.74	-	8
Chambal	Mandwara	25°23'04.59"	76°09'07.64"	Kota	0.72	0.88	122.22	9
Chambal	Dholpur	26°39'16.79"	77°53'45.33"	Dholpur	8.75	0.11	1.26	10
Gomti	Lucknow	26°52'05.89"	80°55'31.30"	Lucknow	9.55	2.95	30.89	11
Ramganga	Bareily	28°16'32.00"	79°22'40.00"	Bareily	17.18	2.87	16.71	12
Ganga	Fatehgarh	27°24'00.00"	79°37'00.00"	Farrukhabad	15.15	2.74	18.09	13
Ganga	Ankinghat	26°55'00.00"	80°05'00.00"	Kanpur	69.94	0.64	0.92	14
Ganga	Bhitaura	26°02'13.65"	80°49'57.50"	Allahabad	96.97	1.98	2.04	15

Group 1: Bahadurgarh, Jagadhari, Jind, Karnal, Rohtak, Sonipat; **Group 2:** Delhi; **Group 3:** Aligarh, Baghpat, Baraut, Deoband, Bulandshehar, Dadri, Etah, Gangoh, Ghaziabad, Greater Noida, Hathras, Kairana, Khatauli, Loni, Modinagar, Muradnagar, Noida, Pilkhuwa, Saharanpur, Sikandrabad; **Group 4:** Mathura, Vrindavan; **Group 5:** Agra, Firozabad, Mainpuri; **Group 6:** Auraiya, Banda, Chitrakoot, Etawah; **Group 7:** Ujjain, Dewas, Indore, Pithampur; **Group 8:** Vidisha, Sehore; **Group 9:** Kota; **Group 10:** Dholpur; **Group 11:** Sitapur, Gola, Lakhimpur, Laharpur, Lucknow; **Group 12:** Bareilly, Baheri, Chandausi, Nagina, Pilibhit, Shambhal, Rampur, Moradabad, Hasanpur, Amroha, Chandpur, Sherkot; **Group13:** Bisalpur, Bijnor, Budaun, Faridpur, Kasganj, Najibabad, Jahangirabad, Kiratpur, Meerut, Mawana, Sahaswann, Shahbad, Shahjanpur, Tilhar, Ujhani; **Group 14:** Gangaghat, Chhibramau, Hardoi, Farrukhabad, Kannauj; **Group 15:** Pratapgarh, Fatehpur, Raebareily, Unnao, Kanpur.

The data presented in Table 5.11 reveals that contribution of treated sewage in comparison to dry weather flows are very high at many places. The quantities of treated sewage are estimated as 70 % of the sewage generated. In other words approximately 56% of water supply can be supplemented and saved by recycling treated sewage. It may be noted that in many locations/stretches of the rivers the entire dry weather flow could be due to sewage. It is also important to note that at very few locations or stretches of the river the dry weather flows exceed ten times the estimated treated sewage flows, which is generally assumed while setting the effluent discharge standards. In reality the situation at most locations/stretches is inferior to what is presented here due to cumulative effect. Thus looking at the comparison of the estimated sewage generation and dry weather flows it can be inferred that treatment of sewage up to tertiary level or equivalent is essential if river water quality standards befitting the ecological needs are to be maintained. It is thus necessary to consider sewage as significant source of water for both human and ecological needs, and bring in the concept of much higher level (at least tertiary level) of treatment for Class I and Class II towns in the GRB. The cost of provisioning sewerage systems does not appear to be unaffordable on per capita per day basis considering the benefits and savings in water supply and health related expenditures.

5. Conclusions and Recommendations

5.1. Conclusions

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

- Length of the sewers of various sizes up to 750 mm diameter appears to be strongly correlated to the population served and area covered by the sewer network.
- Empirical relations developed from the data gathered from various sources on sewerage networks for various urban agglomerations in India can be very useful in estimating the lengths of sewers of various primary, lateral and branch sewers up to 750 mm diameter.
- Approximately 70 % of the total length of sewers is comprised of 150 and 200 mm diameter sewers in typical Indian urban agglomerations.
- Approximately 15, 35 and 50 % of total capital expenditure on sewerage network is incurred on sewer pipes, manholes and laying (including excavation, timbering, dewatering, bedding, etc.) respectively.
- About 85-90 % of annual expenditure on sewage pumping is towards energy consumption, and about 90 % of the capital expenditure on sewage pumping stations is required for procurement of pumps.
- Typical breakup of total annual expenditure on sewage treatment between capex and opex is 52 and 48 % respectively.
- About 79, 2 and 19 % of the total capital expenditure on sewerage system is towards sewer network, sewage pumping and sewage treatment respectively while about 24, 26 and 50 % of the total opex expenditure is incurred in sewer network, sewage pumping and sewage treatment.
- Approximately 68, 8 and 28 % of the total annual expenditure on sewerage system is incurred on sewerage network, sewage pumping and sewage treatment respectively in a typical Indian town.
- Approximately 56 % of the energy bill is towards sewage pumping while only 44% of energy expenditure is incurred on sewage treatment.
- Total annual capex and opex for provisioning sewerage systems in all Class I and Class II towns of GRB is expected to be INR 1,08,930 and 34,740 million

respectively. This amounts to average per capita per day expenditure of INR 3.93.

- The average per capita per day energy consumption in availing sewerage systems is approximately equivalent to lighting a 40 watt bulb for 1 h.
- The expenditure on sewerage expenditure may be justified in GRB based on tangible and intangible benefits.

5.2. 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 relation developed to estimate lengths of various diameter sewers can be further improved if total road length of the area covered is included as an independent parameter.
- Data from many towns on sewerage network to improve the confidence level in estimating lengths of various diameter sewers.
- A detailed study on comparison of contribution of sewage from various Class I and Class II towns to the dry weather flows at many locations on many streams/rivers of the GRB.
- Information on energy consumption and cost of water supplies from various towns through distribution network and long distance conveyance of water to compute per liter cost of water supplies.

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Appendix I

Estimated Length of Various Diameter Pipes in Sewerage Network in Class I and Class II Towns of GRB

Table A1.01: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Dehradun	870.519	52.29	495	10.6	73.6	2.2	2.1	0.8	1.3	1.2	1.4	2.2	1.5	1.1	2.1
02	Haldwani	169.147	10.62	111	10.6	64.3	3.0	2.5	1.5	2.0	2.0	2.5	3.3	2.1	2.3	4.1
03	Hardwar	487.923	13.00	193	12.7	69.0	2.4	2.3	1.3	1.6	1.7	1.3	2.2	1.3	1.7	2.6
04	Kashipur	121.610	5.46	70	11.4	61.4	3.1	2.5	1.8	2.2	2.3	2.4	3.4	2.0	2.8	4.7
05	Nainital	110.726	11.06	94	9.8	63.5	3.3	2.6	1.5	2.1	2.0	3.4	4.0	2.7	0.0	5.0
06	Rishikesh	102.138	10.00	86	9.8	63.0	3.3	2.6	1.6	2.2	2.1	3.4	4.1	2.7	0.0	5.2
07	Roorkee	118.188	20.20	131	8.7	64.3	3.3	2.5	1.2	2.0	1.8	4.0	4.2	3.1	0.0	4.9
08	Rudrapur	140.884	12.43	112	9.9	63.5	3.1	2.5	1.4	2.0	1.9	2.9	3.6	2.4	2.3	4.5

Table A1.02: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	BHEL Ranipur	51.910	26.94	108	6.8	60.9	3.9	2.6	1.2	2.3	1.8	7.6	6.1	0.0	0.0	6.8
02	Manglaur	51.101	1.32	23	13.1	57.4	3.6	2.8	3.2	2.9	3.4	2.7	3.9	0.0	0.0	6.9
03	Pithoragarh	53.957	9.00	62	8.9	60.8	3.8	2.7	1.7	2.5	2.3	5.2	5.2	0.0	0.0	6.8
04	Ramnagar	55.446	2.42	32	11.9	59.1	3.7	2.8	2.6	2.8	3.0	3.2	4.2	0.0	0.0	6.8

Table A1.03: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Uttar Pradesh in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Agra	1746.467	141.00	1111	9.7	77.3	1.9	2.0	0.5	1.0	0.9	1.2	1.9	1.4	0.7	1.5
02	Aligarh	909.559	36.70	423	11.5	73.1	2.1	2.2	0.9	1.3	1.3	1.2	2.0	1.3	1.2	2.0
03	Allahabad	1216.719	63.07	631	10.8	74.9	2.0	2.1	0.7	1.2	1.1	1.2	1.9	1.3	1.0	1.8
04	Amroha	197.135	12.00	126	10.7	65.2	2.9	2.4	1.4	1.9	1.9	2.3	3.2	2.0	2.1	3.9
05	Azamgarh	116.165	12.60	102	9.6	63.9	3.3	2.6	1.5	2.1	2.0	3.4	4.0	2.7	0.0	4.9
06	Badaun	159.221	4.39	70	12.6	62.2	2.9	2.5	1.9	2.1	2.3	1.9	2.9	1.7	2.7	4.2
07	Ballia	111.287	16.00	113	9.0	63.8	3.3	2.5	1.3	2.1	1.9	3.8	4.2	3.0	0.0	5.0
08	Banda	154.388	11.05	109	10.3	63.9	3.0	2.5	1.5	2.0	2.0	2.6	3.4	2.2	2.3	4.3
09	Barabanki	154.692	3.87	65	12.9	61.8	2.9	2.5	2.0	2.1	2.4	1.8	2.9	1.6	2.8	4.3
10	Baraut	101.241	25.00	138	7.9	63.3	3.4	2.5	1.2	2.0	1.7	4.7	4.6	3.5	0.0	5.1
11	Bareilly	979.933	106.43	745	9.3	75.1	2.2	2.1	0.6	1.2	1.0	1.6	2.3	1.7	0.9	2.0
12	Basti	114.651	19.43	127	8.7	64.1	3.3	2.5	1.3	2.0	1.8	4.0	4.3	3.1	0.0	4.9
13	Bijnour	115.381	3.65	55	12.6	62.2	3.2	2.6	2.2	2.3	2.6	2.2	3.3	1.9	0.0	4.9
14	Bulandsahar	222.826	32.50	218	8.9	67.2	2.9	2.4	1.0	1.7	1.5	3.0	3.5	2.6	1.7	3.7
15	Chandausi	114.254	8.80	84	10.4	63.5	3.3	2.6	1.6	2.2	2.1	3.1	3.8	2.5	0.0	5.0
16	Deoria	129.570	16.19	124	9.1	63.3	3.2	2.5	1.3	2.0	1.8	3.4	3.9	2.7	2.2	4.6
17	Etah	131.023	13.49	113	9.5	63.2	3.1	2.5	1.4	2.0	1.9	3.2	3.8	2.6	2.3	4.6
18	Etawah	256.790	48.00	282	8.4	68.3	2.8	2.3	0.9	1.6	1.4	3.1	3.5	2.7	1.5	3.5
19	Faizabad	259.160	16.60	166	10.6	67.1	2.8	2.4	1.2	1.7	1.7	2.1	3.0	2.0	1.9	3.5
20	Farrukhabad	318.540	16.80	182	11.1	68.0	2.6	2.4	1.2	1.7	1.7	1.9	2.8	1.8	1.8	3.2
21	Fatehpur	193.801	56.98	276	7.5	66.6	3.0	2.3	0.8	1.7	1.4	4.0	4.0	3.2	1.6	3.9
22	Firozabad	603.797	21.35	270	12.0	70.8	2.3	2.2	1.1	1.4	1.5	1.3	2.2	1.4	1.4	2.4
23	Gazipur	121.136	13.45	110	9.4	62.7	3.2	2.5	1.4	2.0	1.9	3.3	3.9	2.7	2.3	4.7
24	Ghaziabad	2358.525	215.00	1573	9.3	78.7	1.8	1.9	0.4	0.9	0.8	1.1	1.7	1.3	0.6	1.3
25	Gonda	138.929	24.62	157	8.4	64.1	3.1	2.4	1.1	1.9	1.7	3.7	4.0	3.0	2.0	4.5

Table A1.03 continued to next page … … … …

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S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
26	Gorakhpur	692.519	147.00	756	8.0	74.1	2.4	2.1	0.6	1.2	1.0	2.3	2.8	2.3	0.9	2.3
27	Greater Noida	642.381	27.93	317	11.4	71.5	2.3	2.2	1.0	1.4	1.4	1.4	2.2	1.4	1.3	2.4
28	Hapur	262.801	42.00	266	8.7	68.3	2.8	2.3	0.9	1.6	1.4	2.9	3.4	2.6	1.6	3.4
29	Hardoi	197.046	11.05	121	10.9	65.1	2.9	2.4	1.4	1.9	1.9	2.2	3.1	2.0	2.2	3.9
30	Hathras	161.289	8.40	97	11.1	63.6	3.0	2.5	1.6	2.0	2.1	2.3	3.2	2.0	2.4	4.2
31	Jaunpur	168.128	20.00	153	9.3	65.1	3.0	2.4	1.2	1.9	1.7	3.1	3.6	2.6	2.0	4.1
32	Jhansi	549.391	169.50	738	7.4	73.1	2.5	2.2	0.5	1.3	1.0	2.9	3.1	2.7	1.0	2.5
33	Kanpur	2920.067	261.50	1914	9.3	79.5	1.7	1.9	0.4	0.9	0.8	1.0	1.6	1.3	0.6	1.2
34	Kasganj	101.241	7.10	72	10.6	62.6	3.3	2.6	1.8	2.3	2.3	3.1	3.9	2.5	0.0	5.2
35	Lakhimpur	164.925	10.20	108	10.7	64.1	3.0	2.5	1.5	2.0	2.0	2.5	3.3	2.1	2.3	4.2
36	Lalitpur	133.041	18.00	132	9.0	63.6	3.1	2.5	1.3	2.0	1.8	3.4	3.9	2.8	2.2	4.5
37	Loni	512.296	34.48	319	10.5	71.1	2.4	2.3	0.9	1.4	1.4	1.7	2.5	1.7	1.4	2.6
38	Lucknow	2901.474	330.00	2147	8.8	79.8	1.7	1.8	0.4	0.8	0.7	1.1	1.7	1.3	0.5	1.2
39	Mainpuri	133.078	7.50	85	10.9	62.5	3.1	2.5	1.7	2.1	2.1	2.5	3.4	2.1	2.6	4.6
40	Mathura	454.937	32.80	295	10.3	70.6	2.5	2.3	0.9	1.5	1.4	1.9	2.6	1.8	1.4	2.7
41	Mau	279.060	39.00	263	9.0	68.5	2.8	2.3	0.9	1.6	1.4	2.7	3.3	2.4	1.6	3.4
42	Meerut	1424.908	41.94	554	12.1	74.5	1.9	2.1	0.8	1.1	1.2	0.9	1.7	1.1	1.0	1.7
43	Mirzapur	233.691	40.00	248	8.5	67.6	2.9	2.4	0.9	1.7	1.5	3.1	3.5	2.7	1.6	3.6
44	Modinagar	182.811	14.00	132	10.2	65.1	2.9	2.4	1.3	1.9	1.8	2.6	3.3	2.2	2.1	4.0
45	Moradabad	889.810	80.00	618	9.7	74.4	2.2	2.1	0.7	1.2	1.1	1.6	2.3	1.7	1.0	2.0
46	Mugalsarai	154.692	14.43	125	9.8	64.2	3.0	2.5	1.3	1.9	1.9	2.9	3.6	2.4	2.2	4.3
47	Muradanagar	100.080	12.00	94	9.4	63.0	3.4	2.6	1.5	2.2	2.0	3.7	4.2	2.9	0.0	5.2
48	Muzaffar Nagar	316.729	12.04	154	11.9	67.3	2.6	2.4	1.3	1.7	1.8	1.7	2.6	1.6	1.9	3.2
49	Noida	642.381	203.16	865	7.3	74.0	2.4	2.1	0.5	1.2	0.9	2.7	3.0	2.6	0.9	2.3
50	Orai	190.625	16.00	143	10.0	65.5	2.9	2.4	1.3	1.9	1.8	2.6	3.4	2.3	2.0	3.9
51	Pililbhit	160.146	9.50	103	10.8	63.8	3.0	2.5	1.5	2.0	2.0	2.4	3.3	2.1	2.3	4.2

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S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
52	Raibareliy	191.625	34.00	211	8.5	66.3	3.0	2.4	1.0	1.7	1.5	3.4	3.7	2.8	1.7	3.9
53	Rampur	359.062	20.20	210	10.9	68.8	2.6	2.3	1.1	1.6	1.6	1.8	2.7	1.8	1.7	3.0
54	Saharanpur	703.345	73.72	535	9.4	73.4	2.3	2.2	0.7	1.3	1.2	1.8	2.5	1.8	1.1	2.3
55	Sahaswann	178.000	7.50	96	11.6	63.9	2.9	2.5	1.6	2.0	2.1	2.1	3.1	1.8	2.4	4.0
56	Sahjahanpur	356.103	11.37	157	12.3	67.6	2.5	2.4	1.3	1.7	1.8	1.5	2.5	1.5	1.9	3.0
57	Shambhal	221.334	15.65	151	10.4	66.2	2.8	2.4	1.3	1.8	1.8	2.3	3.2	2.1	2.0	3.7
58	Sitapur	188.230	35.00	212	8.4	66.2	3.0	2.4	1.0	1.7	1.5	3.4	3.8	2.9	1.7	3.9
59	Sultanpur	116.211	16.00	115	9.1	64.1	3.3	2.5	1.3	2.1	1.9	3.7	4.1	2.9	0.0	4.9
60	Ujhani	191.000	6.50	92	12.1	63.9	2.8	2.5	1.7	2.0	2.1	1.9	2.9	1.7	2.4	3.9
61	Unnao	178.681	21.50	162	9.2	65.5	3.0	2.4	1.2	1.8	1.7	3.0	3.6	2.5	1.9	4.0
62	Varansi	1435.113	79.79	764	10.6	75.8	2.0	2.0	0.6	1.1	1.0	1.1	1.9	1.3	0.9	1.7

Table A1.04: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Uttar Pradesh in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Auraiya	70.515	4.00	46	11.3	61.3	3.6	2.7	2.2	2.6	2.7	3.3	4.2	0.0	0.0	6.2
02	Baghpat	50.380	2.83	36	11.2	58.9	3.7	2.8	2.5	2.8	2.9	3.6	4.5	0.0	0.0	7.0
03	Baheri	74.869	15.00	91	8.6	63.4	3.7	2.7	1.4	2.3	2.0	5.0	5.0	0.0	0.0	6.0
04	Balrampur	90.000	36.28	161	7.0	62.3	3.5	2.5	1.0	2.0	1.6	5.7	5.0	4.1	0.0	5.3
05	Bhadohi	94.563	8.00	75	10.1	62.3	3.4	2.6	1.7	2.3	2.2	3.3	4.0	2.6	0.0	5.4
06	Bisalpur	83.347	4.58	54	11.1	60.9	3.4	2.7	2.0	2.4	2.5	3.0	3.9	2.4	0.0	5.6
07	Chandpur	83.456	23.40	124	7.7	61.9	3.5	2.5	1.2	2.1	1.8	5.2	4.9	3.8	0.0	5.5

