

# Assessment of Domestic Pollution Load from Urban Agglomeration in Ganga Basin: Haryana

---

---

## GRBMP: Ganga River Basin Management Plan

*by*

Consortium of 7 “Indian Institute of Technology”s (IITs)



**IIT  
Bombay**



**IIT  
Delhi**



**IIT  
Guwahati**



**IIT  
Kanpur**



**IIT  
Kharagpur**



**IIT  
Madras**



**IIT  
Roorkee**

---

## Preface

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

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

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

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

Dr. Vinod Tare  
Professor and Coordinator  
Development of GRBMP  
IIT Kanpur

## The Team

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

## Lead Persons

1. Vinod Tare, IIT Kanpur
2. Purnendu Bose, IIT Kanpur
3. Suresh Kr Gurjar, IIT Kanpur
4. Abhishek Gaur, IIT Kanpur
5. Vishal Kapoor, IIT Kanpur
6. Shashikant Patel, IIT Kanpur
7. Swatanta Pratap Singh, IIT Kanpur

# Contents

|                                                                                                                                    | <i>Page</i> |
|------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>1 Introduction</b>                                                                                                              | <b>6</b>    |
| <b>2 Major Obstruction and Abstraction Projects on the Tributaries of the river Ganga executed in the State</b>                    | <b>8</b>    |
| <b>3 Demographic profile of Ganga Basin in the State</b>                                                                           | <b>8</b>    |
| <b>4 Pollution Load</b>                                                                                                            | <b>15</b>   |
| <b>5 Conclusions</b>                                                                                                               | <b>22</b>   |
| <b>References</b>                                                                                                                  | <b>23</b>   |
| <b>Appendix 1: Compilation of Data Sheets of Water Balance &amp; Pollution Load (Domestic) of Class I Cities/Towns in Haryana</b>  | <b>25</b>   |
| <b>Appendix 2: Compilation of Data Sheets of Water Balance &amp; Pollution Load (Domestic) of Class II Cities/Towns in Haryana</b> | <b>37</b>   |



## 1. Introduction:

Haryana is among the most prosperous states in India, having one of the highest per-capita-income in the country, and its capital is Chandigarh. Haryana is home of epic battle of Mahabharata and recital of Bhagavad Gita by Lord Krishna. It shares border with Punjab and Himachal Pradesh in the North, and with Rajasthan in the West and South and with Uttarakhand in East. Haryana has the total area of 44,212 sq. km, which is about 1.34 % of the total area of the country. Haryana has total 19 districts and the 17<sup>th</sup> largest populated state. Haryana has a catchment area of 21,265 km<sup>2</sup> in river Yamuna basin while Ganga river basin covers 79.5% cultivable land in Haryana.

The Ganga River Basin (GRB) has a total catchment area of 1,086,000 sqkm across India, Tibet (China), Nepal and Bangladesh. The river basin in India, nearly covers 26% (861,404 sq km; about 80% of total catchment area of Ganga river basin) of the total geographical area. The sprawling Ganga basin, spread across 11 states, is the world's most populous river basin and home to more than 492 million Indians. Haryana is one of the 11 states (Uttarakhand, Uttar Pradesh, Bihar, Chhattisgarh, Delhi, Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh, Jharkhand and West Bengal) of the GRB in India through which the Ganga River and her tributaries flow approximately in the direction of North West to South East. A comparison of state-wise distribution of GRB area within the geographical areas of different states is presented in Table 1.