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S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
08	Chibramau	55.296	11.10	70	8.5	61.1	3.8	2.7	1.6	2.5	2.2	5.5	5.3	0.0	0.0	6.8
09	Chitrakoot	57.452	7.77	59	9.3	61.1	3.8	2.7	1.8	2.5	2.4	4.7	5.0	0.0	0.0	6.7
10	Dadri	91.345	6.50	66	10.5	61.9	3.4	2.6	1.8	2.3	2.3	3.2	4.0	2.5	0.0	5.4
11	Deoband	97.068	7.90	75	10.2	62.5	3.3	2.6	1.7	2.3	2.2	3.3	4.0	2.6	0.0	5.3
12	Faredpur	76.422	9.43	73	9.6	63.0	3.6	2.7	1.7	2.4	2.2	4.2	4.6	0.0	0.0	6.0
13	Gangaghat	84.301	4.91	56	11.0	61.1	3.4	2.6	2.0	2.4	2.5	3.0	3.9	2.4	0.0	5.6
14	Gangoh	59.463	6.00	52	9.9	61.0	3.7	2.7	2.0	2.6	2.5	4.2	4.7	0.0	0.0	6.6
15	Gola	53.842	10.08	66	8.6	60.9	3.8	2.7	1.7	2.5	2.2	5.4	5.3	0.0	0.0	6.8
16	Hasanpur	64.536	5.72	53	10.2	61.4	3.7	2.7	2.0	2.5	2.5	3.9	4.6	0.0	0.0	6.4
17	Jahangerabad	59.873	14.30	82	8.2	61.8	3.8	2.7	1.5	2.4	2.1	5.6	5.3	0.0	0.0	6.5
18	Jalaun	56.871	5.00	47	10.2	60.5	3.7	2.8	2.1	2.6	2.6	4.1	4.7	0.0	0.0	6.7
19	Kaimur	51.469	7.12	54	9.2	60.3	3.8	2.7	1.9	2.6	2.4	4.9	5.1	0.0	0.0	7.0
20	Kairana	95.092	7.11	70	10.4	62.2	3.3	2.6	1.8	2.3	2.3	3.2	4.0	2.5	0.0	5.4
21	Kannauj	71.727	70.70	202	5.9	63.1	3.7	2.5	0.9	2.0	1.4	8.5	6.1	0.0	0.0	5.9
22	Khatauli	72.478	3.76	45	11.5	61.4	3.5	2.7	2.3	2.6	2.7	3.1	4.1	0.0	0.0	6.1
23	Kiratpur	61.801	4.45	46	10.7	60.8	3.7	2.8	2.2	2.6	2.6	3.7	4.5	0.0	0.0	6.5
24	Konch	53.426	2.95	35	11.3	59.3	3.7	2.8	2.5	2.7	2.9	3.5	4.4	0.0	0.0	6.9
25	Laharpur	61.280	8.00	61	9.4	61.5	3.7	2.7	1.8	2.5	2.3	4.6	4.9	0.0	0.0	6.5
26	Mahoba	95.454	12.15	93	9.3	62.7	3.4	2.6	1.5	2.2	2.0	3.8	4.3	3.0	0.0	5.3
27	Mau Ranipur	58.456	5.53	50	10.1	60.8	3.7	2.7	2.0	2.6	2.5	4.1	4.7	0.0	0.0	6.7
28	Mawana	81.126	7.50	68	9.9	61.3	3.4	2.6	1.8	2.3	2.3	3.6	4.2	2.8	0.0	5.7
29	Mubarakpur	71.365	9.00	69	9.5	62.6	3.6	2.7	1.7	2.4	2.3	4.3	4.7	0.0	0.0	6.2
30	Nagina	71.350	10.30	74	9.2	62.7	3.7	2.7	1.6	2.4	2.2	4.5	4.8	0.0	0.0	6.1
31	Nazibabad	88.638	5.06	58	11.1	61.4	3.4	2.6	2.0	2.4	2.4	3.0	3.9	2.4	0.0	5.5
32	Obra	56.116	4.50	44	10.4	60.3	3.7	2.8	2.2	2.6	2.6	4.0	4.6	0.0	0.0	6.8
33	Pilkhuwa	81.651	5.80	60	10.5	61.1	3.4	2.6	1.9	2.4	2.4	3.3	4.1	2.6	0.0	5.7

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S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
34	Pratapgarh	76.750	12.00	82	9.1	63.3	3.6	2.7	1.6	2.3	2.1	4.5	4.8	0.0	0.0	6.0
35	Ramnagar	54.800	3.60	39	10.9	59.8	3.7	2.8	2.3	2.7	2.8	3.7	4.5	0.0	0.0	6.8
36	Rath	65.092	6.10	55	10.1	61.6	3.7	2.7	1.9	2.5	2.5	4.0	4.6	0.0	0.0	6.4
37	S R Nagar	94.563	8.00	75	10.1	62.3	3.4	2.6	1.7	2.3	2.2	3.3	4.0	2.6	0.0	5.4
38	Shahbad	80.305	9.70	77	9.3	61.5	3.5	2.6	1.6	2.3	2.1	4.0	4.4	3.0	0.0	5.7
39	Sherkot	62.148	6.00	53	10.0	61.3	3.7	2.7	2.0	2.5	2.5	4.1	4.7	0.0	0.0	6.5
40	Sikandrabad	80.309	1.14	27	14.7	58.1	3.2	2.7	3.1	2.7	3.3	1.9	3.2	1.6	0.0	5.7
41	Tanda	96.138	10.45	86	9.6	62.7	3.4	2.6	1.6	2.2	2.1	3.6	4.2	2.8	0.0	5.3
42	Tilhar	60.803	3.48	40	11.2	60.3	3.6	2.8	2.3	2.7	2.8	3.4	4.3	0.0	0.0	6.5
43	Vrindavann	62.926	13.49	81	8.4	62.1	3.8	2.7	1.5	2.4	2.1	5.4	5.2	0.0	0.0	6.4

37. S R Nagar – Sant Ravidas Nagar

Table A1.05: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Himanchal Pradesh in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
No Class I town																

Table A1.06: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Himanchal Pradesh in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
No Class II town																

Table A1.07: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Bahadur Garh	170.426	50.00	245	7.5	65.8	3.1	2.4	0.9	1.7	1.4	4.1	4.1	3.3	1.7	4.1
02	Bhiwani	197.662	47.78	254	7.9	66.7	3.0	2.4	0.9	1.7	1.4	3.7	3.9	3.0	1.6	3.8
03	Faridabad	1404.653	207.80	1226	8.6	77.2	2.0	2.0	0.5	1.0	0.9	1.6	2.2	1.7	0.7	1.7
04	Gurgoan	901.968	37.10	424	11.5	73.1	2.1	2.2	0.8	1.3	1.3	1.2	2.0	1.3	1.2	2.0
05	Hisar	301.249	48.03	301	8.7	69.1	2.8	2.3	0.9	1.6	1.4	2.8	3.3	2.5	1.5	3.3
06	Jagadhari	124.915	24.80	152	8.2	63.4	3.2	2.4	1.1	1.9	1.7	4.0	4.2	3.1	2.0	4.6
07	Jind	166.225	42.00	222	7.8	65.5	3.1	2.4	0.9	1.8	1.5	4.0	4.0	3.2	1.7	4.1
08	Kaithal	144.633	45.75	220	7.4	64.6	3.1	2.4	0.9	1.8	1.5	4.5	4.3	3.5	1.7	4.3
09	Karnal	286.974	12.00	147	11.6	66.9	2.7	2.4	1.4	1.8	1.8	1.8	2.7	1.7	1.9	3.3
10	Kurukshetra	154.962	34.50	195	8.0	65.0	3.1	2.4	1.0	1.8	1.5	3.9	4.0	3.1	1.8	4.3
11	Narnaul	134.067	41.10	202	7.4	64.1	3.2	2.4	1.0	1.8	1.5	4.5	4.4	3.5	1.8	4.5
12	Palwal	127.931	8.78	90	10.4	62.5	3.1	2.5	1.6	2.1	2.1	2.8	3.6	2.3	2.5	4.6
13	Panipat	294.15	41.40	277	8.9	68.9	2.8	2.3	0.9	1.6	1.4	2.7	3.3	2.4	1.5	3.3
14	Rohtak	373.133	47.50	327	9.1	70.2	2.6	2.3	0.9	1.5	1.3	2.4	3.0	2.2	1.4	3.0
15	Sonipat	292.339	52.80	312	8.4	69.1	2.8	2.3	0.8	1.6	1.3	3.0	3.4	2.6	1.4	3.3
16	Yamuna Nagar	241.723	34.50	233	8.9	67.7	2.9	2.4	1.0	1.7	1.5	2.9	3.4	2.5	1.6	3.6

Table A1.08: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Hodal	50.003	5.39	46	9.7	59.8	3.8	2.8	2.1	2.7	2.6	4.5	5.0	0.0	0.0	7.1
02	Narvana	61.800	10.00	69	9.0	61.8	3.8	2.7	1.7	2.4	2.2	4.9	5.0	0.0	0.0	6.5
03	Sahadab	51.786	5.00	45	10.0	59.9	3.8	2.8	2.1	2.7	2.6	4.3	4.8	0.0	0.0	7.0

Table A1.09: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	B J	197.150	6.70	94	12.1	64.1	2.8	2.5	1.7	2.0	2.1	1.9	2.9	1.7	2.4	3.9
02	Burari	145.584	11.19	108	10.2	63.6	3.1	2.5	1.5	2.0	2.0	2.8	3.5	2.3	2.3	4.4
03	Dallo Pura	154.955	2.29	51	14.3	60.5	2.8	2.5	2.3	2.2	2.6	1.5	2.7	1.4	3.1	4.2
04	Delhi Cantt.	116.352	42.97	193	7.2	64.2	3.3	2.4	1.0	1.9	1.5	5.1	4.7	3.9	0.0	4.8
05	DMC	11007.835	431.09	4572	10.4	82.2	1.2	1.6	0.3	0.6	0.6	0.5	1.0	0.7	0.3	0.6
06	Deoli	169.410	10.12	109	10.8	64.2	3.0	2.5	1.5	2.0	2.0	2.4	3.3	2.1	2.3	4.1
07	Gokalpur	121.938	2.32	46	13.5	59.5	3.0	2.5	2.4	2.3	2.7	1.8	2.9	1.5	3.2	4.7
08	Hastal	177.033	6.75	91	11.8	63.7	2.9	2.5	1.7	2.0	2.1	2.0	3.0	1.8	2.4	4.1
09	Karawal Nagar	224.666	4.75	84	13.4	63.8	2.7	2.4	1.8	1.9	2.2	1.5	2.6	1.4	2.5	3.7
10	K S N	282.598	4.74	93	14.0	64.6	2.6	2.4	1.8	1.9	2.2	1.3	2.4	1.3	2.3	3.3
11	Mandoli	120.345	41.77	196	7.2	63.3	3.2	2.4	1.0	1.8	1.5	4.9	4.5	3.7	1.8	4.7
12	Mustafabad	127.012	1.29	36	15.3	58.0	2.8	2.5	2.8	2.3	3.0	1.4	2.6	1.2	3.5	4.5
13	Nangloi Jat	205.497	6.67	96	12.3	64.3	2.8	2.5	1.7	1.9	2.1	1.8	2.8	1.7	2.4	3.8
14	NDMC	249.998	42.74	263	8.6	68.0	2.8	2.3	0.9	1.6	1.4	3.1	3.5	2.6	1.6	3.5
15	Sultanpur Majra	181.624	2.86	60	14.1	61.7	2.8	2.5	2.2	2.1	2.5	1.5	2.6	1.3	2.8	4.0

01. 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 Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Babarpur	52.918	0.79	19	14.6	56.2	3.5	2.8	3.7	3.0	3.7	2.2	3.6	0.0	0.0	6.8
02	C S B	81.374	2.58	40	12.5	59.9	3.3	2.7	2.5	2.5	2.8	2.5	3.6	2.0	0.0	5.7
03	Gharoli	84.722	3.56	48	11.8	60.7	3.3	2.7	2.2	2.4	2.6	2.7	3.7	2.2	0.0	5.6
04	Jaffrabad	70.089	0.90	22	15.2	57.8	3.3	2.8	3.5	2.8	3.5	1.9	3.3	0.0	0.0	6.0
05	Khajoori Khas	55.006	0.94	21	14.3	56.9	3.5	2.8	3.5	2.9	3.6	2.3	3.6	0.0	0.0	6.7
06	Mithe Pur	49.583	1.81	27	12.3	58.0	3.7	2.8	2.9	2.9	3.2	3.1	4.2	0.0	0.0	7.1
07	Molar Band	49.439	4.12	40	10.3	59.4	3.8	2.8	2.2	2.7	2.7	4.2	4.8	0.0	0.0	7.1
08	Mundka	53.525	11.89	71	8.3	61.0	3.9	2.7	1.6	2.5	2.2	5.7	5.4	0.0	0.0	6.8
09	Pooth Kalan	61.727	6.97	57	9.7	61.4	3.7	2.7	1.9	2.5	2.4	4.3	4.8	0.0	0.0	6.5
10	Pulpehlad	64.484	2.16	33	12.6	59.6	3.5	2.8	2.7	2.7	3.0	2.8	3.9	0.0	0.0	6.4
11	S P G	52.730	1.05	21	13.9	57.0	3.5	2.8	3.4	2.9	3.5	2.4	3.8	0.0	0.0	6.8
12	Taj Pul	72.764	1.22	26	14.4	58.8	3.3	2.8	3.2	2.7	3.3	2.1	3.4	0.0	0.0	6.0
13	Tigri	54.774	1.05	22	14.0	57.2	3.5	2.8	3.4	2.9	3.5	2.4	3.7	0.0	0.0	6.7
14	Ziauddin Pur	58.661	1.80	29	12.8	58.8	3.6	2.8	2.9	2.8	3.1	2.8	3.9	0.0	0.0	6.6

02. C S B – Chilla Saroda Bangar

11. S P G – Sadat Pur Gurjan

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

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Ajmer	542.580	87.00	521	8.6	72.6	2.5	2.2	0.7	1.3	1.1	2.3	2.8	2.2	1.1	2.5
02	Alwar	315.310	49.00	310	8.7	69.4	2.7	2.3	0.9	1.5	1.4	2.7	3.2	2.4	1.4	3.2
03	Bahilwara	360.009	69.00	390	8.3	70.4	2.7	2.3	0.8	1.5	1.2	2.8	3.2	2.5	1.3	3.0
04	Baran	118.157	72.36	260	6.2	63.0	3.3	2.3	0.8	1.7	1.3	5.9	4.9	4.3	1.6	4.6
05	Bharatpur	252.109	29.00	217	9.4	67.7	2.8	2.4	1.0	1.7	1.5	2.7	3.3	2.3	1.7	3.5
06	Bundi	102.823	22.76	132	8.1	63.4	3.4	2.5	1.2	2.0	1.8	4.5	4.5	3.4	0.0	5.1
07	Chittaugarh	116.409	30.50	161	7.8	64.3	3.3	2.5	1.1	1.9	1.6	4.6	4.5	3.5	0.0	4.8
08	Dhaulpur	126.142	32.00	174	7.7	63.6	3.2	2.4	1.0	1.9	1.6	4.3	4.3	3.4	1.9	4.6
09	Gangapurcity	224.773	17.22	159	10.2	66.4	2.8	2.4	1.2	1.8	1.7	2.4	3.2	2.1	1.9	3.7
10	Hindauncity	105.690	48.00	198	6.8	63.4	3.4	2.4	0.9	1.9	1.5	5.6	4.9	4.2	0.0	5.0
11	Jaipur	3073.350	485.00	2679	8.2	80.4	1.7	1.8	0.3	0.8	0.7	1.2	1.8	1.5	0.5	1.2
12	Jhunjhunun	118.966	50.00	215	6.9	63.2	3.3	2.4	0.9	1.8	1.4	5.2	4.7	3.9	1.8	4.7
13	Kishangarh	155.019	100.00	341	6.2	64.9	3.1	2.3	0.7	1.6	1.2	5.5	4.6	4.2	1.4	4.1
14	Kota	1001.365	527.03	1710	6.4	76.4	2.2	2.0	0.4	1.0	0.7	2.8	2.8	2.7	0.7	1.9
15	Nagaur	100.618	37.81	171	7.2	63.2	3.4	2.5	1.0	1.9	1.6	5.4	4.9	4.0	0.0	5.1
16	Sikar	237.579	39.90	249	8.6	67.7	2.9	2.4	0.9	1.7	1.5	3.1	3.5	2.6	1.6	3.6
17	Swaimadhavpur	120.998	49.00	214	6.9	63.3	3.2	2.4	0.9	1.8	1.4	5.1	4.6	3.9	1.8	4.6
18	Tonk	165.363	16.00	135	9.7	64.7	3.0	2.5	1.3	1.9	1.8	2.9	3.5	2.4	2.1	4.2
19	Udaipur	451.735	56.91	389	9.1	71.3	2.5	2.3	0.8	1.4	1.3	2.3	2.9	2.1	1.3	2.7

Table A1.12: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Rajasthan in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Jhalawara	66.500	12.95	81	8.6	62.5	3.7	2.7	1.5	2.4	2.1	5.1	5.1	0.0	0.0	6.3
02	Makrana	94.447	36.00	163	7.1	62.7	3.4	2.5	1.0	2.0	1.6	5.5	4.9	4.0	0.0	5.2
03	Nawalgarh	64.903	27.91	119	7.2	62.6	3.8	2.6	1.2	2.2	1.8	6.7	5.7	0.0	0.0	6.3
04	Nimbahera	61.000	12.74	77	8.5	61.9	3.8	2.7	1.5	2.4	2.1	5.4	5.2	0.0	0.0	6.5

Table A1.13: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Madhya Pradesh in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Bhind	197.332	17.79	153	9.9	65.8	2.9	2.4	1.2	1.8	1.7	2.6	3.4	2.3	2.0	3.9
02	Bopal	1883.381	285.00	1640	8.4	78.4	1.9	1.9	0.4	0.9	0.8	1.4	2.0	1.6	0.6	1.5
03	Chatarpur	147.688	54.00	242	7.1	64.8	3.1	2.4	0.9	1.7	1.4	4.6	4.4	3.6	1.7	4.3
04	Damoh	147.515	16.00	129	9.4	64.1	3.1	2.5	1.3	1.9	1.8	3.1	3.7	2.5	2.2	4.4
05	Datia	100.466	6.85	71	10.7	62.5	3.3	2.6	1.8	2.3	2.3	3.0	3.9	2.4	0.0	5.2
06	Dewas	289.438	102.00	437	7.2	69.3	2.8	2.3	0.7	1.5	1.2	3.7	3.7	3.1	1.3	3.3
07	Guna	180.978	45.75	240	7.8	66.1	3.0	2.4	0.9	1.7	1.4	3.9	4.0	3.1	1.7	4.0
08	Gwalior	1101.981	173.88	1006	8.5	76.1	2.1	2.0	0.5	1.1	0.9	1.8	2.3	1.9	0.8	1.9
09	Indore	2167.447	131.17	1181	10.2	77.7	1.8	1.9	0.5	1.0	0.9	1.0	1.7	1.2	0.7	1.4
10	Jabalpur	1267.564	135.00	941	9.2	76.3	2.1	2.0	0.5	1.1	1.0	1.5	2.1	1.6	0.8	1.7
11	Katni	221.875	68.60	320	7.5	67.6	2.9	2.3	0.8	1.6	1.3	3.9	3.9	3.2	1.5	3.7
12	Mandsour	141.468	36.00	193	7.8	64.4	3.2	2.4	1.0	1.8	1.5	4.2	4.2	3.3	1.8	4.4
13	Morena	200.506	12.00	127	10.8	65.3	2.9	2.4	1.4	1.9	1.9	2.3	3.2	2.0	2.1	3.9
14	Neemuch	128.575	22.00	144	8.5	63.5	3.2	2.5	1.2	1.9	1.7	3.8	4.1	3.0	2.1	4.6

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S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
15	Pithampur	126.099	89.90	299	6.0	63.3	3.2	2.3	0.7	1.7	1.3	6.0	4.9	4.5	1.5	4.5
16	Ratlam	273.892	39.19	261	8.9	68.5	2.8	2.3	0.9	1.6	1.4	2.8	3.3	2.5	1.6	3.4
17	Rewa	235.422	102.00	403	6.9	68.0	2.9	2.3	0.7	1.5	1.2	4.2	4.0	3.5	1.3	3.5
18	Sagar	370.296	33.75	275	9.8	69.7	2.6	2.3	1.0	1.5	1.4	2.2	2.9	2.0	1.5	3.0
19	Satna	283.004	12.00	146	11.6	66.9	2.7	2.4	1.4	1.8	1.8	1.8	2.8	1.7	2.0	3.3
20	Sehore	1090.025	13.10	278	14.7	70.9	2.0	2.1	1.1	1.3	1.5	0.7	1.6	0.9	1.3	1.8
21	Shahdol	100.565	28.24	147	7.7	63.3	3.4	2.5	1.1	2.0	1.7	4.9	4.7	3.7	0.0	5.1
22	Shepour	105.026	5.00	61	11.5	62.3	3.2	2.6	2.0	2.3	2.4	2.7	3.6	2.2	0.0	5.1
23	Shivpuri	179.972	86.55	334	6.7	66.1	3.1	2.3	0.7	1.6	1.2	4.8	4.3	3.8	1.4	3.9
24	Singrauli	220.295	280.66	674	5.3	66.8	2.9	2.2	0.5	1.4	0.9	6.1	4.6	4.7	1.1	3.5
25	Tikamgarh	101.786	6.22	68	10.9	62.4	3.3	2.6	1.8	2.3	2.3	2.9	3.8	2.4	0.0	5.2
26	Ujjain	515.215	92.68	527	8.4	72.4	2.5	2.2	0.7	1.3	1.1	2.4	2.9	2.3	1.1	2.6
27	Vidisha	155.959	8.83	98	10.9	63.6	3.0	2.5	1.6	2.0	2.0	2.4	3.3	2.1	2.4	4.3

Table A1.14: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Madhya Pradesh in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Basoda	78.265	5.90	58	10.7	62.5	3.5	2.7	1.9	2.5	2.5	3.5	4.3	0.0	0.0	5.9
02	Bina	64.579	12.00	77	8.7	62.2	3.7	2.7	1.6	2.4	2.1	5.1	5.1	0.0	0.0	6.4
03	Dabra	61.260	12.00	75	8.6	61.9	3.8	2.7	1.6	2.4	2.2	5.2	5.2	0.0	0.0	6.5
04	Dhar	95.000	30.00	148	7.5	62.8	3.4	2.5	1.1	2.0	1.7	5.2	4.8	3.8	0.0	5.2
05	Jaora	65.111	5.54	52	10.3	61.4	3.7	2.7	2.0	2.5	2.5	3.9	4.5	0.0	0.0	6.4
06	Mandla	55.145	8.87	62	8.9	60.9	3.8	2.7	1.7	2.5	2.3	5.1	5.2	0.0	0.0	6.8

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S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
07	Narshimpur	59.858	14.71	83	8.1	61.9	3.8	2.7	1.5	2.4	2.1	5.7	5.4	0.0	0.0	6.5
08	Panna	50.432	4.50	43	10.2	59.6	3.8	2.8	2.2	2.7	2.7	4.2	4.8	0.0	0.0	7.0
09	Shajapur	70.000	11.16	76	9.0	62.7	3.7	2.7	1.6	2.4	2.2	4.7	4.9	0.0	0.0	6.2
10	Sidhi	54.317	12.31	73	8.3	61.1	3.9	2.7	1.6	2.5	2.2	5.7	5.4	0.0	0.0	6.8

Table A1.15: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Arrah	261.099	30.97	227	9.3	68.0	2.8	2.4	1.0	1.7	1.5	2.7	3.3	2.3	1.7	3.5
02	Aurangabad	101.520	8.00	77	10.3	62.7	3.3	2.6	1.7	2.2	2.2	3.2	3.9	2.5	0.0	5.2
03	Bagaha	113.012	11.00	94	9.9	63.7	3.3	2.6	1.5	2.1	2.0	3.3	4.0	2.7	0.0	5.0
04	Begusarai	251.136	8.98	121	12.0	65.8	2.7	2.4	1.5	1.8	2.0	1.8	2.8	1.6	2.1	3.5
05	Bettiah	132.896	11.55	105	9.9	63.1	3.1	2.5	1.4	2.0	2.0	3.0	3.7	2.4	2.4	4.6
06	B M C	398.138	30.17	268	10.2	69.9	2.6	2.3	1.0	1.5	1.5	2.0	2.8	1.9	1.5	2.9
07	B M C	296.889	22.46	204	10.3	68.2	2.7	2.4	1.1	1.7	1.6	2.2	3.0	2.0	1.7	3.3
08	Buxar	102.591	8.00	77	10.3	62.8	3.3	2.6	1.7	2.2	2.2	3.2	3.9	2.5	0.0	5.2
09	Chapra (NP)	201.597	16.96	151	10.0	65.9	2.9	2.4	1.2	1.8	1.8	2.6	3.3	2.2	2.0	3.9
10	Darbhanga	294.116	19.18	188	10.6	67.9	2.7	2.4	1.2	1.7	1.7	2.1	2.9	1.9	1.8	3.3
11	Dehri	137.068	21.32	145	8.7	63.9	3.1	2.4	1.2	1.9	1.7	3.6	4.0	2.9	2.1	4.5
12	D N	182.241	11.63	120	10.6	64.8	2.9	2.5	1.4	1.9	1.9	2.4	3.3	2.1	2.2	4.0
13	Gaya	463.454	50.17	369	9.4	71.3	2.5	2.3	0.8	1.4	1.3	2.1	2.8	2.0	1.3	2.7
14	Hajipur	147.126	19.64	143	9.0	64.3	3.1	2.4	1.2	1.9	1.7	3.3	3.8	2.7	2.1	4.4
15	Jamalpur	105.221	10.65	90	9.8	63.2	3.3	2.6	1.5	2.2	2.1	3.4	4.1	2.7	0.0	5.1

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S No	Town	Population in Thousands	Area in Km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
16	Jehanabad	102.456	20.23	124	8.4	63.4	3.4	2.5	1.3	2.1	1.8	4.3	4.5	3.3	0.0	5.1
17	Katihar	225.982	24.54	191	9.5	66.9	2.9	2.4	1.1	1.7	1.6	2.7	3.3	2.4	1.8	3.7
18	Kishanganj	107.076	30.12	155	7.7	63.7	3.4	2.5	1.1	2.0	1.6	4.8	4.6	3.6	0.0	5.0
19	M T	105.000	8.50	80	10.3	63.0	3.3	2.6	1.7	2.2	2.2	3.2	3.9	2.5	0.0	5.1
20	Motihari	125.183	13.52	111	9.4	62.9	3.2	2.5	1.4	2.0	1.9	3.3	3.8	2.6	2.3	4.7
21	Munger	213.101	17.50	157	10.1	66.2	2.9	2.4	1.2	1.8	1.7	2.5	3.3	2.2	1.9	3.8
22	Muzaffarpur	351.838	26.43	238	10.3	69.2	2.6	2.3	1.0	1.6	1.5	2.1	2.8	1.9	1.6	3.1
23	Nawada	109.141	5.68	66	11.3	62.7	3.2	2.6	1.9	2.3	2.4	2.7	3.6	2.2	0.0	5.1
24	Patna	1683.200	108.34	957	10.2	76.7	1.9	2.0	0.6	1.0	1.0	1.1	1.8	1.3	0.8	1.5
25	Purnia	280.547	44.52	282	8.7	68.7	2.8	2.3	0.9	1.6	1.4	2.9	3.4	2.5	1.5	3.4
26	Saharsa	155.175	21.13	152	9.0	64.7	3.1	2.4	1.2	1.9	1.7	3.3	3.8	2.7	2.0	4.3
27	Sasaram	147.396	12.00	112	10.1	63.7	3.1	2.5	1.4	2.0	1.9	2.8	3.5	2.3	2.3	4.4
28	Siwan	134.458	15.68	123	9.3	63.5	3.1	2.5	1.3	2.0	1.8	3.3	3.8	2.6	2.2	4.5

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

Table A1.16: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Araria	80.000	4.50	52	11.1	60.7	3.4	2.7	2.1	2.4	2.5	3.1	4.0	2.4	0.0	5.7
02	Barahiya	50.230	26.54	106	6.7	60.6	3.9	2.6	1.2	2.3	1.8	7.7	6.1	0.0	0.0	6.9
03	Barh	61.037	4.50	46	10.6	60.7	3.7	2.8	2.2	2.6	2.6	3.8	4.5	0.0	0.0	6.5
04	Bhabua	52.611	7.12	54	9.3	60.4	3.8	2.7	1.9	2.6	2.4	4.8	5.1	0.0	0.0	6.9
05	D M	67.995	11.30	76	8.9	62.5	3.7	2.7	1.6	2.4	2.2	4.8	4.9	0.0	0.0	6.3
06	Dumraon	57.716	15.33	83	8.0	61.6	3.8	2.7	1.5	2.4	2.0	5.9	5.5	0.0	0.0	6.6
07	Forbesganj	52.289	4.98	45	10.0	60.0	3.8	2.8	2.1	2.7	2.6	4.3	4.8	0.0	0.0	7.0
08	Gopalganj	66.624	11.11	75	8.9	62.4	3.7	2.7	1.6	2.4	2.2	4.8	5.0	0.0	0.0	6.3
09	Kaimur	51.469	7.12	54	9.2	60.3	3.8	2.7	1.9	2.6	2.4	4.9	5.1	0.0	0.0	7.0
10	Khagaria	56.978	2.97	36	11.4	59.7	3.7	2.8	2.5	2.7	2.9	3.4	4.3	0.0	0.0	6.7
11	Khagaul	60.866	5.32	50	10.3	61.0	3.7	2.7	2.0	2.6	2.5	4.0	4.6	0.0	0.0	6.6
12	Lakhisarai	98.123	24.79	136	7.9	63.1	3.4	2.5	1.2	2.0	1.7	4.8	4.7	3.6	0.0	5.2
13	Madhepura	56.739	25.84	109	7.0	61.6	3.9	2.6	1.2	2.3	1.8	7.1	5.9	0.0	0.0	6.6
14	Masaurhi	57.012	9.43	65	8.9	61.2	3.8	2.7	1.7	2.5	2.3	5.1	5.1	0.0	0.0	6.7
15	Mokameh	71.335	14.18	87	8.6	63.0	3.7	2.7	1.5	2.3	2.1	5.0	5.0	0.0	0.0	6.1
16	Narkatiaganj	51.446	10.96	67	8.4	60.6	3.9	2.7	1.6	2.5	2.2	5.7	5.4	0.0	0.0	7.0
17	Phulwari Sharif	67.348	6.48	57	10.1	61.8	3.7	2.7	1.9	2.5	2.4	4.0	4.6	0.0	0.0	6.3
18	Raxaul Bazar	52.429	5.82	49	9.7	60.2	3.8	2.8	2.0	2.6	2.5	4.5	4.9	0.0	0.0	6.9
19	Samastipur	70.042	3.45	42	11.6	61.0	3.5	2.7	2.3	2.6	2.7	3.1	4.1	0.0	0.0	6.2
20	Shekhpura	54.322	15.58	82	7.8	61.2	3.9	2.7	1.4	2.4	2.0	6.2	5.6	0.0	0.0	6.8
21	Sitamarhi	87.279	8.00	72	10.0	61.8	3.4	2.6	1.7	2.3	2.2	3.5	4.2	2.7	0.0	5.5
22	Sultanganj	52.867	12.29	72	8.2	60.9	3.9	2.7	1.6	2.5	2.2	5.8	5.5	0.0	0.0	6.9
23	Supaul	85.200	22.37	122	7.8	62.1	3.5	2.5	1.2	2.1	1.8	5.0	4.8	3.7	0.0	5.5

05. D M – Digha-Mainpura

Table A1.17: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Chhatisgarh in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Ambikapur	114.575	9.39	87	10.2	63.6	3.3	2.6	1.6	2.2	2.1	3.1	3.9	2.5	0.0	5.0
02	Bhilai Nagar	625.697	141.30	709	8.0	73.6	2.4	2.1	0.6	1.2	1.0	2.5	2.9	2.4	1.0	2.4
03	Bilaspur	330.106	37.56	276	9.4	69.4	2.7	2.3	0.9	1.6	1.4	2.4	3.1	2.2	1.5	3.1
04	Durg	268.679	66.09	339	7.9	68.7	2.8	2.3	0.8	1.6	1.3	3.4	3.6	2.9	1.4	3.4
05	Jagdalpur	125.345	22.49	144	8.4	63.4	3.2	2.5	1.2	1.9	1.7	3.9	4.1	3.0	2.1	4.6
06	Korba	363.210	215.02	707	6.4	70.7	2.7	2.2	0.5	1.3	1.0	4.1	3.7	3.5	1.0	2.9
07	Raigarh	137.097	20.68	143	8.8	63.9	3.1	2.5	1.2	1.9	1.7	3.5	3.9	2.8	2.1	4.5
08	Raipur	1010.087	108.66	763	9.3	75.3	2.2	2.1	0.6	1.2	1.0	1.6	2.3	1.7	0.9	1.9
09	Rajnandgaon	163.122	78.09	305	6.7	65.4	3.1	2.3	0.8	1.7	1.3	4.9	4.4	3.8	1.5	4.1

Table A1.18: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Chhatisgarh in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Bhatapara	54.846	30.42	117	6.7	61.3	3.9	2.6	1.2	2.2	1.8	7.6	6.1	0.0	0.0	6.7
02	Bhilai Charoda	95.848	141.30	343	5.0	61.2	3.4	2.3	0.6	1.7	1.1	8.3	5.7	5.7	0.0	4.9
03	Chirmiri	99.934	64.94	228	6.2	62.7	3.4	2.4	0.8	1.8	1.4	6.4	5.2	4.6	0.0	5.0
04	Dalli-Rajhara	55.684	37.25	131	6.4	61.3	3.9	2.6	1.1	2.2	1.7	8.1	6.2	0.0	0.0	6.6
05	Dhamtari	89.857	23.40	127	7.8	62.5	3.4	2.5	1.2	2.1	1.8	4.9	4.8	3.7	0.0	5.4
06	Mahasamund	51.543	14.68	78	7.8	60.8	3.9	2.7	1.5	2.4	2.1	6.3	5.7	0.0	0.0	6.9

Table A1.19: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Area in Km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Aditya	173.988	49.82	247	7.6	65.9	3.1	2.4	0.9	1.7	1.4	4.1	4.1	3.3	1.6	4.0
02	Bhuli	110.127	11.74	96	9.7	63.6	3.3	2.6	1.5	2.1	2.0	3.5	4.0	2.7	0.0	5.0
03	Bokaro	413.934	162.91	644	7.0	71.5	2.6	2.2	0.6	1.3	1.0	3.4	3.4	3.0	1.0	2.8
04	Chas	141.618	20.49	144	8.8	64.1	3.1	2.4	1.2	1.9	1.7	3.5	3.9	2.8	2.1	4.4
05	Deoghar	203.116	14.00	138	10.5	65.6	2.9	2.4	1.3	1.9	1.8	2.4	3.2	2.1	2.1	3.8
06	Dhanbad	1161.561	23.39	379	13.2	72.6	2.0	2.1	1.0	1.2	1.4	0.8	1.7	1.0	1.2	1.8
07	Giridih	114.447	9.75	89	10.2	63.6	3.3	2.6	1.6	2.2	2.1	3.2	3.9	2.5	0.0	5.0
08	Hazaribag	142.494	26.37	165	8.4	64.3	3.1	2.4	1.1	1.9	1.6	3.8	4.0	3.0	2.0	4.4
09	JNAC	629.659	59.80	459	9.7	72.7	2.4	2.2	0.8	1.3	1.2	1.8	2.5	1.8	1.2	2.4
10	Jharia	100.839	4.42	57	11.7	61.9	3.3	2.6	2.0	2.3	2.5	2.6	3.6	2.1	0.0	5.2
11	Jorapokhar	104.673	16.40	112	8.8	63.5	3.3	2.5	1.3	2.1	1.9	4.0	4.3	3.1	0.0	5.1
12	MNAC	224.002	19.45	169	9.9	66.6	2.9	2.4	1.2	1.8	1.7	2.5	3.2	2.2	1.9	3.7
13	Phusro	102.673	40.64	179	7.1	63.3	3.4	2.4	1.0	1.9	1.5	5.4	4.9	4.0	0.0	5.0
14	Ranchi	1073.440	177.19	1004	8.4	76.1	2.2	2.1	0.5	1.1	0.9	1.8	2.4	1.9	0.8	1.9
15	Saunda	104.642	24.26	137	8.1	63.5	3.4	2.5	1.2	2.0	1.7	4.5	4.5	3.5	0.0	5.1

09. JNAC – Jamshedpur Notified Area Committee

12. MNAC – Mango Notified Area Committee

Table A1.20: Estimated Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Bagbera	82.559	10.70	82	9.2	61.7	3.5	2.6	1.6	2.3	2.1	4.0	4.4	3.1	0.0	5.6
02	Bhowrah	54.483	15.73	83	7.8	61.2	3.9	2.7	1.4	2.4	2.0	6.2	5.6	0.0	0.0	6.8
03	Bhuli	99.990	8.60	79	10.1	62.7	3.3	2.6	1.7	2.2	2.2	3.3	4.0	2.6	0.0	5.2
04	Chaibasa	78.287	11.11	82	9.0	61.4	3.5	2.6	1.5	2.3	2.1	4.2	4.5	3.2	0.0	5.7
05	Chatra	51.685	3.45	38	10.8	59.4	3.8	2.8	2.4	2.7	2.8	3.8	4.6	0.0	0.0	7.0
06	Daltonganj	87.849	14.00	97	8.8	62.2	3.4	2.6	1.4	2.2	2.0	4.2	4.5	3.2	0.0	5.5
07	Dumka	55.336	6.12	51	9.7	60.6	3.8	2.7	2.0	2.6	2.5	4.5	4.9	0.0	0.0	6.8
08	Gumia	56.024	26.11	109	7.0	61.5	3.9	2.6	1.2	2.3	1.8	7.2	5.9	0.0	0.0	6.6
09	Jhumri Tilaiya	85.489	51.14	190	6.3	61.6	3.5	2.4	0.9	1.9	1.5	6.5	5.3	4.6	0.0	5.3
10	Jugsalai	56.720	3.69	40	10.9	60.0	3.7	2.8	2.3	2.7	2.8	3.7	4.5	0.0	0.0	6.7
11	Katras	63.017	5.00	49	10.5	61.1	3.7	2.7	2.1	2.6	2.6	3.8	4.5	0.0	0.0	6.5
12	Lohardaga	56.821	14.57	81	8.0	61.5	3.8	2.7	1.5	2.4	2.1	5.9	5.5	0.0	0.0	6.7
13	Madhupur	58.211	18.36	92	7.7	61.7	3.8	2.7	1.4	2.3	2.0	6.2	5.6	0.0	0.0	6.6
14	Ramgarh Cantt.	90.324	34.46	157	7.1	62.4	3.5	2.5	1.0	2.0	1.6	5.6	5.0	4.1	0.0	5.3
15	Sahibganj	98.589	8.98	80	10.0	62.7	3.3	2.6	1.6	2.2	2.2	3.4	4.1	2.7	0.0	5.3
16	Sindri	94.398	46.65	187	6.7	62.5	3.4	2.4	0.9	1.9	1.5	6.0	5.1	4.3	0.0	5.2
17	Tisra	65.894	14.02	84	8.4	62.5	3.7	2.7	1.5	2.4	2.1	5.3	5.2	0.0	0.0	6.3

Table A1.21: Estimated Length of Various Diameter Pipes in Sewerage Network in Class I Towns (Population > 0.1 Million) of West Bengal in NRGB

S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Alipurduar	127.342	9.80	95	10.1	62.6	3.1	2.5	1.5	2.1	2.0	2.9	3.6	2.4	2.5	4.6
02	Asansol	564.491	127.87	645	8.0	73.1	2.5	2.2	0.6	1.3	1.1	2.5	2.9	2.4	1.0	2.5
03	A-K	123.906	18.44	130	8.8	63.2	3.2	2.5	1.3	2.0	1.8	3.6	4.0	2.9	2.2	4.7
04	Baidyabati	121.081	7.89	84	10.5	62.0	3.1	2.5	1.6	2.1	2.1	2.8	3.6	2.3	2.6	4.7
05	Bally	115.715	11.68	98	9.8	63.9	3.3	2.6	1.5	2.1	2.0	3.3	4.0	2.7	0.0	4.9
06	Balurghat	151.183	10.46	106	10.4	63.7	3.0	2.5	1.5	2.0	2.0	2.6	3.4	2.2	2.3	4.3
07	Bangaon	110.668	24.70	142	8.1	63.9	3.3	2.5	1.2	2.0	1.7	4.4	4.5	3.4	0.0	5.0
08	Bankura	138.036	19.06	138	8.9	63.9	3.1	2.5	1.2	1.9	1.8	3.4	3.9	2.8	2.1	4.5
09	Bansberia	103.799	9.07	83	10.1	63.0	3.3	2.6	1.6	2.2	2.1	3.3	4.0	2.6	0.0	5.2
10	Bara Nagar	248.466	7.12	107	12.6	65.2	2.7	2.4	1.6	1.9	2.0	1.6	2.7	1.5	2.2	3.5
11	Barasat	283.443	34.50	248	9.2	68.5	2.8	2.3	1.0	1.6	1.5	2.6	3.2	2.3	1.6	3.3
12	Bardhaman	314.638	26.30	226	10.0	68.7	2.7	2.3	1.0	1.6	1.5	2.2	3.0	2.0	1.6	3.2
13	Barrackpore	154.475	11.65	112	10.2	63.9	3.0	2.5	1.4	2.0	1.9	2.7	3.5	2.3	2.3	4.3
14	Basirhat	127.135	22.50	145	8.4	63.5	3.2	2.4	1.2	1.9	1.7	3.8	4.1	3.0	2.1	4.6
15	Beharampore	195.363	31.43	204	8.7	66.4	3.0	2.4	1.0	1.7	1.5	3.2	3.7	2.7	1.8	3.9
16	Bhadreswar	101.334	8.28	78	10.2	62.8	3.3	2.6	1.7	2.2	2.2	3.2	4.0	2.6	0.0	5.2
17	Bhatpara	390.467	30.42	266	10.2	69.8	2.6	2.3	1.0	1.5	1.5	2.0	2.8	1.9	1.5	2.9
18	Bidhannagar	218.323	30.00	208	9.0	67.0	2.9	2.4	1.0	1.7	1.6	3.0	3.5	2.5	1.7	3.7
19	Chakdaha	132.855	15.54	122	9.3	63.4	3.1	2.5	1.3	2.0	1.8	3.3	3.8	2.7	2.2	4.6
20	Champadani	110.983	6.47	71	11.0	63.0	3.2	2.6	1.8	2.2	2.3	2.8	3.7	2.3	0.0	5.0
21	Chandernagore	166.949	22.03	160	9.0	65.2	3.0	2.4	1.2	1.9	1.7	3.2	3.7	2.6	2.0	4.2
22	Chinsurah	180.502	17.24	146	9.7	65.3	3.0	2.4	1.3	1.9	1.8	2.8	3.5	2.4	2.0	4.0
23	Darjiling	120.414	10.57	97	9.8	62.4	3.2	2.5	1.5	2.1	2.0	3.1	3.8	2.5	2.5	4.7
24	Dhulian	239.022	10.27	126	11.6	65.8	2.8	2.4	1.4	1.8	1.9	1.9	2.9	1.8	2.1	3.6
25	Durgapur	566.937	1.10	64	20.8	61.2	2.0	2.2	2.5	1.7	2.6	0.5	1.3	0.5	2.4	2.3