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

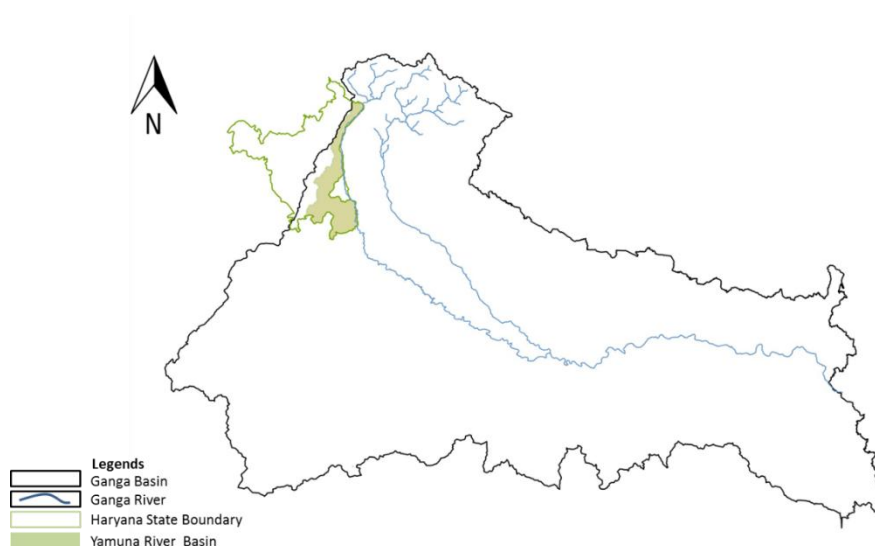
| State/<br>Union Territory | *Total Geographical<br>Area (sqkm) | #Area contributing to<br>Ganga Basin (sqkm) | Percentage of the<br>Basin Area (%) |
|---------------------------|------------------------------------|---------------------------------------------|-------------------------------------|
| Uttarakhand               | 53,483                             | 53,436                                      | 6.2                                 |
| <b>Uttar Pradesh</b>      | <b>240,928</b>                     | <b>240,928</b>                              | <b>28</b>                           |
| Bihar                     | 94,163                             | 143,961                                     | 16.7                                |
| Jharkhand                 | 79,716                             |                                             |                                     |
| Madhya Pradesh            | 308,252                            | 198,962                                     | 23.1                                |
| Chhattisgarh              | 135,192                            |                                             |                                     |
| Delhi                     | 1,484                              | 1,484                                       | 0.17                                |
| Haryana                   | 44,212                             | 34,341                                      | 4.0                                 |
| Himachal Pradesh          | 55,673                             | 4,317                                       | 0.5                                 |
| Rajasthan                 | 342,239                            | 112,490                                     | 13.1                                |
| West Bengal               | 88,752                             | 71,485                                      | 8.3                                 |

River Yamuna touches the Haryana near Kalesar (Yamuna Nager) and shareseastern boundary with Uttar Pradesh and then finally enters inDelhi. The salient features of some major tributaries contributing directly or indirectly to the Ganga basin in the state of Haryana are presented in Table 2.

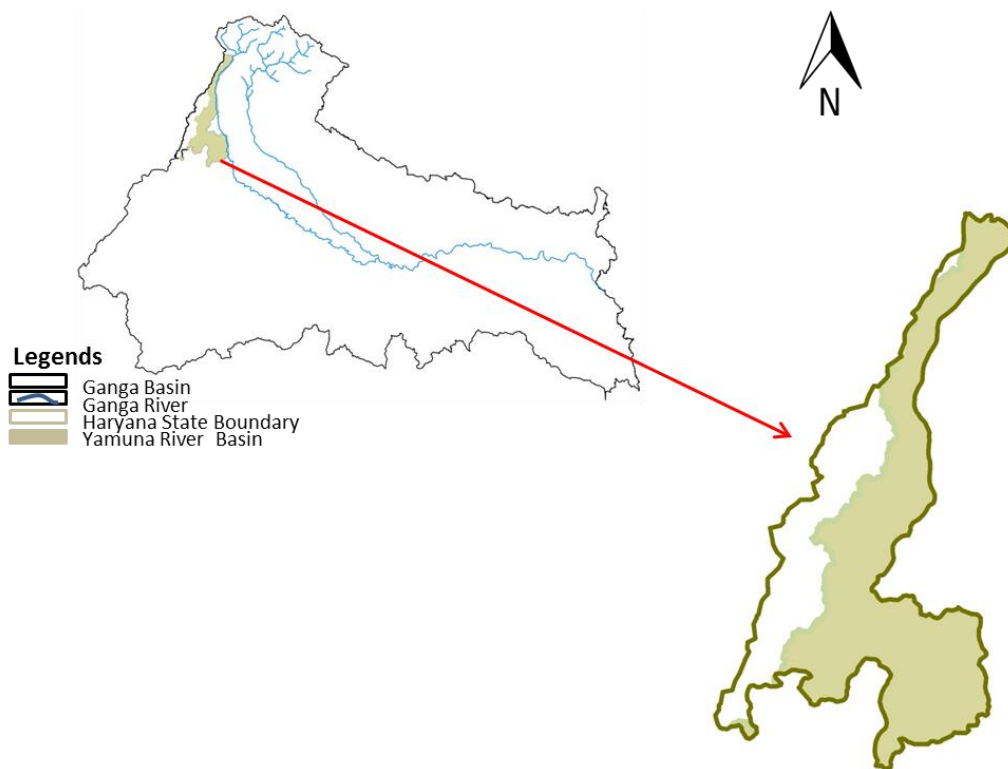
**Table 2: The Salient Features of Tributaries of the Ganga River Basin Contributing to the Riverin the State of Haryana**

| Characteristics                   | Yamuna                                                                                                    |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------|
| Position                          | Right bank                                                                                                |
| Region of origin                  | Yamunotri glacier at Bandar Punch                                                                         |
| Mouth                             | Ganga                                                                                                     |
| Total length (km)                 | 1376                                                                                                      |
| Total catchment area (sq km)      | 366,223                                                                                                   |
| Catchment area in Haryana (sq km) | 21,265                                                                                                    |
| River bed/ Soil texture           | Alluvial about 42% of the basinarea, followed by medium black soil 25.5% and mixed red and black soil 15% |

The total annual average rainfall in the state of Haryana isabout619 mm and it contributes approximately 1.6% of the total rainfall in the catchment of the Ganga basin.Location of Haryana in Ganga river basin is shown in Figure 1. Figure 2 shows Yamuna basin in Haryana stateFigure 2.



**Figure 1: Ganga River Basin the Indian Territory and Haryana State**



**Figure 2: Major Sub-Basins or their Portions under the Ganga River Basin in the State of Haryana**

## **2. Major Obstruction and Abstraction Projectson the Tributaries of the River GangaExecutedin the State**

The natural flow regime in the river Yamunahas been altered due to construction of number of dams and barrages in the Haryana state. Haryana has 1 Dam, 5 Barrages under Ganga basin (Table 3). These Dams and barrages are essentially for irrigation and domestic water supplies.Kaushalya Dam at Pinjorehas 34 meter height. The list of the major dams on Ganga River and its tributaries in Haryana are mentioned underneath.



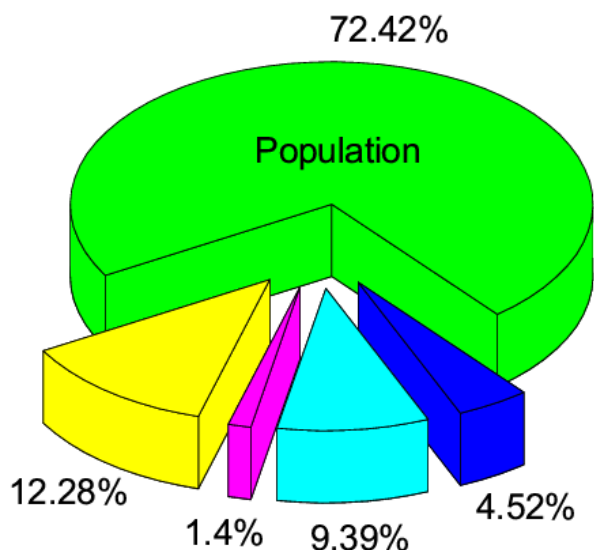
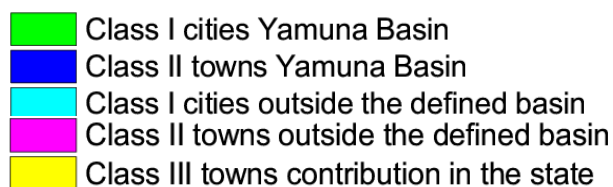
**Table 3: Details of the Major Dams/Barrages on River of Ganga Basin in the State of Haryana (WRIS-wiki)**

| Projects            | River     | Year of Completion | Remark                   |
|---------------------|-----------|--------------------|--------------------------|
| Kaushalya Dam       | Kaushalya | 2011               | Major Irrigation Project |
| Dadupur Barrage     | Somb      | 1890               | Major Irrigation Project |
| HathiniKund Barrage | Yamuna    | 1999               | Major Irrigation Project |
| Masani Barrage      | Sahibi    | 1989               | -                        |
| Ottu Barrage        | Ghaggar   | -                  | -                        |
| Palla Barrage       | Yamuna    | -                  | -                        |

### 3. Demographic Profile of Ganga Basin in the State

Haryana has 11 Class I cities, 5 Class II cities and 21 Class III cities under Ganga basin (Figure 4-6). The total population of the state according to the Census 2011 is 25.35 million out of which 34.8% live in urban area. The density in the state is about 573 people per square kilometer. According to the Population Census 2011, some of the Class I cities are Bahadurgarh, Faridabad, Gurgaon, Jagadhri, Karnal, Palwal, Panipat, Rewari, Rohtak, Sonipat, and Yamunanagar. The details of the area, population and the major river systems of all the Class I, II and III cities are presented in Table 4-6, respectively.