Table A1.21 continued to next page … … … …

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S No	Town	Population in Thousands	Area in km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
26	Habra	149.675	21.80	152	8.8	64.5	3.1	2.4	1.2	1.9	1.7	3.4	3.8	2.8	2.0	4.3
27	Haldia	200.762	104.90	385	6.6	66.9	3.0	2.3	0.7	1.6	1.2	4.7	4.2	3.8	1.4	3.8
28	Halisahar	126.893	8.28	88	10.5	62.4	3.1	2.5	1.6	2.1	2.1	2.7	3.6	2.2	2.5	4.6
29	H-C	177.209	8.29	100	11.3	64.1	2.9	2.5	1.6	2.0	2.0	2.2	3.1	1.9	2.3	4.1
30	Jalpaiguri	107.351	12.50	98	9.5	63.5	3.3	2.6	1.5	2.1	2.0	3.6	4.1	2.8	0.0	5.1
31	Jamuria	144.791	73.23	282	6.6	64.6	3.2	2.3	0.8	1.7	1.3	5.2	4.6	4.0	1.6	4.3
32	Jangipore	122.875	7.86	84	10.6	62.1	3.1	2.5	1.6	2.1	2.1	2.7	3.6	2.2	2.6	4.7
33	Kalyani	100.62	21.91	128	8.2	63.3	3.4	2.5	1.2	2.0	1.8	4.5	4.5	3.4	0.0	5.2
34	Kamarhati	336.579	20.48	205	10.7	68.6	2.6	2.3	1.1	1.6	1.6	1.9	2.8	1.8	1.7	3.1
35	Kanchapara	122.181	29.21	164	7.9	63.3	3.2	2.4	1.1	1.9	1.6	4.3	4.3	3.3	2.0	4.7
36	Kharagpur	206.923	90.65	361	6.9	67.1	3.0	2.3	0.7	1.6	1.2	4.4	4.1	3.6	1.4	3.7
37	Khardaha	111.13	10.96	93	9.8	63.6	3.3	2.6	1.5	2.1	2.1	3.4	4.0	2.7	0.0	5.0
38	Kolkata	4486.689	185.00	1964	10.8	79.6	1.5	1.8	0.4	0.8	0.8	0.7	1.3	0.9	0.5	1.0
39	Konnagar	124.585	9.07	91	10.3	62.4	3.1	2.5	1.6	2.1	2.1	2.8	3.6	2.3	2.5	4.7
40	Krishnanagar	181.182	6.87	92	11.9	63.8	2.9	2.5	1.7	2.0	2.1	2.0	3.0	1.8	2.4	4.0
41	Madhyamgram	198.964	21.32	169	9.5	66.1	2.9	2.4	1.2	1.8	1.7	2.8	3.4	2.4	1.9	3.9
42	Mahestala	449.423	21.50	238	11.3	69.8	2.5	2.3	1.1	1.5	1.6	1.6	2.5	1.6	1.6	2.8
43	Medinipur	169.127	14.78	131	9.9	64.8	3.0	2.5	1.3	1.9	1.8	2.8	3.5	2.3	2.1	4.1
44	Nabadwip	125.528	11.66	104	9.7	62.8	3.1	2.5	1.4	2.0	2.0	3.1	3.8	2.5	2.4	4.7
45	Naihati	221.762	11.55	130	11.1	65.7	2.8	2.4	1.4	1.8	1.9	2.1	3.0	1.9	2.1	3.7
46	N B	134.825	17.17	129	9.1	63.6	3.1	2.5	1.3	2.0	1.8	3.4	3.9	2.7	2.2	4.5
47	NDD	253.625	26.45	207	9.6	67.6	2.8	2.4	1.1	1.7	1.6	2.6	3.2	2.3	1.7	3.5
48	Panihati	383.522	6.89	127	13.8	66.6	2.4	2.4	1.6	1.7	2.0	1.2	2.2	1.2	2.0	2.9
49	Puruliya	121.436	13.90	112	9.3	62.8	3.2	2.5	1.4	2.0	1.9	3.3	3.9	2.7	2.3	4.7
50	Raiganj	183.682	10.64	115	10.8	64.7	2.9	2.5	1.5	1.9	1.9	2.3	3.2	2.0	2.2	4.0
51	R G	404.991	28.00	260	10.4	69.8	2.6	2.3	1.0	1.5	1.5	1.9	2.7	1.8	1.5	2.9

Table A1.21 continued to next page … … … …

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S No	Town	Population in Thousands	Area in Km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
52	R S	423.806	49.25	352	9.3	70.8	2.6	2.3	0.8	1.5	1.3	2.2	2.9	2.1	1.3	2.8
53	Rana Ghat	235.583	7.72	109	12.2	65.2	2.7	2.4	1.6	1.9	2.0	1.7	2.8	1.6	2.2	3.6
54	Raniganj	128.624	23.44	149	8.4	63.6	3.2	2.4	1.2	1.9	1.7	3.9	4.1	3.0	2.1	4.6
55	Rishra	124.591	6.48	77	11.0	61.9	3.1	2.5	1.7	2.1	2.2	2.5	3.4	2.1	2.7	4.7
56	Santipur	151.774	24.60	163	8.6	64.7	3.1	2.4	1.1	1.9	1.7	3.5	3.9	2.9	2.0	4.3
57	Serampore	183.339	14.50	134	10.1	65.2	2.9	2.4	1.3	1.9	1.8	2.6	3.4	2.2	2.1	4.0
58	Siliguri	509.709	41.90	351	10.0	71.4	2.5	2.3	0.9	1.4	1.3	1.9	2.6	1.8	1.3	2.6
59	S D D	410.524	17.39	206	11.6	69.0	2.5	2.3	1.2	1.6	1.6	1.6	2.5	1.6	1.7	2.9
60	Titagarh	118.426	3.24	54	12.6	60.2	3.0	2.5	2.2	2.2	2.5	2.0	3.1	1.7	3.1	4.7
61	Uluberia	221.175	33.72	222	8.8	67.2	2.9	2.4	1.0	1.7	1.5	3.1	3.5	2.6	1.7	3.7
62	Uttarpara K	162.386	16.34	136	9.6	64.7	3.0	2.5	1.3	1.9	1.8	2.9	3.6	2.4	2.1	4.2

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 Length of Various Diameter Pipes in Sewerage Network in Class II Towns (Population between 0.05 and 0.1 Million) of West Bengal in NRGB

S No	Town	Population in Thousands	Area in Km^2	Estimated Total Length of Sewer Network, km	Estimated Percentage Lengths of Various Diameter (mm) Pipes											
					150	200	250	300	350	400	450	500	600	700	750	> 750
01	Arambagh	67.000	34.75	135	6.8	62.8	3.8	2.6	1.1	2.2	1.7	7.1	5.8	0.0	0.0	6.2
02	Baduria	52.500	22.43	98	7.1	61.0	3.9	2.6	1.3	2.3	1.9	7.1	5.9	0.0	0.0	6.8
03	Bankra	55.229	3.59	39	10.9	59.8	3.7	2.8	2.3	2.7	2.8	3.7	4.5	0.0	0.0	6.8
04	Baruipur	53.500	9.50	63	8.7	60.8	3.8	2.7	1.7	2.5	2.3	5.3	5.3	0.0	0.0	6.9
05	Bishnupur	70.620	22.01	108	7.7	63.2	3.7	2.6	1.3	2.2	1.9	5.9	5.3	0.0	0.0	6.1
06	Bolpur	74.890	10.73	77	9.2	63.1	3.6	2.7	1.6	2.4	2.2	4.4	4.7	0.0	0.0	6.0
07	Budge Budge	76.858	9.06	71	9.7	63.0	3.6	2.7	1.7	2.4	2.3	4.1	4.6	0.0	0.0	6.0
08	Chittaranjan	52.391	19.65	92	7.3	61.0	3.9	2.6	1.3	2.4	1.9	6.8	5.8	0.0	0.0	6.8
09	Contai	88.365	14.25	98	8.7	62.3	3.4	2.6	1.4	2.2	2.0	4.2	4.5	3.2	0.0	5.5
10	Gangarampur	61.028	10.29	69	8.9	61.7	3.8	2.7	1.7	2.4	2.2	5.0	5.1	0.0	0.0	6.5
11	Garulia	91.116	5.38	60	11.0	61.7	3.3	2.6	1.9	2.3	2.4	3.0	3.9	2.4	0.0	5.4
12	Gayeshpur	65.398	30.00	124	7.0	62.7	3.8	2.6	1.2	2.2	1.8	6.8	5.7	0.0	0.0	6.3
13	Gobardanga	57.878	13.50	78	8.2	61.6	3.8	2.7	1.5	2.4	2.1	5.7	5.4	0.0	0.0	6.6
14	J-A Ganj	51.790	11.66	70	8.3	60.7	3.9	2.7	1.6	2.5	2.2	5.8	5.5	0.0	0.0	6.9
15	Katwa	81.510	7.93	70	9.8	61.4	3.4	2.6	1.7	2.3	2.2	3.7	4.3	2.8	0.0	5.7

14. J-A Ganj – Jiyaganj-Azimganj

Appendix II

Estimated Capital Expenditure on Sewerage Infrastructure in Class I and Class II Towns of GRB

Table A2.01: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Dehradun	870.519	94.0	52.29	495	3463.8	54.7	1034.2	4552.7
02	Haldwani	169.147	18.3	10.62	111	778.8	4.8	200.9	984.5
03	Hardwar	487.923	52.7	13.00	193	1348.4	15.3	579.7	1943.4
04	Kashipur	121.610	13.1	5.46	70	490.4	2.5	144.5	637.4
05	Nainital	110.726	12.0	11.06	94	655.2	3.2	131.5	789.9
06	Rishikesh	102.138	11.0	10.00	86	603.1	2.8	121.3	727.2
07	Roorkee	118.188	12.8	20.20	131	915.6	4.6	140.4	1060.6
08	Rudrapur	140.884	15.2	12.43	112	783.0	4.3	167.4	954.7
Total		**2121.135**	**229.1**	**135.06**	**1292**	**9038.3**	**92.2**	**2519.9**	**11650.4**

Table A2.02: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousand	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	BHEL Ranipur	51.910	5.6	26.94	108	646.9	2.3	61.7	710.9
02	Manglaur	51.101	5.5	1.32	23	140.5	0.5	60.7	201.7
03	Pithoragarh	53.957	5.8	9.00	62	371.8	1.4	64.1	437.3
04	Ramnagar	55.446	6.0	2.42	32	194.9	0.7	65.9	261.5
Total		**212.414**	**22.9**	**39.68**	**225**	**1354.1**	**4.9**	**252.4**	**1611.4**

Table A2.03: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Uttar Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Agra	1746.467	188.6	141.00	1111	7773.7	180.2	2074.8	10028.7
02	Aligarh	909.559	98.2	36.70	423	2962.2	47.9	1080.6	4090.7
03	Allahabad	1216.719	131.4	63.07	631	4416.4	84.0	1445.5	5945.9
04	Amroha	197.135	21.3	12.00	126	881.0	5.9	234.2	1121.1
05	Azamgarh	116.165	12.5	12.60	102	713.6	3.6	138.0	855.2
06	Badaun	159.221	17.2	4.39	70	492.0	2.9	189.2	684.1
07	Ballia	111.287	12.0	16.00	113	793.2	3.9	132.2	929.3
08	Banda	154.388	16.7	11.05	109	765.6	4.5	183.4	953.5
09	Barabanki	154.692	16.7	3.87	65	457.3	2.6	183.8	643.7
10	Baraut	101.241	10.9	25.00	138	964.7	4.4	120.3	1089.4
11	Bareilly	979.933	105.8	106.43	745	5215.0	87.9	1164.2	6467.1
12	Basti	114.651	12.4	19.43	127	886.9	4.4	136.2	1027.5
13	Bijnour	115.381	12.5	3.65	55	382.3	1.9	137.1	521.3
14	Bulandsahar	222.826	24.1	32.50	218	1529.4	11.0	264.7	1805.1
15	Chandausi	114.254	12.3	8.80	84	590.7	2.9	135.7	729.3
16	Deoria	129.570	14.0	16.19	124	865.9	4.5	153.9	1024.3
17	Etah	131.023	14.2	13.49	113	793.0	4.2	155.7	952.9
18	Etawah	256.790	27.7	48.00	282	1976.4	15.5	305.1	2297.0
19	Faizabad	259.160	28.0	16.60	166	1159.7	9.2	307.9	1476.8
20	Farrukhabad	318.540	34.4	16.80	182	1272.3	11.3	378.4	1662.0
21	Fatehpur	193.801	20.9	56.98	276	1932.4	12.7	230.2	2175.3
22	Firozabad	603.797	65.2	21.35	270	1889.5	24.2	717.3	2631.0
23	Gazipur	121.136	13.1	13.45	110	767.9	3.9	143.9	915.7
24	Ghaziabad	2358.525	254.7	215.00	1573	11014.1	300.5	2801.9	14116.5
25	Gonda	138.929	15.0	24.62	157	1101.8	6.0	165.0	1272.8

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
26	Gorakhpur	692.519	74.8	147.00	756	5290.2	73.0	822.7	6185.9
27	Greater Noida	642.381	69.4	27.93	317	2217.3	29.5	763.1	3009.9
28	Hapur	262.801	28.4	42.00	266	1863.2	14.8	312.2	2190.2
29	Hardoi	197.046	21.3	11.05	121	845.5	5.7	234.1	1085.3
30	Hathras	161.289	17.4	8.40	97	679.9	4.1	191.6	875.6
31	Jaunpur	168.128	18.2	20.00	153	1067.8	6.5	199.7	1274.0
32	Jhansi	549.391	59.3	169.50	738	5165.6	62.2	652.7	5880.5
33	Kanpur	2920.067	315.4	261.50	1914	13399.5	410.4	3469.0	17278.9
34	Kasganj	101.241	10.9	7.10	72	505.2	2.3	120.3	627.8
35	Lakhimpur	164.925	17.8	10.20	108	755.5	4.6	195.9	956.0
36	Lalitpur	133.041	14.4	18.00	132	923.3	4.9	158.1	1086.3
37	Loni	512.296	55.3	34.48	319	2230.9	26.1	608.6	2865.6
38	Lucknow	2901.474	313.4	330.00	2147	15025.7	458.0	3447.0	18930.7
39	Mainpuri	133.078	14.4	7.50	85	594.8	3.2	158.1	756.1
40	Mathura	454.937	49.1	32.80	295	2067.5	22.6	540.5	2630.6
41	Mau	279.060	30.1	39.00	263	1838.5	15.1	331.5	2185.1
42	Meerut	1424.908	153.9	41.94	554	3876.3	80.2	1692.8	5649.3
43	Mirzapur	233.691	25.2	40.00	248	1733.3	12.8	277.6	2023.7
44	Modinagar	182.811	19.7	14.00	132	922.6	5.9	217.2	1145.7
45	Moradabad	889.810	96.1	80.00	618	4328.3	69.2	1057.1	5454.6
46	Mugalsarai	154.692	16.7	14.43	125	876.0	5.1	183.8	1064.9
47	Muradanagar	100.080	10.8	12.00	94	656.7	3.0	118.9	778.6
48	Muzaffar Nagar	316.729	34.2	12.04	154	1076.6	9.6	376.3	1462.5
49	Noida	642.381	69.4	203.16	865	6054.6	79.6	763.1	6897.3
50	Orai	190.625	20.6	16.00	143	1003.4	6.6	226.5	1236.5
51	Pililbhit	160.146	17.3	9.50	103	720.6	4.3	190.3	915.2
52	Raibareliy	191.625	20.7	34.00	211	1473.8	9.7	227.7	1711.2

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
53	Rampur	359.062	38.8	20.20	210	1467.2	14.0	426.6	1907.8
54	Saharanpur	703.345	76.0	73.72	535	3748.4	52.5	835.6	4636.5
55	Sahaswann	178.000	19.2	7.50	96	669.4	4.2	211.5	885.1
56	Sahjahanpur	356.103	38.5	11.37	157	1100.8	10.4	423.1	1534.3
57	Shambhal	221.334	23.9	15.65	151	1054.8	7.6	262.9	1325.3
58	Sitapur	188.230	20.3	35.00	212	1485.4	9.7	223.6	1718.7
59	Sultanpur	116.211	12.6	16.00	115	806.6	4.0	138.1	948.7
60	Ujhani	191.000	20.6	6.50	92	642.5	4.2	226.9	873.6
61	Unnao	178.681	19.3	21.50	162	1134.8	7.2	212.3	1354.3
62	Varansi	1435.113	155.0	79.79	764	5349.2	111.4	1704.9	7165.5
TOTAL		**29613.440**	**3198.3**	**2869.73**	**20894**	**146248.7**	**2494.2**	**35181.1**	**183924.0**

Table A2.04: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Uttar Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Auraiya	70.515	7.6	4.00	46	274.7	1.2	83.8	359.7
02	Baghpat	50.380	5.4	2.83	34	202.5	0.7	59.9	263.1
03	Baheri	74.869	8.1	15.00	91	546.4	2.5	88.9	637.8
04	Balrampur	90.000	9.7	36.28	161	964.1	4.7	106.9	1075.7
05	Bhadohi	94.563	10.2	8.00	75	447.8	2.3	112.3	562.4
06	Bisalpur	83.347	9.0	4.58	54	321.7	1.6	99.0	422.3

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
07	Chandpur	83.456	9.0	23.40	124	743.8	3.5	99.1	846.4
08	Chibramau	55.296	6.0	11.10	70	417.6	1.6	65.7	484.9
09	Chitrakoot	57.452	6.2	7.77	59	353.3	1.4	68.3	423.0
10	Dadri	91.345	9.9	6.50	66	397.7	2.0	108.5	508.2
11	Deoband	97.068	10.5	7.90	75	449.5	2.4	115.3	567.2
12	Faredpur	76.422	8.3	9.43	73	435.1	2.0	90.8	527.9
13	Gangaghat	84.301	9.1	4.91	56	334.6	1.6	100.1	436.3
14	Gangoh	59.463	6.4	6.00	52	314.3	1.3	70.6	386.2
15	Gola	53.842	5.8	10.08	66	393.6	1.5	64.0	459.1
16	Hasanpur	64.536	7.0	5.72	53	316.8	1.3	76.7	394.8
17	Jahangerabad	59.873	6.5	14.30	82	490.0	2.0	71.1	563.1
18	Jalaun	56.871	6.1	5.00	47	281.9	1.1	67.6	350.6
19	Kaimur	51.469	5.6	7.12	54	324.2	1.2	61.1	386.5
20	Kairana	95.092	10.3	7.11	70	422.8	2.2	113.0	538.0
21	Kannauj	71.727	7.7	70.70	202	1209.5	5.2	85.2	1299.9
22	Khatauli	72.478	7.8	3.76	45	269.3	1.2	86.1	356.6
23	Kiratpur	61.801	6.7	4.45	46	274.8	1.1	73.4	349.3
24	Konch	53.426	5.8	2.95	35	211.7	0.8	63.5	276.0
25	Laharpur	61.280	6.6	8.00	61	367.5	1.5	72.8	441.8
26	Mahoba	95.454	10.3	12.15	93	556.3	2.9	113.4	672.6
27	Mau Ranipur	58.456	6.3	5.53	50	299.7	1.2	69.4	370.3
28	Mawana	81.126	8.8	7.50	68	408.4	1.9	96.4	506.7
29	Mubarakpur	71.365	7.7	9.00	69	413.7	1.9	84.8	500.4
30	Nagina	71.350	7.7	10.30	74	442.9	2.0	84.8	529.7
31	Nazibabad	88.638	9.6	5.06	58	346.5	1.7	105.3	453.5
32	Obra	56.116	6.1	4.50	44	266.1	1.0	66.7	333.8

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in Km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
33	Pilkhuwa	81.651	8.8	5.80	60	359.4	1.7	97.0	458.1
34	Pratapgarh	76.750	8.3	12.00	82	492.3	2.3	91.2	585.8
35	Ramnagar	54.800	5.9	3.60	39	236.0	0.9	65.1	302.0
36	Rath	65.092	7.0	6.10	55	328.2	1.4	77.3	406.9
37	S R Nagar	94.563	10.2	8.00	75	447.8	2.3	112.3	562.4
38	Shahbad	80.305	8.7	9.70	77	463.9	2.2	95.4	561.5
39	Sherkot	62.148	6.7	6.00	53	319.7	1.3	73.8	394.8
40	Sikandrabad	80.309	8.7	1.14	27	160.4	0.7	95.4	256.5
41	Tanda	96.138	10.4	10.45	86	516.4	2.7	114.2	633.3
42	Tilhar	60.803	6.6	3.48	40	241.7	1.0	72.2	314.9
43	Vrindavann	62.926	6.8	13.49	81	484.4	2.0	74.8	561.2
TOTAL		**3108.862**	**335.8**	**420.69**	**2928**	**17549.0**	**79.0**	**3693.2**	**21321.2**

37. S R Nagar – Sant Ravidas Nagar

Table A2.05: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Himanchal Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in Km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
No Class I town									

Table A2.06: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Himanchal Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in Km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
No Class II town									

Table A2.07: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Bhadur Garh	170.426	18.4	50.00	245	1718.4	10.5	202.5	1931.4
02	Bhiwani	197.662	21.3	47.78	254	1777.4	11.9	234.8	2024.1
03	Faridabad	1404.653	151.7	207.80	1226	8579.9	176.0	1668.7	10424.6
04	Gurgoan	901.968	97.4	37.10	424	2967.0	47.7	1071.5	4086.2
05	Hisar	301.249	32.5	48.03	301	2109.3	18.1	357.9	2485.3
06	Jagadhari	124.915	13.5	24.80	152	1061.9	5.4	148.4	1215.7
07	Jind	166.225	18.0	42.00	222	1554.7	9.4	197.5	1761.6
08	Kaithal	144.633	15.6	45.75	220	1541.6	8.5	171.8	1721.9
09	Karnal	286.974	31.0	12.00	147	1030.6	8.6	340.9	1380.1
10	Kurukhetra	154.962	16.7	34.50	195	1367.0	7.9	184.1	1559
11	Narnaul	134.067	14.5	41.10	202	1416.9	7.5	159.3	1583.7
12	Palwal	127.931	13.8	8.78	90	633.2	3.3	152.0	788.5
13	Panipat	294.150	31.8	41.40	277	1936.5	16.4	349.5	2302.4
14	Rohtak	373.133	40.3	47.50	327	2291.3	22.3	443.3	2756.9
15	Sonipat	292.339	31.6	52.80	312	2187.0	18.5	347.3	2552.8
16	Yamuna Nagar	241.723	26.1	34.50	233	1629.3	12.3	287.2	1928.8
Total		**5317.010**	**574.2**	**775.84**	**4827**	**33802.0**	**384.3**	**6316.7**	**40503.0**

Table A2.08: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Hodal	50.003	5.4	5.39	46	278.7	1.0	59.4	339.1
02	Narvana	61.800	6.7	10.00	69	412.9	1.7	73.4	488.0
03	Sahadab	51.786	5.6	5.00	45	271.9	1.0	61.5	334.4
Total		**163.589**	**17.7**	**20.39**	**160**	**963.5**	**3.7**	**194.3**	**1161.5**

Table A2.09: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	B J	197.150	21.3	6.70	94	660.8	4.4	234.2	899.4
02	Burari	145.584	15.7	11.19	108	752.6	4.2	173.0	929.8
03	Dallo Pura	154.955	16.7	2.29	51	355.6	2.0	184.1	541.7
04	Delhi Cantt.	116.352	12.6	42.97	193	1350.9	6.6	138.2	1495.7
05	DMC	11007.835	1188.8	431.09	4572	32002.2	1986.2	13077.3	47065.7
06	Deoli	169.410	18.3	10.12	109	760.8	4.7	201.3	966.8
07	Gokalpur	121.938	13.2	2.32	46	323.9	1.6	144.9	470.4
08	Hastal	177.033	19.1	6.75	91	634.2	4.0	210.3	848.5
09	Karawal Nagar	224.666	24.3	4.75	84	590.7	4.3	266.9	861.9
10	K S N	282.598	30.5	4.74	93	651.2	5.3	335.7	992.2
11	Mandoli	120.345	13.0	41.77	196	1372.8	6.8	143.0	1522.6
12	Mustafabad	127.012	13.7	1.29	36	249.3	1.3	150.9	401.5
13	Nangloi Jat	205.497	22.2	6.67	96	670.9	4.6	244.1	919.6
14	NDMC	249.998	27.0	42.74	263	1842.4	14.2	297.0	2153.6
15	Sultanpur Majra	181.624	19.6	2.86	60	422.9	2.7	215.8	641.4
Total		**13482.000**	**1456.1**	**618.25**	**6092**	**42641.2**	**2052.9**	**16016.7**	**60710.8**

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

Table A2.10: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Babarpur	52.918	5.7	0.79	19	111.5	0.4	62.9	174.8
02	C S B	81.374	8.8	2.58	40	239.6	1.1	96.7	337.4
03	Gharoli	84.722	9.1	3.56	48	285.6	1.4	100.6	387.6
04	Jaffrabad	70.089	7.6	0.90	22	133.2	0.6	83.3	217.1
05	Khajoori Khas	55.006	5.9	0.94	21	123.0	0.5	65.3	188.8
06	Mithe Pur	49.583	5.4	1.81	27	161.8	0.6	58.9	221.3
07	Molar Band	49.439	5.3	4.12	40	242.5	0.9	58.7	302.1
08	Mundka	53.525	5.8	11.89	71	427.4	1.6	63.6	492.6
09	Pooth Kalan	61.727	6.7	6.97	57	343.8	1.4	73.3	418.5
10	Pulpehlad	64.484	7.0	2.16	33	195.9	0.8	76.6	273.3
11	S P G	52.730	5.7	1.05	21	127.5	0.5	62.6	190.6
12	Taj Pul	72.764	7.9	1.22	26	156.3	0.7	86.4	243.4
13	Tigri	54.774	5.9	1.05	22	129.5	0.5	65.1	195.1
14	Ziauddin Pur	58.661	6.3	1.80	29	172.6	0.7	69.7	243.0
Total		**861.796**	**93.1**	**40.84**	**476**	**2850.2**	**11.7**	**1023.7**	**3885.6**

02. C S B – Chilla Saroda Bangar

11. S P G – Sadat Pur Gurjan

Table A2.11: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Rajasthan in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Ajmer	542.580	58.6	87.00	521	3648.2	44.0	644.6	4336.8
02	Alwar	315.310	34.1	49.00	310	2171.1	19.2	374.6	2564.9
03	Bahilwara	360.009	38.9	69.00	390	2731.0	26.0	427.7	3184.7
04	Baran	118.157	12.8	72.36	260	1823.1	8.7	140.4	1972.2
05	Bharatpur	252.109	27.2	29.00	217	1517.5	11.8	299.5	1828.8
06	Bundi	102.823	11.1	22.76	132	923.9	4.3	122.2	1050.4
07	Chittaugarh	116.409	12.6	30.50	161	1128.1	5.6	138.3	1272.0
08	Dhaulpur	126.142	13.6	32.00	174	1215.9	6.2	149.9	1372.0
09	Gangapurcity	224.773	24.3	17.22	159	1113.5	8.1	267.0	1388.6
10	Hindauncity	105.690	11.4	48.00	198	1383.2	6.4	125.6	1515.2
11	Jaipur	3073.350	331.9	485.00	2679	18750.6	588.2	3651.1	22989.9
12	Jhunjhunun	118.966	12.8	50.00	215	1502.5	7.3	141.3	1651.1
13	Kishangarh	155.019	16.7	100.00	341	2388.4	13.5	184.2	2586.1
14	Kota	1001.365	108.1	527.03	1710	11967.9	199.8	1189.6	13357.3
15	Nagaur	100.618	10.9	37.81	171	1196.9	5.4	119.5	1321.8
16	Sikar	237.579	25.7	39.90	249	1742.6	13.0	282.2	2037.8
17	Swaimadhavpur	120.998	13.1	49.00	214	1495.8	7.4	143.7	1646.9
18	Tonk	165.363	17.9	16.00	135	947.6	5.7	196.5	1149.8
19	Udaipur	451.735	48.8	56.91	389	2721.0	29.6	536.7	3287.3
Total		**7688.995**	**830.4**	**1818.49**	**8625**	**60368.8**	**1010.2**	**9134.6**	**70513.6**

Table A2.12: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Rajasthan in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Jhalawara	66.500	7.2	12.95	81	484.4	2.1	79.0	565.5
02	Makrana	94.447	10.2	36.00	163	976.9	4.9	112.2	1094.0
03	Nawalgarh	64.903	7.0	27.91	119	714.0	3.0	77.1	794.1
04	Nimbahera	61.000	6.6	12.74	77	465.0	1.9	72.5	539.4
Total		**286.85**	**31.0**	**89.6**	**440**	**2640.3**	**11.9**	**340.8**	**2993.0**

Table A2.13: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Madhya Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Bhind	197.332	21.3	17.79	153	1073.3	7.2	234.4	1314.9
02	Bopal	1883.381	203.4	285.00	1640	11477.8	276.3	2237.5	13991.6
03	Chatarpur	147.688	16.0	54.00	242	1694.4	9.4	175.5	1879.3
04	Damoh	147.515	15.9	16.00	129	905.6	5.1	175.2	1085.9
05	Datia	100.466	10.9	6.85	71	494.6	2.3	119.4	616.3
06	Dewas	289.438	31.3	102.00	437	3060.6	25.4	343.9	3429.9
07	Guna	180.978	19.5	45.75	240	1679.3	10.6	215.0	1904.9
08	Gwalior	1101.981	119.0	173.88	1006	7042.7	126.3	1309.2	8478.2
09	Indore	2167.447	234.1	131.17	1181	8269.7	215.7	2574.9	11060.3
10	Jabalpur	1267.564	136.9	135.00	941	6588.6	128.0	1505.9	8222.5
11	Katni	221.875	24.0	68.60	320	2242.8	16.0	263.6	2522.4
12	Mandsour	141.468	15.3	36.00	193	1349.7	7.4	168.1	1525.2
13	Morena	200.506	21.7	12.00	127	887.2	6.0	238.2	1131.4

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
14	Neemuch	128.575	13.9	22.00	144	1009.6	5.2	152.7	1167.5
15	Pithampur	126.099	13.6	89.90	299	2095.1	10.4	149.8	2255.3
16	Ratlam	273.892	29.6	39.19	261	1829.0	14.9	325.4	2169.3
17	Rewa	235.422	25.4	102.00	403	2823.2	20.7	279.7	3123.6
18	Sagar	370.296	40.0	33.75	275	1921.7	18.7	439.9	2380.3
19	Satna	283.004	30.6	12.00	146	1024.5	8.5	336.2	1369.2
20	Sehore	1090.025	117.7	13.10	278	1944.2	34.3	1294.9	3273.4
21	Shahdol	100.565	10.9	28.24	147	1025.8	4.6	119.5	1149.9
22	Shepour	105.026	11.3	5.00	61	430.0	2.0	124.8	556.8
23	Shivpuri	179.972	19.4	86.55	334	2338.0	14.6	213.8	2566.4
24	Singrauli	220.295	23.8	280.66	674	4720.5	32.1	261.7	5014.3
25	Tikamgarh	101.786	11.0	6.22	68	473.7	2.2	120.9	596.8
26	Ujjain	515.215	55.6	92.68	527	3686.6	43.1	612.1	4341.8
27	Vidisha	155.959	16.8	8.83	98	687.5	4.0	185.3	876.8
TOTAL		**11933.77**	**1288.8**	**1904.16**	**10395**	**72775.7**	**1051.0**	**14177.5**	**88004.2**

Table A2.14: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Madhya Pradesh in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Basoda	78.265	8.5	5.90	58	347.2	1.7	93.0	441.9
02	Bina	64.579	7.0	12.00	77	460.8	1.9	76.7	539.4
03	Dabra	61.260	6.6	12.00	75	451.7	1.8	72.8	526.3
04	Dhar	95.000	10.3	30.00	148	888.9	4.5	112.9	1006.3

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
05	Jaora	65.111	7.0	5.54	52	312.8	1.3	77.4	391.5
06	Mandla	55.145	6.0	8.87	62	372.1	1.4	65.5	439.0
07	Narshimpur	59.858	6.5	14.71	83	497.1	2.0	71.1	570.2
08	Panna	50.432	5.4	4.50	43	255.4	0.9	59.9	316.2
09	Shajapur	70.000	7.6	11.16	76	457.9	2.0	83.2	543.1
10	Sidhi	54.317	5.9	12.31	73	437.5	1.7	64.5	503.7
Total		**653.967**	**70.6**	**116.99**	**747**	**4481.4**	**19.2**	**777.0**	**5277.6**

Table A2.15: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Arrah	261.099	28.2	30.97	227	1591.5	12.6	310.2	1914.3
02	Aurangabad	101.520	11.0	8.00	77	537.2	2.5	120.6	660.3
03	Bagaha	113.012	12.2	11.00	94	658.7	3.3	134.3	796.3
04	Begusarai	251.136	27.1	8.98	121	844.5	6.5	298.3	1149.3
05	Bettiah	132.896	14.4	11.55	105	737.4	3.9	157.9	899.2
06	B M C	398.138	43.0	30.17	268	1873.0	19.0	473.0	2365.0
07	B M C	296.889	32.1	22.46	204	1427.6	12.2	352.7	1792.5
08	Buxar	102.591	11.1	8.00	77	539.4	2.5	121.9	663.8
09	Chapra (NP)	201.597	21.8	16.96	151	1057.0	7.2	239.5	1303.7
10	Darbhanga	294.116	31.8	19.18	188	1314.1	11.2	349.4	1674.7
11	Dehri	137.068	14.8	21.32	145	1018.3	5.5	162.8	1186.6
12	D N	182.241	19.7	11.63	120	840.0	5.4	216.5	1061.9

Table A2.15 continued to next page … … … …

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
13	Gaya	463.454	50.1	50.17	369	2580.5	28.5	550.6	3159.6
14	Hajipur	147.126	15.9	19.64	143	1003.8	5.7	174.8	1184.3
15	Jamalpur	105.221	11.4	10.65	90	630.0	3.0	125.0	758.0
16	Jehanabad	102.456	11.1	20.23	124	867.7	4.0	121.7	993.4
17	Katihar	225.982	24.4	24.54	191	1333.7	9.7	268.5	1611.9
18	Kishanganj	107.076	11.6	30.12	155	1086.2	5.1	127.2	1218.5
19	M T	105.000	11.3	8.50	80	561.3	2.7	124.7	688.7
20	Motihari	125.183	13.5	13.52	111	779.8	4.0	148.7	932.5
21	Munger	213.101	23.0	17.50	157	1098.3	7.7	253.2	1359.2
22	Muzaffarpur	351.838	38.0	26.43	238	1663.4	15.7	418.0	2097.1
23	Nawada	109.141	11.8	5.68	66	465.4	2.3	129.7	597.4
24	Patna	1683.200	181.8	108.34	957	6698.7	152.3	1999.6	8850.6
25	Purnia	280.547	30.3	44.52	282	1971.1	16.3	333.3	2320.7
26	Saharsa	155.175	16.8	21.13	152	1063.8	6.2	184.3	1254.3
27	Sasaram	147.396	15.9	12.00	112	783.2	4.4	175.1	962.7
28	Siwan	134.458	14.5	15.68	123	864.4	4.6	159.7	1028.7
TOTAL		**6928.657**	**748.3**	**628.87**	**5127**	**35890.0**	**364.0**	**8231.2**	**44485.2**

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 Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Araria	80.000	8.6	4.50	52	313.8	1.5	95.0	410.3
02	Barahiya	50.230	5.4	26.54	106	634.5	2.2	59.7	696.4
03	Barh	61.037	6.6	4.50	46	275.0	1.1	72.5	348.6
04	Bhabua	52.611	5.7	7.12	54	326.9	1.2	62.5	390.6
05	D M	67.995	7.3	11.30	76	455.7	2.0	80.8	538.5
06	Dumraon	57.716	6.2	15.33	83	501.0	2.0	68.6	571.6
07	Forbesganj	52.289	5.6	4.98	45	272.4	1.0	62.1	335.5
08	Gopalganj	66.624	7.2	11.11	75	448.3	1.9	79.1	529.3
09	Kaimur	51.469	5.6	7.12	54	324.2	1.2	61.1	386.5
10	Khagaria	56.978	6.2	2.97	36	217.9	0.9	67.7	286.5
11	Khagaul	60.866	6.6	5.32	50	298.6	1.2	72.3	372.1
12	Lakhisarai	98.123	10.6	24.79	136	813.7	4.2	116.6	934.5
13	Madhepura	56.739	6.1	25.84	109	653.2	2.5	67.4	723.1
14	Masaurhi	57.012	6.2	9.43	65	388.7	1.5	67.7	457.9
15	Mokameh	71.335	7.7	14.18	87	521.2	2.3	84.7	608.2
16	Narkatiaganj	51.446	5.6	10.96	67	404.0	1.5	61.1	466.6
17	Phulwari Sharif	67.348	7.3	6.48	57	342.9	1.5	80.0	424.4
18	Raxaul Bazar	52.429	5.7	5.82	49	294.9	1.1	62.3	358.3
19	Samastipur	70.042	7.6	3.45	42	254.7	1.1	83.2	339.0
20	Shekhpura	54.322	5.9	15.58	82	494.0	1.9	64.5	560.4
21	Sitamarhi	87.279	9.4	8.00	72	434.1	2.1	103.7	539.9
22	Sultanganj	52.867	5.7	12.29	72	432.8	1.6	62.8	497.2
23	Supaul	85.200	9.2	22.37	122	731.9	3.5	101.2	836.6
TOTAL		**1461.957**	**157.9**	**259.98**	**1637**	**9834.4**	**41.0**	**1736.6**	**11612.0**

05. D M – Digha-Mainpura

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

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Ambikapur	114.575	12.4	9.39	87	611.1	3.1	136.1	750.3
02	Bhilai Nagar	625.697	67.6	141.30	709	4966.0	64.6	743.3	5773.9
03	Bilaspur	330.106	35.7	37.56	276	1933.0	17.6	392.2	2342.8
04	Durg	268.679	29.0	66.09	339	2372.6	19.0	319.2	2710.8
05	Jagdalpur	125.345	13.5	22.49	144	1011.2	5.2	148.9	1165.3
06	Korba	363.210	39.2	215.02	707	4947.4	46.3	431.5	5425.2
07	Raigarh	137.097	14.8	20.68	143	1002.6	5.4	162.9	1170.9
08	Raipur	1010.087	109.1	108.66	763	5340.6	91.5	1200.0	6632.1
09	Rajnandgaon	163.122	17.6	78.09	305	2134.7	12.5	193.8	2341.0
Total		**3137.918**	**338.9**	**699.28**	**3473**	**24319.2**	**265.2**	**3727.9**	**28312.3**

Table A2.18: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Chhatisgarh in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Bhatapara	54.846	5.9	30.42	117	703.2	2.6	65.2	771.0
02	Bhilai Charoda	95.848	10.4	141.30	343	2059.9	9.9	113.9	2183.7
03	Chirmiri	99.934	10.8	64.94	228	1366.6	7.0	118.7	1492.3
04	Dalli-Rajhara	55.684	6.0	37.25	131	786.9	3.0	66.2	856.1
05	Dhamtari	89.857	9.7	23.40	127	764.2	3.8	106.8	874.8
06	Mahasamund	51.543	5.6	14.68	78	470.0	1.7	61.2	532.9
Total		**447.712**	**48.4**	**311.99**	**1024**	**6150.8**	**28.0**	**532.0**	**6710.8**