Figure 3 shows the population distribution of Class I cities, Class II and III towns in the Ganga basin in the Haryana state and along the main stream of the river Yamuna. Map in the Figure 4, 5 and 6 showing the distribution of Class I cities, Class II, and Class III towns respectively in the state under Ganga River Basin. The average population of class I town in the state is 0.39 million, approximately six times and thirteen times higher than the population of class II and class III towns, respectively. Faridabad is the highly populated class I city having the population of 1.4 million, while Jagadhri is the least populated (0.12 million) class I city. Narnaul and Hodal are the cities having maximum and minimum population under class II towns, contains 0.074 and 0.05 million, respectively. In class III towns where the population is less than 0.05 million, the maximum population is in the Jhajjar town (0.048 million), while minimum is in the Pataudi (0.02 million).



**Figure 3: Population Distribution of Class I Cities and Class II, Class III Towns in the Major Basins in the State.**

**Table4: Demographic details of Major urban centers (Class I) in Haryana.**

| SNo. | Name                     | River System | Total Area (sq km) | Population (as in 2011) |
|------|--------------------------|--------------|--------------------|-------------------------|
| 1    | Bahadurgarh (M CI)       | Yamuna River | 29.5               | 170767                  |
| 2    | Faridabad (M Corp.)      | Yamuna River | 204                | 1414050                 |
| 3    | Gurgaon (M Corp. + OG)   | Yamuna River | 184.59             | 886519                  |
| 4    | Jagadhri (M CI)          | Yamuna River | 24.8               | 124894                  |
| 5    | Karnal (M CI + OG)       | Yamuna River | 29.46              | 302140                  |
| 6    | Palwal (M CI + OG)       | Yamuna River | 8.42               | 131926                  |
| 7    | Panipat (M CI + OG)      | Yamuna River | 21.86              | 295970                  |
| 8    | Rewari (M CI)            | Yamuna River | 22.5               | 143021                  |
| 9    | Rohtak (M CI)            | Yamuna River | 72.18              | 374292                  |
| 10   | Sonipat (M CI + OG)      | Yamuna River | 42.61              | 289333                  |
| 11   | Yamuna Nagar (M CI + OG) | Yamuna River | 16.48              | 217071                  |

**Table5: Demographic details of class II cites in Haryana.**

| SNo. | Name                               | River System | Total Area (sq km) | Population (as in 2011) |
|------|------------------------------------|--------------|--------------------|-------------------------|
| 1    | Charkhi Dadri (MC)                 | Yamuna River | 5.42               | 56337                   |
| 2    | Gohana (MC)                        | Yamuna River | 11.51              | 65708                   |
| 3    | Hodal (MC)                         | Yamuna River | 5.39               | 50143                   |
| 4    | Narnaul (M CI)                     | Yamuna River | 12.67              | 74581                   |
| 5    | Panipat<br>TarafMakhdumZadgan (CT) | Yamuna River | 6.54               | 67998                   |

**Table 6: Demographic details of class III cites in Haryana.**

| SNo. | Name                            | River System | Total Area (sq km) | Population (as in 2011) |
|------|---------------------------------|--------------|--------------------|-------------------------|
| 1    | Dharuhera (MC)                  | Sahibi River | 11.49              | 30344                   |
| 2    | Ferozepur jhirka (MC)           | Yamuna River | 8.86               | 24750                   |
| 3    | Ganaur (MC)                     | Yamuna River | 9.06               | 35603                   |
| 4    | Gharaunda (MC)                  | Yamuna River | 12.98              | 37816                   |
| 5    | Hailey Mandi (MC)               | Yamuna River | 16.27              | 20906                   |
| 6    | Jhajjar (MC)                    | Yamuna River | 36                 | 48424                   |
| 7    | Kalanaur (MC)                   | Yamuna River | 6.85               | 23319                   |
| 8    | Kharkhoda (MC)                  | Yamuna River | 1.63               | 25051                   |
| 9    | Kundli (55) (CT)                | Yamuna River | 7.9                | 21633                   |
| 10   | Manesar (154) (CT)              | Yamuna River | 14.7               | 23448                   |
| 11   | Palwal (Rural) (Part) (73) (CT) | Yamuna River | 20.1               | 23072                   |
| 12   | Panipat Taraf Ansar (CT)        | Yamuna River | 7.88               | 42877                   |
| 13   | Panipat TarafRajputan (CT)      | Yamuna River | 5.1                | 28803                   |
| 14   | Pataudi (MC)                    | Yamuna River | 13.51              | 20418                   |
| 15   | Punahana (MC)                   | Yamuna River | 10.12              | 24734                   |
| 16   | Safidon (MC)                    | Yamuna River | 9.48               | 34728                   |
| 17   | Samalkha (MC + OG)              | Yamuna River | 4.66               | 39710                   |
| 18   | Sampla (MC)                     | Yamuna River | 17.83              | 20563                   |
| 19   | Sasauli (CT)                    | Yamuna River | 2.88               | 22479                   |
| 20   | Sohna (MC)                      | Yamuna River | 9.7                | 36552                   |
| 21   | Taoru (MC)                      | Yamuna River | 4.52               | 22599                   |