Table A2.19: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Aditya	173.988	18.8	49.82	247	1728.8	10.7	206.7	1946.2
02	Bhuli	110.127	11.9	11.74	96	674.0	3.3	130.8	808.1
03	Bokaro	413.934	44.7	162.91	644	4506.7	45.9	491.8	5044.4
04	Chas	141.618	15.3	20.49	144	1010.5	5.6	168.2	1184.3
05	Deoghar	203.116	21.9	14.00	138	963.1	6.6	241.3	1211.0
06	Dhanbad	1161.561	125.4	23.39	379	2651.7	48.8	1379.9	4080.4
07	Giridih	114.447	12.4	9.75	89	622.6	3.1	136.0	761.7
08	Hazaribag	142.494	15.4	26.37	165	1152.6	6.4	169.3	1328.3
09	JNAC	629.659	68.0	59.80	459	3215.1	42.3	748.0	4005.4
10	Jharia	100.839	10.9	4.42	57	397.8	1.8	119.8	519.4
11	Jorapokhar	104.673	11.3	16.40	112	784.6	3.7	124.4	912.7
12	MNAC	224.002	24.2	19.45	169	1182.0	8.6	266.1	1456.7
13	Phusro	102.673	11.1	40.64	179	1252.8	5.7	122.0	1380.5
14	Ranchi	1073.440	115.9	177.19	1004	7029.6	124.2	1275.2	8429.0
15	Saunda	104.642	11.3	24.26	137	961.5	4.5	124.3	1090.3
Total		**4801.213**	**518.5**	**660.63**	**4019**	**28133.4**	**321.2**	**5703.8**	**34158.4**

09. JNAC – Jamshedpur Notified Area Committee

12. MNAC – Mango Notified Area Committee

Table A2.20: Estimated Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Bagbera	82.559	8.9	10.70	82	493.1	2.3	98.1	593.5
02	Bhowrah	54.483	5.9	15.73	83	497.0	1.9	64.7	563.6
03	Bhuli	99.999	10.8	8.60	79	474.8	2.5	118.8	596.1
04	Chaibasa	78.287	8.5	11.11	82	492.8	2.3	93.0	588.1
05	Chatra	51.685	5.6	3.45	38	225.8	0.8	61.4	288.0
06	Daltonganj	87.849	9.5	14.00	97	579.8	2.9	104.4	687.1
07	Dumka	55.336	6.0	6.12	51	308.8	1.2	65.7	375.7
08	Gumia	56.024	6.1	26.11	109	653.8	2.5	66.6	722.9
09	Jhumri Tilaiya	85.489	9.2	51.14	190	1137.8	5.3	101.6	1244.7
10	Jugsalai	56.720	6.1	3.69	40	242.1	0.9	67.4	310.4
11	Katras	63.017	6.8	5.00	49	293.4	1.2	74.9	369.5
12	Lohardaga	56.821	6.1	14.57	81	485.2	1.9	67.5	554.6
13	Madhupur	58.211	6.3	18.36	92	551.7	2.2	69.2	623.1
14	Ramgarh Cantt.	90.324	9.8	34.46	157	939.3	4.6	107.3	1051.2
15	Sahibganj	98.589	10.6	8.98	80	482.7	2.6	117.1	602.4
16	Sindri	94.398	10.2	46.65	187	1121.4	5.6	112.1	1239.1
17	Tisra	65.894	7.1	14.02	84	502.8	2.1	78.3	583.2
Total		**1235.685**	**133.5**	**292.69**	**1581**	**9482.3**	**42.8**	**1468.1**	**10993.2**

Table A2.21: Estimated Capital Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of West Bengal in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in Km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Alipurduar	127.342	13.8	9.80	95	667.8	3.5	151.3	822.6
02	Asansol	564.491	61.0	127.87	645	4517.7	55.5	670.6	5243.8
03	A-K	123.906	13.4	18.44	130	909.4	4.6	147.2	1061.2
04	Baidyabati	121.081	13.1	7.89	84	587.4	3.0	143.8	734.2
05	Bally	115.715	12.5	11.68	98	685.4	3.4	137.5	826.3
06	Balurghat	151.183	16.3	10.46	106	738.7	4.2	179.6	922.5
07	Bangaon	110.668	12.0	24.70	142	991.2	4.8	131.5	1127.5
08	Bankura	138.036	14.9	19.06	138	964.3	5.2	164.0	1133.5
09	Bansberia	103.799	11.2	9.07	83	577.5	2.7	123.3	703.5
10	Bara Nagar	248.466	26.8	7.12	107	750.4	5.8	295.2	1051.4
11	Barasat	283.443	30.6	34.50	248	1738.6	14.5	336.7	2089.8
12	Bardhaman	314.638	34.0	26.30	226	1583.2	14.0	373.8	1971.0
13	Barrackpore	154.475	16.7	11.65	112	786.3	4.6	183.5	974.4
14	Basirhat	127.135	13.7	22.50	145	1016.9	5.2	151.0	1173.1
15	Beharampore	195.363	21.1	31.43	204	1426.6	9.5	232.1	1668.2
16	Bhadreswar	101.334	10.9	8.28	78	546.2	2.5	120.4	669.1
17	Bhatpara	390.467	42.2	30.42	266	1865.3	18.7	463.9	2347.9
18	Bidhannagar	218.323	23.6	30.00	208	1456.3	10.4	259.4	1726.1
19	Chakdaha	132.855	14.3	15.54	122	856.4	4.6	157.8	1018.8
20	Champadani	110.983	12.0	6.47	71	500.1	2.5	131.8	634.4
21	Chandernagore	166.949	18.0	22.03	160	1118.4	6.8	198.3	1323.5
22	Chinsurah	180.502	19.5	17.24	146	1019.1	6.5	214.4	1240.0
23	Darjiling	120.414	13.0	10.57	97	678.5	3.4	143.1	825.0
24	Dhulian	239.022	25.8	10.27	126	883.5	6.7	284.0	1174.2
25	Durgapur	566.937	61.2	1.10	64	449.3	5.2	673.5	1128.0

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
26	Habra	149.675	16.2	21.80	152	1065.7	6.1	177.8	1249.6
27	Haldia	200.762	21.7	104.90	385	2696.3	17.9	238.5	2952.7
28	Halisahar	126.893	13.7	8.28	88	613.0	3.2	150.7	766.9
29	H-C	177.209	19.1	8.29	100	702.0	4.4	210.5	916.9
30	Jalpaiguri	107.351	11.6	12.50	98	689.1	3.3	127.5	819.9
31	Jamuria	144.791	15.6	73.23	282	1974.6	10.8	172.0	2157.4
32	Jangipore	122.875	13.3	7.86	84	589.7	3.0	146.0	738.7
33	Kalyani	100.62	10.9	21.91	128	898.4	4.1	119.5	1022.0
34	Kamarhati	336.579	36.4	20.48	205	1437.2	13.2	399.9	1850.3
35	Kanchapara	122.181	13.2	29.21	164	1146.0	5.7	145.2	1296.9
36	Kharagpur	206.923	22.3	90.65	361	2525.6	17.1	245.8	2788.5
37	Khardaha	111.13	12.0	10.96	93	653.1	3.2	132.0	788.3
38	Kolkata	4486.689	484.6	185.00	1964	13745.5	530.3	5330.2	19606.0
39	Konnagar	124.585	13.5	9.07	91	636.9	3.3	148.0	788.2
40	Krishnanagar	181.182	19.6	6.87	92	645.9	4.1	215.2	865.2
41	Madhyamgram	198.964	21.5	21.32	169	1179.8	8.0	236.4	1424.2
42	Mahestala	449.423	48.5	21.50	238	1666.4	18.1	533.9	2218.4
43	Medinipur	169.127	18.3	14.78	131	918.8	5.7	200.9	1125.4
44	Nabadwip	125.528	13.6	11.66	104	724.5	3.7	149.1	877.3
45	Naihati	221.762	24.0	11.55	130	907.5	6.5	263.5	1177.5
46	N B	134.825	14.6	17.17	129	906.1	4.9	160.2	1071.2
47	NDD	253.625	27.4	26.45	207	1452.0	11.3	301.3	1764.6
48	Panihati	383.522	41.4	6.89	127	891.0	8.7	455.6	1355.3
49	Puruliya	121.436	13.1	13.90	112	781.6	3.9	144.3	929.8
50	Raiganj	183.682	19.8	10.64	115	806.2	5.2	218.2	1029.6
51	R G	404.991	43.7	28.00	260	1817.5	18.6	481.1	2317.2

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S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
52	R S	423.806	45.8	49.25	352	2461.6	25.8	503.5	2990.9
53	Rana Ghat	235.583	25.4	7.72	109	763.3	5.7	279.9	1048.9
54	Raniganj	128.624	13.9	23.44	149	1043.1	5.4	152.8	1201.3
55	Rishra	124.591	13.5	6.48	77	538.8	2.8	148.0	689.6
56	Santipur	151.774	16.4	24.60	163	1139.7	6.5	180.3	1326.5
57	Serampore	183.339	19.8	14.50	134	940.1	6.1	217.8	1164.0
58	Siliguri	509.709	55.0	41.90	351	2454.4	28.7	605.5	3088.6
59	S D D	410.524	44.3	17.39	206	1442.8	14.9	487.7	1945.4
60	Titagarh	118.426	12.8	3.24	54	376.0	1.9	140.7	518.6
61	Uluberia	221.175	23.9	33.72	222	1553.8	11.2	262.8	1827.8
62	Uttarpara K	162.386	17.5	16.34	136	950.8	5.7	192.9	1149.4
TOTAL		**17123.79**	**1849.4**	**1557.84**	**11863**	**83049.3**	**1046.8**	**20342.9**	**104439.0**

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 Capital Expenditure on Sewerage Infrastructure in Class II Towns (Population between 0.05 and 0.1 Million) of West Bengal in NRGB

S No	Town	Population in Thousands	Estimated Sewage Generation, MLD	Town Area in km^2	Estimated Length of Sewer Network, km	Estimated Capital Expenditure, Millions of INR			Estimated Total Expenditure, Millions of INR
						Sewerage Network	Sewage Pumping	Sewage Treatment	
01	Arambagh	67.000	7.2	34.75	135	810.2	3.4	79.6	893.2
02	Baduria	52.500	5.7	22.43	98	589.9	2.2	62.4	654.5
03	Bankra	55.229	6.0	3.59	39	236.4	0.9	65.6	302.9
04	Baruipur	53.500	5.8	9.50	63	381.0	1.4	63.6	446.0
05	Bishnupur	70.620	7.6	22.01	108	651.0	2.9	83.9	737.8
06	Bolpur	74.890	8.1	10.73	77	460.8	2.1	89.0	551.9
07	Budge Budge	76.858	8.3	9.06	71	427.3	2.0	91.3	520.6
08	Chittaranjan	52.391	5.7	19.65	92	550.1	2.0	62.2	614.3
09	Contai	88.365	9.5	14.25	98	586.5	2.9	105.0	694.4
10	Gangarampur	61.028	6.6	10.29	69	417.0	1.7	72.5	491.2
11	Garulia	91.116	9.8	5.38	60	361.2	1.8	108.2	471.2
12	Gayeshpur	65.398	7.1	30.00	124	743.5	3.1	77.7	824.3
13	Gobardanga	57.878	6.3	13.50	78	469.7	1.8	68.8	540.3
14	J-A Ganj	51.790	5.6	11.66	70	418.1	1.5	61.5	481.1
15	Katwa	81.510	8.8	7.93	70	420.9	2.0	96.8	519.7
Total		**1000.073**	**108.0**	**224.73**	**1252**	**7523.6**	**31.7**	**1188.1**	**8743.4**

14. J-A Ganj – Jiyaganj-Azimganj

Appendix III

Estimated Footprint, Energy Consumption, and Expenditure on Sewerage Infrastructure in Class I and Class II Towns of GRB

Table A3.01: Estimated Footprint, Energy Consumption, and Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Uttarakhand in NRGB

S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in kWh (Unit of Electricity)	Expenditure in INR
01	Dehradun	870.519	52.29	495	9.4	0.1	21.5	43.0	904.9	0.05	2.8
02	Haldwani	169.147	10.62	111	1.8	0.1	4.0	5.9	186.6	0.03	3.0
03	Hardwar	487.923	13.00	193	5.3	0.1	11.5	17.5	394.4	0.04	2.2
04	Kashipur	121.610	5.46	70	1.3	0.1	2.8	3.8	121.9	0.03	2.7
05	Nainital	110.726	11.06	94	1.2	0.1	2.6	3.9	145.8	0.03	3.6
06	Rishikesh	102.138	10.00	86	1.1	0.1	2.4	3.5	134.1	0.03	3.6
07	Roorkee	118.188	20.20	131	1.3	0.1	2.8	4.6	191.9	0.04	4.4
08	Rudrapur	140.884	12.43	112	1.5	0.1	3.3	5.0	177.6	0.04	3.5
Total/Range		**2121.135**	**167.15**	**1291**	**22.9**		**51.0**	**87.2**	**2257.3**	**0.03-0.05**	**2.2-4.4**

Table A3.02: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in kWh (Unit of Electricity)	Expenditure in INR
01	BHEL Ranipur	51.910	26.94	108	0.6	0.1	1.3	2.2	124.3	0.04	6.6
02	Manglaur	51.101	1.32	23	0.6	0.1	1.2	1.4	40.0	0.03	2.1
03	Pithoragarh	53.957	9.00	62	0.6	0.1	1.3	1.8	79.4	0.03	4.0
04	Ramnagar	55.446	2.42	32	0.6	0.1	1.3	1.6	50.5	0.03	2.5
Total/Range		**212.414**	**39.68**	**226**	**2.3**		**5.0**	**6.9**	**294.2**	**0.03-0.04**	**2.2-6.6**

Table A3.03: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in kWh (Unit of Electricity)	Expenditure in INR
01	Agra	1746.467	141.00	1111	18.9	0.1	45.7	116.5	2025.6	0.07	3.2
02	Aligarh	909.559	36.70	423	9.8	0.1	22.2	41.0	829.0	0.05	2.5
03	Allahabad	1216.719	63.07	631	13.1	0.1	30.4	63.3	1204.1	0.05	2.7
04	Amroha	197.135	12.00	126	2.1	0.1	4.6	7.0	213.6	0.04	3.0
05	Azamgarh	116.165	12.60	102	1.3	0.1	2.7	4.1	157.4	0.04	3.7
06	Badaun	159.221	4.39	70	1.7	0.1	3.7	4.8	134.9	0.03	2.3
07	Ballia	111.287	16.00	113	1.2	0.1	2.6	4.2	169.1	0.04	4.2
08	Banda	154.388	11.05	109	1.7	0.1	3.6	5.4	179.3	0.03	3.2
09	Barabanki	154.692	3.87	65	1.7	0.1	3.6	4.6	127.5	0.03	2.3
10	Baraut	101.241	25.00	138	1.1	0.1	2.4	4.2	194.1	0.04	5.3
11	Bareilly	979.933	106.43	745	10.6	0.1	25.2	59.7	1260.4	0.06	3.5
12	Basti	114.651	19.43	127	1.2	0.1	2.7	4.5	185.9	0.04	4.4
13	Bijnour	115.381	3.65	55	1.2	0.1	2.7	3.4	101.7	0.03	2.4
14	Bulandsahar	222.826	32.50	218	2.4	0.1	5.4	9.7	332.5	0.04	4.1
15	Chandausi	114.254	8.80	84	1.2	0.1	2.7	3.8	136.2	0.03	3.3
16	Deoria	129.570	16.19	124	1.4	0.1	3.1	4.9	187.5	0.04	4.0
17	Etah	131.023	13.49	113	1.4	0.1	3.1	4.7	175.8	0.04	3.7
18	Etawah	256.790	48.00	282	2.8	0.1	6.3	12.4	420.9	0.05	4.5
19	Faizabad	259.160	16.60	166	2.8	0.1	6.2	9.8	282.5	0.04	3.0

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in kWh (Unit of Electricity)	Expenditure in INR
20	Farrukhabad	318.540	16.80	182	3.4	0.1	7.6	12.0	322.5	0.04	2.8
21	Fatehpur	193.801	56.98	276	2.1	0.1	4.8	9.8	390.2	0.05	5.5
22	Firozabad	603.797	21.35	270	6.5	0.1	14.4	24.0	529.7	0.04	2.4
23	Gazipur	121.136	13.45	110	1.3	0.1	2.9	4.4	168.2	0.04	3.8
24	Ghaziabad	2358.525	215.00	1573	25.5	0.1	63.8	181.8	2881.1	0.08	3.3
25	Gonda	138.929	24.62	157	1.5	0.1	3.3	5.7	230.4	0.04	4.5
26	Gorakhpur	692.519	147.00	756	7.5	0.1	18.2	46.8	1162.5	0.07	4.6
27	Greater Noida	642.381	27.93	317	6.9	0.1	15.5	27.1	601.1	0.04	2.6
28	Hapur	262.801	42.00	266	2.8	0.1	6.4	12.3	403.8	0.05	4.2
29	Hardoi	197.046	11.05	121	2.1	0.1	4.6	6.9	207.5	0.03	2.9
30	Hathras	161.289	8.40	97	1.7	0.1	3.8	5.4	167.3	0.03	2.8
31	Jaunpur	168.128	20.00	153	1.8	0.1	4.0	6.6	235.0	0.04	3.8
32	Jhansi	549.391	169.50	738	5.9	0.1	14.6	39.0	1083.8	0.07	5.4
33	Kanpur	2920.067	261.50	1914	31.5	0.1	80.3	241.5	3570.2	0.08	3.3
34	Kasganj	101.241	7.10	72	1.1	0.1	2.4	3.3	117.5	0.03	3.2
35	Lakhimpur	164.925	10.20	108	1.8	0.1	3.9	5.7	181.2	0.03	3.0
36	Lalitpur	133.041	18.00	132	1.4	0.1	3.2	5.1	198.4	0.04	4.1
37	Loni	512.296	34.48	319	5.5	0.1	12.5	22.7	557.1	0.04	3.0
38	Lucknow	2901.474	330.00	2147	31.3	0.1	81.6	261.5	3879.3	0.09	3.7
39	Mainpuri	133.078	7.50	85	1.4	0.1	3.1	4.3	143.3	0.03	2.9

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
40	Mathura	454.937	32.80	295	4.9	0.1	11.0	19.9	508.1	0.04	3.1
41	Mau	279.060	39.00	263	3.0	0.1	6.8	12.8	405.4	0.05	4.0
42	Meerut	1424.908	41.94	554	15.4	0.1	34.9	66.4	1180.5	0.05	2.3
43	Mirzapur	233.691	40.00	248	2.5	0.1	5.7	10.8	371.1	0.05	4.4
44	Modinagar	182.811	14.00	132	2.0	0.1	4.3	6.7	215.6	0.04	3.2
45	Moradabad	889.810	80.00	618	9.6	0.1	22.5	49.6	1067.0	0.06	3.3
46	Mugalsarai	154.692	14.43	125	1.7	0.1	3.7	5.7	198.0	0.04	3.5
47	Muradanagar	100.080	12.00	94	1.1	0.1	2.4	3.5	142.4	0.04	3.9
48	Muzaffar Nagar	316.729	12.04	154	3.4	0.1	7.5	11.2	288.2	0.04	2.5
49	Noida	642.381	203.16	865	6.9	0.1	17.3	48.5	1277.1	0.08	5.4
50	Orai	190.625	16.00	143	2.1	0.1	4.5	7.1	232.0	0.04	3.3
51	Pililbhit	160.146	9.50	103	1.7	0.1	3.8	5.4	173.7	0.03	3.0
52	Raibareliy	191.625	34.00	211	2.1	0.1	4.7	8.5	311.9	0.04	4.5
53	Rampur	359.062	20.20	210	3.9	0.1	8.6	14.1	370.2	0.04	2.8
54	Saharanpur	703.345	73.72	535	7.6	0.1	17.7	38.3	894.0	0.05	3.5
55	Sahaswann	178.000	7.50	96	1.9	0.1	4.2	5.8	171.2	0.03	2.6
56	Sahjahanpur	356.103	11.37	157	3.8	0.1	8.4	12.5	306.0	0.04	2.4
57	Shambhal	221.334	15.65	151	2.4	0.1	5.2	8.2	251.4	0.04	3.1
58	Sitapur	188.230	35.00	212	2.0	0.1	4.6	8.4	312.6	0.04	4.6
59	Sultanpur	116.211	16.00	115	1.3	0.1	2.8	4.3	173.0	0.04	4.1

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
60	Ujhani	191.000	6.50	92	2.1	0.1	4.4	6.1	171.1	0.03	2.5
61	Unnao	178.681	21.50	162	1.9	0.1	4.3	7.1	250.0	0.04	3.8
62	Varansi	1435.113	79.79	764	15.5	0.1	36.2	80.0	1456.4	0.06	2.8
Total/Range		**29613.440**	**2869.73**	**20893**	**319.8**		**755.0**	**1734.9**	**36074.9**	**0.03-0.09**	**2.3-5.5**

Table A3.04: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in kWh (Unit of Electricity)	Expenditure in INR
01	Auraiya	70.515	4.00	46	0.8	0.1	1.6	2.1	68.9	0.03	2.7
02	Baghpat	50.380	2.83	34	0.5	0.1	1.2	1.4	50.1	0.03	2.7
03	Baheri	74.869	15.00	91	0.8	0.1	1.8	2.8	115.7	0.04	4.2
04	Balrampur	90.000	36.28	161	1.0	0.1	2.2	4.0	190.7	0.04	5.8
05	Bhadohi	94.563	8.00	75	1.0	0.1	2.2	3.1	106.0	0.03	3.1
06	Bisalpur	83.347	4.58	54	0.9	0.1	1.9	2.5	81.0	0.03	2.7
07	Chandpur	83.456	23.40	124	0.9	0.1	2.0	3.4	151.6	0.04	5.0

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in kWh (Unit of Electricity)	Expenditure in INR
08	Chibramau	55.296	11.10	70	0.6	0.1	1.3	1.9	87.5	0.03	4.3
09	Chitrakoot	57.452	7.77	59	0.6	0.1	1.3	1.9	77.5	0.03	3.7
10	Dadri	91.345	6.50	66	1.0	0.1	2.1	2.9	96.5	0.03	2.9
11	Deoband	97.068	7.90	75	1.0	0.1	2.3	3.2	107.1	0.03	3.0
12	Faredpur	76.422	9.43	73	0.8	0.1	1.8	2.6	97.7	0.03	3.5
13	Gangaghat	84.301	4.91	56	0.9	0.1	2.0	2.6	83.5	0.03	2.7
14	Gangoh	59.463	6.00	52	0.6	0.1	1.4	1.9	71.7	0.03	3.3
15	Gola	53.842	10.08	66	0.6	0.1	1.3	1.8	83.0	0.03	4.2
16	Hasanpur	64.536	5.72	53	0.7	0.1	1.5	2.0	73.9	0.03	3.1
17	Jahangerabad	59.873	14.30	82	0.6	0.1	1.4	2.2	101.1	0.04	4.6
18	Jalaun	56.871	5.00	47	0.6	0.1	1.3	1.8	65.5	0.03	3.2
19	Kaimur	51.469	7.12	54	0.6	0.1	1.2	1.7	70.6	0.03	3.8
20	Kairana	95.092	7.11	70	1.0	0.1	2.2	3.1	101.9	0.03	2.9
21	Kannauj	71.727	70.70	202	0.8	0.1	1.8	3.9	225.1	0.05	8.6
22	Khatauli	72.478	3.76	45	0.8	0.1	1.7	2.2	68.6	0.03	2.6
23	Kiratpur	61.801	4.45	46	0.7	0.1	1.4	1.9	65.9	0.03	2.9
24	Konch	53.426	2.95	35	0.6	0.1	1.2	1.5	52.6	0.03	2.7
25	Laharpur	61.280	8.00	61	0.7	0.1	1.4	2.0	81.2	0.03	3.6
26	Mahoba	95.454	12.15	93	1.0	0.1	2.2	3.4	124.4	0.04	3.6
27	Mau Ranipur	58.456	5.53	50	0.6	0.1	1.4	1.8	68.9	0.03	3.2

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in kWh (Unit of Electricity)	Expenditure in INR
28	Mawana	81.126	7.50	68	0.9	0.1	1.9	2.7	94.8	0.03	3.2
29	Mubarakpur	71.365	9.00	69	0.8	0.1	1.7	2.4	92.4	0.03	3.5
30	Nagina	71.350	10.30	74	0.8	0.1	1.7	2.5	97.2	0.03	3.7
31	Nazibabad	88.638	5.06	58	1.0	0.1	2.1	2.7	87.0	0.03	2.7
32	Obra	56.116	4.50	44	0.6	0.1	1.3	1.7	62.6	0.03	3.1
33	Pilkhuwa	81.651	5.80	60	0.9	0.1	1.9	2.6	86.8	0.03	2.9
34	Pratapgarh	76.750	12.00	82	0.8	0.1	1.8	2.7	107.3	0.04	3.8
35	Ramnagar	54.800	3.60	39	0.6	0.1	1.3	1.6	57.1	0.03	2.9
36	Rath	65.092	6.10	55	0.7	0.1	1.5	2.1	76.0	0.03	3.2
37	Sant R D Nagar	94.563	8.00	75	1.0	0.1	2.2	3.1	106.0	0.03	3.1
38	Shahbad	80.305	9.70	77	0.9	0.1	1.9	2.7	103.8	0.03	3.5
39	Sherkot	62.148	6.00	53	0.7	0.1	1.4	2.0	73.5	0.03	3.2
40	Sikandrabad	80.309	1.14	27	0.9	0.1	1.8	2.1	53.0	0.03	1.8
41	Tanda	96.138	10.45	86	1.0	0.1	2.3	3.3	118.0	0.03	3.4
42	Tilhar	60.803	3.48	40	0.7	0.1	1.4	1.8	60.1	0.03	2.7
43	Vrindavann	62.926	13.49	81	0.7	0.1	1.5	2.3	101.2	0.04	4.4
Total/Range		**3108.862**	**420.69**	**2925**	**33.6**		**72.7**	**103.9**	**3944.7**	**0.03-0.05**	**1.8-8.6**

Table A3.05: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in kWh (Unit of Electricity)	Expenditure in INR
No Class I town											

Table A3.06: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
No Class II town											

Table A3.07: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Haryana in NRGB

S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Bahadur Garh	170.426	50.00	245	1.8	0.1	4.2	8.3	345.4	0.05	5.6
02	Bhiwani	197.662	47.78	254	2.1	0.1	4.9	9.5	365.4	0.05	5.1
03	Faridabad	1404.653	207.80	1226	15.2	0.1	37.9	107.0	2039.9	0.08	4.0
04	Gurgoan	901.968	37.10	424	9.7	0.1	22.0	40.7	827.2	0.05	2.5
05	Hisar	301.249	48.03	301	3.3	0.1	7.4	14.5	459.8	0.05	4.2
06	Jagadhari	124.915	24.80	152	1.3	0.1	3.0	5.1	218.7	0.04	4.8
07	Jind	166.225	42.00	222	1.8	0.1	4.1	7.7	316.3	0.05	5.2
08	Kaithal	144.633	45.75	220	1.6	0.1	3.6	6.9	306.2	0.05	5.8
09	Karnal	286.974	12.00	147	3.1	0.1	6.8	10.2	270.1	0.04	2.6
10	Kurukshetra	154.962	34.50	195	1.7	0.1	3.8	6.9	280.7	0.04	5.0
11	Narnaul	134.067	41.10	202	1.4	0.1	3.3	6.2	281.5	0.05	5.8
12	Palwal	127.931	8.78	90	1.4	0.1	3.0	4.3	148.0	0.03	3.2
13	Panipat	294.15	41.40	277	3.2	0.1	7.2	13.7	427.7	0.05	4.0
14	Rohtak	373.133	47.50	327	4.0	0.1	9.2	18.0	517.3	0.05	3.8
15	Sonipat	292.339	52.80	312	3.2	0.1	7.2	14.5	469.8	0.05	4.4
16	Yamuna Nagar	241.723	34.50	233	2.6	0.1	5.9	10.7	356.3	0.04	4.0
Total/Range		**5317.010**	**775.84**	**4829**	**57.4**		**133.3**	**284.3**	**7630.2**	**0.03-0.08**	**2.51-5.80**

Table A3.08: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Hodal	50.003	5.39	46	0.5	0.1	1.2	1.6	62.6	0.03	3.4
02	Narvana	61.800	10.00	69	0.7	0.1	1.5	2.1	88.9	0.03	3.9
03	Sahadab	51.786	5.00	45	0.6	0.1	1.2	1.6	62.1	0.03	3.3
Total/Range		**163.589**	**20.39**	**161**	**1.8**		**3.8**	**5.3**	**213.6**	**0.03-0.03**	**3.3-3.9**

Table A3.09: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Delhi in NRGB

S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	B J	197.150	6.70	94	2.1	0.1	4.6	6.3	176.3	0.03	2.4
02	Burari	145.584	11.19	108	1.6	0.1	3.4	5.1	174.1	0.03	3.3
03	Dallo Pura	154.955	2.29	51	1.7	0.1	3.6	4.4	110.4	0.03	2.0
04	Delhi Cantt.	116.352	42.97	193	1.3	0.1	2.9	5.5	264.0	0.05	6.2
05	DMC	11007.835	431.09	4572	118.9	0.1	318.5	1098.7	10936.8	0.10	2.7
06	Deoli	169.410	10.12	109	1.8	0.1	4.0	5.8	183.7	0.03	3.0

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
07	Gokalpur	121.938	2.32	46	1.3	0.1	2.8	3.4	94.1	0.03	2.1
08	Hastal	177.033	6.75	91	1.9	0.1	4.1	5.7	164.9	0.03	2.6
09	Karawal Nagar	224.666	4.75	84	2.4	0.1	5.2	6.9	173.7	0.03	2.1
10	K S N	282.598	4.74	93	3.1	0.1	6.5	8.6	203.6	0.03	2.0
11	Mandoli	120.345	41.77	196	1.3	0.1	2.9	5.6	269.1	0.05	6.1
12	Mustafabad	127.012	1.29	36	1.4	0.1	2.9	3.4	83.2	0.03	1.8
13	Nangloi Jat	205.497	6.67	96	2.2	0.1	4.8	6.6	180.8	0.03	2.4
14	NDMC	249.998	42.74	263	2.7	0.1	6.1	11.7	395.6	0.05	4.3
15	Sultanpur Majra	181.624	2.86	60	2.0	0.1	4.2	5.2	130.7	0.03	2.0
Total/Range		**13482.000**	**618.25**	**6092**	**145.6**		**376.5**	**1183.0**	**13541.0**	**0.03-0.10**	**1.8-6.2**

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

Table A3.10: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Babarpur	52.918	0.79	19	0.6	0.1	1.2	1.4	35.8	0.03	1.9
02	C S B	81.374	2.58	40	0.9	0.1	1.9	2.3	66.6	0.03	2.2
03	Gharoli	84.722	3.56	48	0.9	0.1	2.0	2.5	75.4	0.03	2.4
04	Jaffrabad	70.089	0.90	22	0.8	0.1	1.6	1.8	45.1	0.03	1.8
05	Khajoori Khas	55.006	0.94	21	0.6	0.1	1.3	1.4	38.4	0.03	1.9
06	Mithe Pur	49.583	1.81	27	0.5	0.1	1.1	1.4	43.0	0.03	2.4
07	Molar Band	49.439	4.12	40	0.5	0.1	1.1	1.5	56.4	0.03	3.1
08	Mundka	53.525	11.89	71	0.6	0.1	1.3	1.9	88.5	0.04	4.5
09	Pooth Kalan	61.727	6.97	57	0.7	0.1	1.4	2.0	77.4	0.03	3.4
10	Pulpehlad	64.484	2.16	33	0.7	0.1	1.5	1.8	53.7	0.03	2.3
11	S P G	52.730	1.05	21	0.6	0.1	1.2	1.4	38.4	0.03	2.0
12	Taj Pul	72.764	1.22	26	0.8	0.1	1.7	1.9	49.9	0.03	1.9
13	Tigri	54.774	1.05	22	0.6	0.1	1.2	1.4	39.4	0.03	2.0
14	Ziauddin Pur	58.661	1.80	29	0.6	0.1	1.3	1.6	47.9	0.03	2.2
	Total/Range	**861.796**	**40.84**	**475**	**9.3**		**19.8**	**24.4**	**755.9**	**0.03-0.04**	**1.8-4.5**

02. C S B – Chilla Saroda Bangar

11. S P G – Sadat Pur Gurjan

Table A3.11: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Rajasthan in NRGB

S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Ajmer	542.580	87.00	521	5.9	0.1	13.8	31.0	816.0	0.06	4.1
02	Alwar	315.310	49.00	310	3.4	0.1	7.8	15.3	475.6	0.05	4.1
03	Bahilwara	360.009	69.00	390	3.9	0.1	9.0	19.2	588.3	0.05	4.5
04	Baran	118.157	72.36	260	1.3	0.1	3.0	6.4	343.4	0.05	8.0
05	Bharatpur	252.109	29.00	217	2.7	0.1	6.1	10.7	341.0	0.04	3.7
06	Bundi	102.823	22.76	132	1.1	0.1	2.5	4.1	187.9	0.04	5.0
07	Chittaugarh	116.409	30.50	161	1.3	0.1	2.8	5.0	226.8	0.04	5.3
08	Dhaulpur	126.142	32.00	174	1.4	0.1	3.1	5.5	244.9	0.04	5.3
09	Gangapurcity	224.773	17.22	159	2.4	0.1	5.3	8.5	262.6	0.04	3.2
10	Hindauncity	105.690	48.00	198	1.1	0.1	2.6	5.1	265.5	0.05	6.9
11	Jaipur	3073.350	485.00	2679	33.2	0.1	90.1	321.2	4680.2	0.10	4.2
12	Jhunjhunun	118.966	50.00	215	1.3	0.1	2.9	5.8	290.2	0.05	6.7
13	Kishangarh	155.019	100.00	341	1.7	0.1	4.0	9.3	452.2	0.06	8.0
14	Kota	1001.365	527.03	1710	10.8	0.1	29.7	108.1	2482.8	0.11	6.8
15	Nagaur	100.618	37.81	171	1.1	0.1	2.5	4.6	232.6	0.05	6.3
16	Sikar	237.579	39.90	249	2.6	0.1	5.8	10.9	374.1	0.05	4.3
17	Swaimadhavpur	120.998	49.00	214	1.3	0.1	3.0	5.9	289.8	0.05	6.6
18	Tonk	165.363	16.00	135	1.8	0.1	3.9	6.2	213.8	0.04	3.5
19	Udaipur	451.735	56.91	389	4.9	0.1	11.2	22.8	620.5	0.05	3.8
Total/Range		**7688.995**	**1818.49**	**8624**	**83.0**		**209.0**	**605.8**	**13388.3**	**0.04-0.11**	**3.2-8.0**

Table A3.12: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Jhalawara	66.500	12.95	81	0.7	0.1	1.6	2.4	102.5	0.04	4.2
02	Makrana	94.447	36.00	163	1.0	0.1	2.3	4.2	194.5	0.04	5.6
03	Nawalgarh	64.903	27.91	119	0.7	0.1	1.6	2.7	140.1	0.04	5.9
04	Nimbahera	61.000	12.74	77	0.7	0.1	1.4	2.2	97.3	0.04	4.4
Total/Range		**286.850**	**89.60**	**440**	**3.1**		**6.9**	**11.4**	**534.3**	**0.04-0.04**	**4.2-5.9**

Table A3.13: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Bhind	197.332	17.79	153	2.1	0.1	4.7	7.5	246.2	0.04	3.4
02	Bopal	1883.381	285.00	1640	20.3	0.1	52.2	160.8	2774.7	0.09	4.0
03	Chatarpur	147.688	54.00	242	1.6	0.1	3.7	7.4	333.0	0.05	6.2

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
04	Damoh	147.515	16.00	129	1.6	0.1	3.5	5.5	200.5	0.04	3.7
05	Datia	100.466	6.85	71	1.1	0.1	2.3	3.2	115.4	0.03	3.1
06	Dewas	289.438	102.00	437	3.1	0.1	7.4	17.4	618.0	0.06	5.8
07	Guna	180.978	45.75	240	2.0	0.1	4.4	8.6	342.7	0.05	5.2
08	Gwalior	1101.981	173.88	1006	11.9	0.1	29.3	78.9	1638.0	0.07	4.1
09	Indore	2167.447	131.17	1181	23.4	0.1	56.4	141.2	2282.0	0.07	2.9
10	Jabalpur	1267.564	135.00	941	13.7	0.1	33.1	83.4	1620.4	0.07	3.5
11	Katni	221.875	68.60	320	2.4	0.1	5.6	11.8	453.2	0.05	5.6
12	Mandsour	141.468	36.00	193	1.5	0.1	3.4	6.3	272.9	0.04	5.3
13	Morena	200.506	12.00	127	2.2	0.1	4.7	7.1	215.8	0.04	2.9
14	Neemuch	128.575	22.00	144	1.4	0.1	3.1	5.1	211.2	0.04	4.5
15	Pithampur	126.099	89.90	299	1.4	0.1	3.2	7.3	391.9	0.06	8.5
16	Ratlam	273.892	39.19	261	3.0	0.1	6.7	12.5	402.0	0.05	4.0
17	Rewa	235.422	102.00	403	2.5	0.1	6.0	14.1	556.7	0.06	6.5
18	Sagar	370.296	33.75	275	4.0	0.1	9.0	16.3	452.6	0.04	3.3
19	Satna	283.004	12.00	146	3.1	0.1	6.7	10.0	267.7	0.04	2.6
20	Sehore	1090.025	13.10	278	11.8	0.1	25.7	39.2	708.3	0.04	1.8
21	Shahdol	100.565	28.24	147	1.1	0.1	2.4	4.3	204.1	0.04	5.6
22	Shepour	105.026	5.00	61	1.1	0.1	2.4	3.2	106.2	0.03	2.8

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
23	Shivpuri	179.972	86.55	334	1.9	0.1	4.6	10.3	453.4	0.06	6.9
24	Singrauli	220.295	280.66	674	2.4	0.1	6.1	18.7	871.5	0.08	10.8
25	Tikamgarh	101.786	6.22	68	1.1	0.1	2.4	3.2	112.4	0.03	3.0
26	Ujjain	515.215	92.68	527	5.6	0.1	13.1	30.1	812.3	0.06	4.3
27	Vidisha	155.959	8.83	98	1.7	0.1	3.7	5.2	166.7	0.03	2.9
Total/Range		**11933.770**	**1904.16**	**10397**	**128.9**		**305.9**	**718.8**	**16829.5**	**0.03-0.09**	**1.8-10.8**

Table A3.14: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Basoda	78.265	5.90	58	0.8	0.1	1.8	2.4	83.6	0.03	2.9
02	Bina	64.579	12.00	77	0.7	0.1	1.5	2.3	97.9	0.03	4.2
03	Dabra	61.260	12.00	75	0.7	0.1	1.4	2.1	95.2	0.03	4.3

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
04	Dhar	95.000	30.00	148	1.0	0.1	2.3	4.0	180.0	0.04	5.2
05	Jaora	65.111	5.54	52	0.7	0.1	1.5	2.0	73.4	0.03	3.1
06	Mandla	55.145	8.87	62	0.6	0.1	1.3	1.8	79.8	0.03	4.0
07	Narshimpur	59.858	14.71	83	0.6	0.1	1.4	2.2	102.3	0.04	4.7
08	Panna	50.432	4.50	43	0.5	0.1	1.2	1.5	58.9	0.03	3.2
09	Shajapur	70.000	11.16	76	0.8	0.1	1.6	2.4	99.3	0.03	3.9
10	Sidhi	54.317	12.31	73	0.6	0.1	1.3	1.9	90.4	0.04	4.6
Total/Range		**653.967**	**116.99**	**747**	**7.1**		**15.4**	**22.7**	**960.6**	**0.03-0.04**	**2.9-5.2**

Table A3.15: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Bihar in NRGB

S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Arrah	261.099	30.97	227	2.8	0.1	6.3	11.3	356.8	0.04	3.7
02	Aurangabad	101.520	8.00	77	1.1	0.1	2.4	3.4	122.9	0.03	3.3
03	Bagaha	113.012	11.00	94	1.2	0.1	2.7	3.9	147.2	0.03	3.6
04	Begusarai	251.136	8.98	121	2.7	0.1	5.9	8.4	226.0	0.03	2.5
05	Bettiah	132.896	11.55	105	1.4	0.1	3.1	4.7	167.1	0.04	3.4
06	B M C	398.138	30.17	268	4.3	0.1	9.6	17.1	454.1	0.04	3.1
07	B M C	296.889	22.46	204	3.2	0.1	7.1	11.9	341.5	0.04	3.2
08	Buxar	102.591	8.00	77	1.1	0.1	2.4	3.4	123.6	0.03	3.3
09	Chapra (NP)	201.597	16.96	151	2.2	0.1	4.8	7.6	244.9	0.04	3.3
10	Darbhanga	294.116	19.18	188	3.2	0.1	7.0	11.4	321.1	0.04	3.0
11	Dehri	137.068	21.32	145	1.5	0.1	3.3	5.4	215.7	0.04	4.3
12	D N	182.241	11.63	120	2.0	0.1	4.3	6.4	201.5	0.04	3.0
13	Gaya	463.454	50.17	369	5.0	0.1	11.4	22.6	600.4	0.05	3.5
14	Hajipur	147.126	19.64	143	1.6	0.1	3.5	5.7	216.8	0.04	4.0
15	Jamalpur	105.221	10.65	90	1.1	0.1	2.5	3.6	139.7	0.03	3.6
16	Jehanabad	102.456	20.23	124	1.1	0.1	2.4	4.0	178.4	0.04	4.8
17	Katihar	225.982	24.54	191	2.4	0.1	5.4	9.3	300.5	0.04	3.6
18	Kishanganj	107.076	30.12	155	1.2	0.1	2.6	4.6	216.5	0.04	5.5
19	M T	105.000	8.50	80	1.1	0.1	2.5	3.5	128.1	0.03	3.3

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
20	Motihari	125.183	13.52	111	1.4	0.1	3.0	4.5	171.6	0.04	3.8
21	Munger	213.101	17.50	157	2.3	0.1	5.1	8.1	256.0	0.04	3.3
22	Muzaffarpur	351.838	26.43	238	3.8	0.1	8.5	14.6	401.5	0.04	3.1
23	Nawada	109.141	5.68	66	1.2	0.1	2.5	3.4	113.5	0.03	2.8
24	Patna	1683.200	108.34	957	18.2	0.1	43.3	103.1	1800.4	0.06	2.9
25	Purnia	280.547	44.52	282	3.0	0.1	6.9	13.3	428.6	0.05	4.2
26	Saharsa	155.175	21.13	152	1.7	0.1	3.7	6.1	229.8	0.04	4.1
27	Sasaram	147.396	12.00	112	1.6	0.1	3.5	5.2	179.9	0.04	3.3
28	Siwan	134.458	15.68	123	1.5	0.1	3.2	5.0	189.0	0.04	3.9
Total/Range		**6928.657**	**628.87**	**5127**	**74.8**		**168.8**	**311.8**	**8473.0**	**0.03-0.06**	**2.5-5.5**

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

Table A3.16: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Araria	80.000	4.50	52	0.9	0.1	1.9	2.4	78.6	0.03	2.7
02	Barahiya	50.230	26.54	106	0.5	0.1	1.2	2.1	121.6	0.04	6.6
03	Barh	61.037	4.50	46	0.7	0.1	1.4	1.9	65.7	0.03	2.9
04	Bhabua	52.611	7.12	54	0.6	0.1	1.2	1.7	71.5	0.03	3.7
05	D M	67.995	11.30	76	0.7	0.1	1.6	2.4	98.2	0.04	4.0
06	Dumraon	57.716	15.33	83	0.6	0.1	1.4	2.1	102.1	0.04	4.8
07	Forbesganj	52.289	4.98	45	0.6	0.1	1.2	1.6	62.3	0.03	3.3
08	Gopalganj	66.624	11.11	75	0.7	0.1	1.6	2.3	96.5	0.03	4.0
09	Kaimur	51.469	7.12	54	0.6	0.1	1.2	1.7	70.6	0.03	3.8
10	Khagaria	56.978	2.97	36	0.6	0.1	1.3	1.6	54.8	0.03	2.6
11	Khagaul	60.866	5.32	50	0.7	0.1	1.4	1.9	69.6	0.03	3.1
12	Lakhisarai	98.123	24.79	136	1.1	0.1	2.4	4.0	168.5	0.04	4.7
13	Madhepura	56.739	25.84	109	0.6	0.1	1.4	2.4	127.1	0.04	6.1
14	Masaurhi	57.012	9.43	65	0.6	0.1	1.3	1.9	83.2	0.03	4.0
15	Mokameh	71.335	14.18	87	0.8	0.1	1.7	2.6	110.3	0.04	4.2
16	Narkatiaganj	51.446	10.96	67	0.6	0.1	1.2	1.8	83.9	0.03	4.5
17	Phulwari Sharif	67.348	6.48	57	0.7	0.1	1.6	2.2	79.2	0.03	3.2
18	Raxaul Bazar	52.429	5.82	49	0.6	0.1	1.2	1.6	66.1	0.03	3.5

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
19	Samastipur	70.042	3.45	42	0.8	0.1	1.6	2.1	65.4	0.03	2.6
20	Shekhpura	54.322	15.58	82	0.6	0.1	1.3	2.0	99.8	0.04	5.0
21	Sitamarhi	87.279	8.00	72	0.9	0.1	2.0	2.9	101.2	0.03	3.2
22	Sultanganj	52.867	12.29	72	0.6	0.1	1.2	1.9	89.1	0.04	4.6
23	Supaul	85.200	22.37	122	0.9	0.1	2.0	3.4	150.2	0.04	4.8
Total/Range		**1461.957**	**259.98**	**1639**	**15.8**		**34.3**	**50.5**	**2115.5**	**0.03-0.04**	**2.6-6.6**

05. D M – Digha-Mainpura

Table A3.17: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Chhatisgarh in NRGB

S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Ambikapur	114.575	9.39	87	1.2	0.1	2.7	3.9	139.7	0.03	3.3
02	Bhilai Nagar	625.697	141.30	709	6.8	0.1	16.4	41.8	1079.1	0.07	4.7
03	Bilaspur	330.106	37.56	276	3.6	0.1	8.1	15.0	440.1	0.05	3.7
04	Durg	268.679	66.09	339	2.9	0.1	6.7	14.2	492.7	0.05	5.0
05	Jagdalpur	125.345	22.49	144	1.4	0.1	3.0	5.0	210.4	0.04	4.6
06	Korba	363.210	215.02	707	3.9	0.1	9.8	28.0	970.4	0.08	7.3
07	Raigarh	137.097	20.68	143	1.5	0.1	3.3	5.4	213.1	0.04	4.3
08	Raipur	1010.087	108.66	763	10.9	0.1	26.0	61.9	1294.5	0.06	3.5
09	Rajnandgaon	163.122	78.09	305	1.8	0.1	4.1	9.0	412.7	0.06	6.9
Total/Range		**3137.918**	**699.28**	**3474**	**33.9**		**80.0**	**184.20**	**5252.7**	**0.03-0.08**	**3.3-7.3**

Table A3.18 Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Bhatapara	54.846	30.42	117	0.6	0.1	1.3	2.4	134.7	0.04	6.7
02	Bhilai Charoda	95.848	141.30	343	1.0	0.1	2.5	6.4	375.8	0.07	10.7
03	Chirmiri	99.934	64.94	228	1.1	0.1	2.5	5.2	261.6	0.05	7.2
04	Dalli-Rajhara	55.684	37.25	131	0.6	0.1	1.4	2.5	148.9	0.05	7.3
05	Dhamtari	89.857	23.40	127	1.0	0.1	2.2	3.6	157.3	0.04	4.8
06	Mahasamund	51.543	14.68	78	0.6	0.1	1.2	1.9	94.8	0.04	5.0
Total/Range		**447.712**	**311.99**	**1025**	**4.8**		**11.1**	**22.1**	**1173.1**	**0.04-0.07**	**4.8-10.7**

Table A3.19: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure in Class I Towns (Population > 0.1 Million) of Jharkhand in NRGB

S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Aditya	173.988	49.82	247	1.9	0.1	4.3	8.5	348.5	0.05	5.5
02	Bhuli	110.127	11.74	96	1.2	0.1	2.6	3.9	148.7	0.04	3.7
03	Bokaro	413.934	162.91	644	4.5	0.1	10.9	29.0	915.2	0.07	6.1
04	Chas	141.618	20.49	144	1.5	0.1	3.4	5.6	216.0	0.04	4.2
05	Deoghar	203.116	14.00	138	2.2	0.1	4.8	7.4	229.6	0.04	3.1
06	Dhanbad	1161.561	23.39	379	12.5	0.1	27.9	47.0	862.1	0.04	2.0
07	Giridih	114.447	9.75	89	1.2	0.1	2.7	3.9	141.6	0.03	3.4
08	Hazaribag	142.494	26.37	165	1.5	0.1	3.4	5.9	240.2	0.04	4.6
09	JNAC	629.659	59.80	459	6.8	0.1	15.7	32.3	772.5	0.05	3.4
10	Jharia	100.839	4.42	57	1.1	0.1	2.3	3.1	99.4	0.03	2.7
11	Jorapokhar	104.673	16.40	112	1.1	0.1	2.5	3.9	165.3	0.04	4.3
12	MNAC	224.002	19.45	169	2.4	0.1	5.3	8.7	274.0	0.04	3.4
13	Phusro	102.673	40.64	179	1.1	0.1	2.5	4.7	242.7	0.05	6.5
14	Ranchi	1073.440	177.19	1004	11.6	0.1	28.6	77.4	1624.3	0.07	4.1
15	Saunda	104.642	24.26	137	1.1	0.1	2.5	4.3	194.8	0.04	5.1
Total/Range		**4801.213**	**660.63**	**4019**	**51.9**		**119.4**	**245.6**	**6474.8**	**0.03-0.07**	**2.0-6.5**

09. JNAC – Jamshedpur Notified Area Committee

12. MNAC – Mango Notified Area Committee

Table A3.20: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Bagbera	82.559	10.70	82	0.9	0.1	1.9	2.9	109.4	0.03	3.6
02	Bhowrah	54.483	15.73	83	0.6	0.1	1.3	2.0	100.4	0.04	5.0
03	Bhuli	99.990	8.60	79	1.1	0.1	2.3	3.3	112.4	0.03	3.1
04	Chaibasa	78.287	11.11	82	0.8	0.1	1.8	2.7	107.9	0.03	3.8
05	Chatra	51.685	3.45	38	0.6	0.1	1.2	1.5	54.4	0.03	2.9
06	Daltonganj	87.849	14.00	97	0.9	0.1	2.1	3.2	125.7	0.04	3.9
07	Dumka	55.336	6.12	51	0.6	0.1	1.3	1.8	69.4	0.03	3.4
08	Gumia	56.024	26.11	109	0.6	0.1	1.3	2.3	126.9	0.04	6.2
09	Jhumri Tilaiya	85.489	51.14	190	0.9	0.1	2.1	4.2	218.0	0.05	7.0
10	Jugsalai	56.720	3.69	40	0.6	0.1	1.3	1.7	58.8	0.03	2.8
11	Katras	63.017	5.00	49	0.7	0.1	1.5	1.9	69.5	0.03	3.0
12	Lohardaga	56.821	14.57	81	0.6	0.1	1.3	2.1	99.2	0.04	4.8
13	Madhupur	58.211	18.36	92	0.6	0.1	1.4	2.2	110.7	0.04	5.2
14	Ramgarh Cantt.	90.324	34.46	157	1.0	0.1	2.2	4.0	186.7	0.04	5.7
15	Sahibganj	98.589	8.98	80	1.1	0.1	2.3	3.3	113.2	0.03	3.1
16	Sindri	94.398	46.65	187	1.0	0.1	2.3	4.5	218.6	0.05	6.3
17	Tisra	65.894	14.02	84	0.7	0.1	1.6	2.4	105.3	0.04	4.4
Total/Range		**1235.676**	**292.69**	**1580**	**13.3**		**29.3**	**46.2**	**1986.3**	**0.03-0.05**	**2.8-7.0**

Table A3.21: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Alipurduar	127.342	9.80	95	1.4	0.1	3.0	4.3	153.5	0.03	3.3
02	Asansol	564.491	127.87	645	6.1	0.1	14.7	36.5	976.5	0.06	4.7
03	A-K	123.906	18.44	130	1.3	0.1	3.0	4.8	192.8	0.04	4.3
04	Baidyabati	121.081	7.89	84	1.3	0.1	2.8	4.0	137.9	0.03	3.1
05	Bally	115.715	11.68	98	1.2	0.1	2.7	4.1	152.6	0.04	3.6
06	Balurghat	151.183	10.46	106	1.6	0.1	3.6	5.2	173.7	0.03	3.1
07	Bangaon	110.668	24.70	142	1.2	0.1	2.7	4.5	201.9	0.04	5.0
08	Bankura	138.036	19.06	138	1.5	0.1	3.3	5.3	207.0	0.04	4.1
09	Bansberia	103.799	9.07	83	1.1	0.1	2.4	3.5	130.4	0.03	3.4
10	Bara Nagar	248.466	7.12	107	2.7	0.1	5.8	8.1	209.0	0.03	2.3
11	Barasat	283.443	34.50	248	3.1	0.1	6.9	12.6	390.0	0.04	3.8
12	Bardhaman	314.638	26.30	226	3.4	0.1	7.6	13.1	374.5	0.04	3.3
13	Barrackpore	154.475	11.65	112	1.7	0.1	3.6	5.4	182.8	0.04	3.2
14	Basirhat	127.135	22.50	145	1.4	0.1	3.0	5.1	212.0	0.04	4.6
15	Beharampore	195.363	31.43	204	2.1	0.1	4.7	8.5	305.3	0.04	4.3
16	Bhadreswar	101.334	8.28	78	1.1	0.1	2.4	3.4	124.3	0.03	3.4
17	Bhatpara	390.467	30.42	266	4.2	0.1	9.4	16.8	450.1	0.04	3.2

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
18	Bidhannagar	218.323	30.00	208	2.4	0.1	5.3	9.4	318.5	0.04	4.0
19	Chakdaha	132.855	15.54	122	1.4	0.1	3.1	4.9	187.1	0.04	3.9
20	Champadani	110.983	6.47	71	1.2	0.1	2.6	3.5	119.9	0.03	3.0
21	Chandernagore	166.949	22.03	160	1.8	0.1	4.0	6.7	243.1	0.04	4.0
22	Chinsurah	180.502	17.24	146	1.9	0.1	4.3	6.9	231.1	0.04	3.5
23	Darjiling	120.414	10.57	97	1.3	0.1	2.8	4.2	152.9	0.03	3.5
24	Dhulian	239.022	10.27	126	2.6	0.1	5.6	8.2	228.4	0.03	2.6
25	Durgapur	566.937	1.10	64	6.1	0.1	12.9	15.0	263.6	0.03	1.3
26	Habra	149.675	21.80	152	1.6	0.1	3.6	6.0	228.1	0.04	4.2
27	Haldia	200.762	104.90	385	2.2	0.1	5.2	12.2	521.8	0.06	7.1
28	Halisahar	126.893	8.28	88	1.4	0.1	3.0	4.2	144.2	0.03	3.1
29	H-C	177.209	8.29	100	1.9	0.1	4.1	5.9	176.4	0.03	2.7
30	Jalpaiguri	107.351	12.50	98	1.2	0.1	2.5	3.8	150.3	0.04	3.8
31	Jamuria	144.791	73.23	282	1.6	0.1	3.6	7.9	378.9	0.05	7.2
32	Jangipore	122.875	7.86	84	1.3	0.1	2.9	4.0	138.9	0.03	3.1
33	Kalyani	100.62	21.91	128	1.1	0.1	2.4	4.0	182.9	0.04	5.0
34	Kamarhati	336.579	20.48	205	3.6	0.1	8.0	13.2	357.2	0.04	2.9
35	Kanchapara	122.181	29.21	164	1.3	0.1	3.0	5.2	231.8	0.04	5.2
36	Kharagpur	206.923	90.65	361	2.2	0.1	5.3	12.0	495.3	0.06	6.6

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
37	Khardaha	111.13	10.96	93	1.2	0.1	2.6	3.9	145.6	0.03	3.6
38	Kolkata	4486.689	185.00	1964	48.5	0.1	119.8	328.2	4268.3	0.07	2.6
39	Konnagar	124.585	9.07	91	1.3	0.1	2.9	4.2	147.4	0.03	3.2
40	Krishnanagar	181.182	6.87	92	2.0	0.1	4.2	5.8	168.3	0.03	2.5
41	Madhyamgram	198.964	21.32	169	2.1	0.1	4.8	7.9	264.8	0.04	3.6
42	Mahestala	449.423	21.50	238	4.9	0.1	10.8	17.9	436.4	0.04	2.7
43	Medinipur	169.127	14.78	131	1.8	0.1	4.0	6.2	210.2	0.04	3.4
44	Nabadwip	125.528	11.66	104	1.4	0.1	3.0	4.4	162.4	0.04	3.5
45	Naihati	221.762	11.55	130	2.4	0.1	5.2	7.8	226.6	0.04	2.8
46	N B	134.825	17.17	129	1.5	0.1	3.2	5.1	196.1	0.04	4.0
47	NDD	253.625	26.45	207	2.7	0.1	6.1	10.6	330.4	0.04	3.6
48	Panihati	383.522	6.89	127	4.1	0.1	8.9	12.4	279.1	0.03	2.0
49	Puruliya	121.436	13.90	112	1.3	0.1	2.9	4.4	170.6	0.04	3.8
50	Raiganj	183.682	10.64	115	2.0	0.1	4.3	6.4	196.3	0.03	2.9
51	R G	404.991	28.00	260	4.4	0.1	9.8	17.1	447.0	0.04	3.0
52	R S	423.806	49.25	352	4.6	0.1	10.5	20.6	565.3	0.05	3.7
53	Rana Ghat	235.583	7.72	109	2.5	0.1	5.5	7.7	206.8	0.03	2.4
54	Raniganj	128.624	23.44	149	1.4	0.1	3.1	5.2	216.9	0.04	4.6
55	Rishra	124.591	6.48	77	1.3	0.1	2.9	4.0	131.0	0.03	2.9

Table A3.21 continued to next page … … … …

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S No	Town	Population in Thousands	Town Area in km^2	Estimated Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
56	Santipur	151.774	24.60	163	1.6	0.1	3.6	6.2	241.3	0.04	4.4
57	Serampore	183.339	14.50	134	2.0	0.1	4.3	6.7	218.8	0.04	3.3
58	Siliguri	509.709	41.90	351	5.5	0.1	12.5	23.7	595.3	0.05	3.2
59	S D D	410.524	17.39	206	4.4	0.1	9.8	15.6	384.0	0.04	2.6
60	Titagarh	118.426	3.24	54	1.3	0.1	2.7	3.5	101.6	0.03	2.4
61	Uluberia	221.175	33.72	222	2.4	0.1	5.4	9.8	336.1	0.04	4.2
62	Uttarpara K	162.386	16.34	136	1.8	0.1	3.9	6.1	213.3	0.04	3.6
Total/Range		**17123.790**	**1557.84**	**11864**	**184.9**		**422.4**	**833.6**	**20184.6**	**0.03-0.07**	**1.3-7.2**

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 A3.22: Estimated Footprint, Energy Consumption and Expenditure on Sewerage Infrastructure 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 Length of Sewer Network in km	Estimated STP Footprint in ha	Estimated STP Land Required Per Capita in m^2	Estimated Energy Demand in MW	Estimated Annual		Estimated Per Capita Per Day	
								Energy Consumption in MWh	Expenditure on Sewerage System in Millions of INR	Energy Consumption in KWh (Unit of Electricity)	Expenditure in INR
01	Arambagh	67.000	34.75	135	0.7	0.1	1.6	3.0	156.9	0.04	6.4
02	Baduria	52.500	22.43	98	0.6	0.1	1.3	2.1	115.1	0.04	6.0
03	Bankra	55.229	3.59	39	0.6	0.1	1.3	1.6	57.3	0.03	2.8
04	Baruipur	53.500	9.50	63	0.6	0.1	1.3	1.8	80.8	0.03	4.1
05	Bishnupur	70.620	22.01	108	0.8	0.1	1.7	2.8	131.7	0.04	5.1
06	Bolpur	74.890	10.73	77	0.8	0.1	1.8	2.6	101.4	0.03	3.7
07	Budge Budge	76.858	9.06	71	0.8	0.1	1.8	2.6	96.5	0.03	3.4
08	Chittaranjan	52.391	19.65	92	0.6	0.1	1.3	2.0	108.4	0.04	5.7
09	Contai	88.365	14.25	98	1.0	0.1	2.1	3.2	127.0	0.04	3.9
10	Gangarampur	61.028	10.29	69	0.7	0.1	1.4	2.1	89.3	0.03	4.0
11	Garulia	91.116	5.38	60	1.0	0.1	2.1	2.8	90.3	0.03	2.7
12	Gayeshpur	65.398	30.00	124	0.7	0.1	1.6	2.8	145.2	0.04	6.1
13	Gobardanga	57.878	13.50	78	0.6	0.1	1.4	2.1	97.0	0.04	4.6
14	J-A Ganj	51.790	11.66	70	0.6	0.1	1.2	1.8	86.3	0.04	4.6
15	Katwa	81.510	7.93	70	0.9	0.1	1.9	2.7	97.0	0.03	3.3
Total/Range		**1000.073**	**224.73**	**1254**	**10.8**		**23.6**	**36.2**	**1580.2**	**0.03-0.04**	**2.7-6.4**

14. J-A Ganj – Jiyaganj-Azimganj