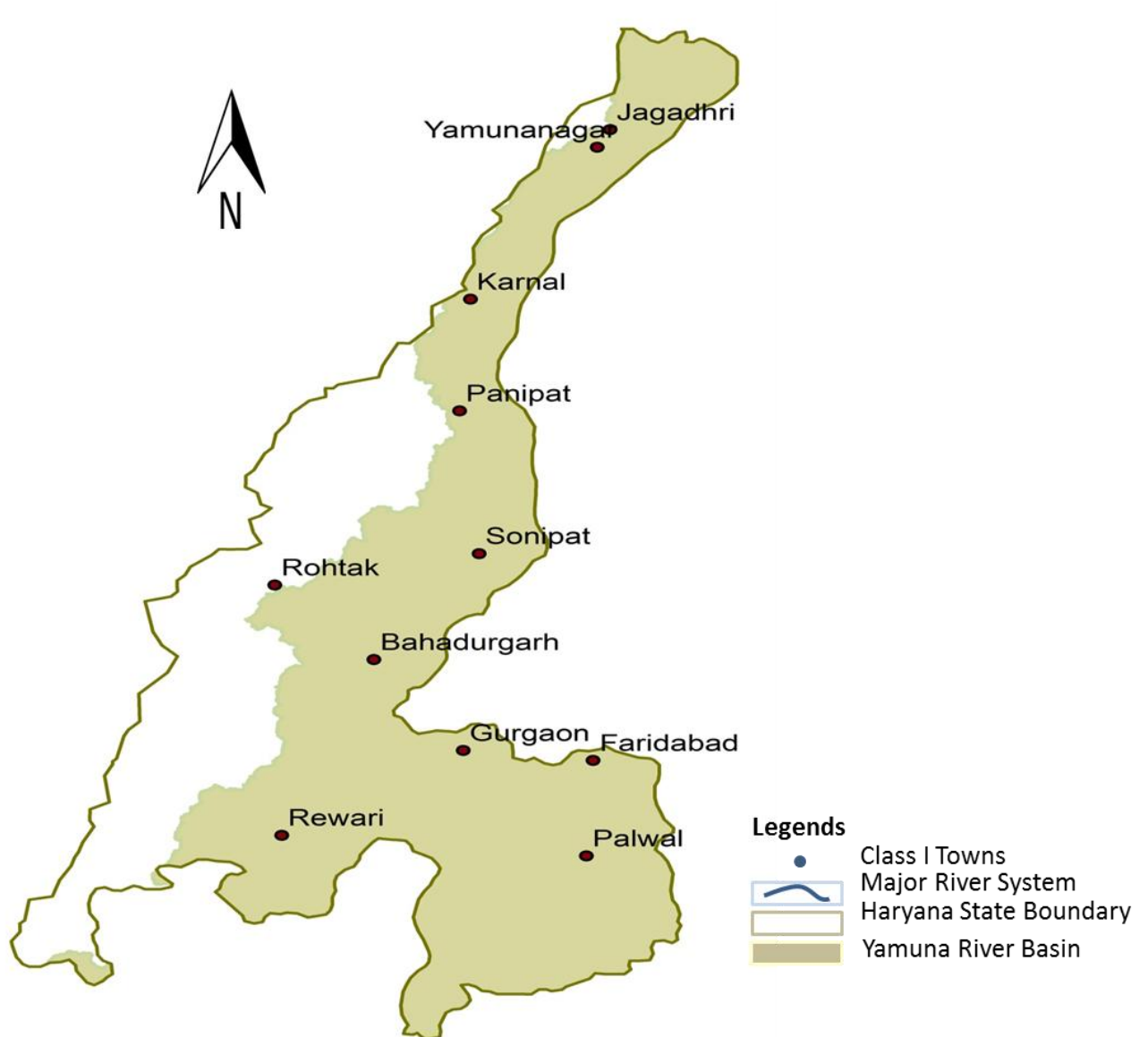
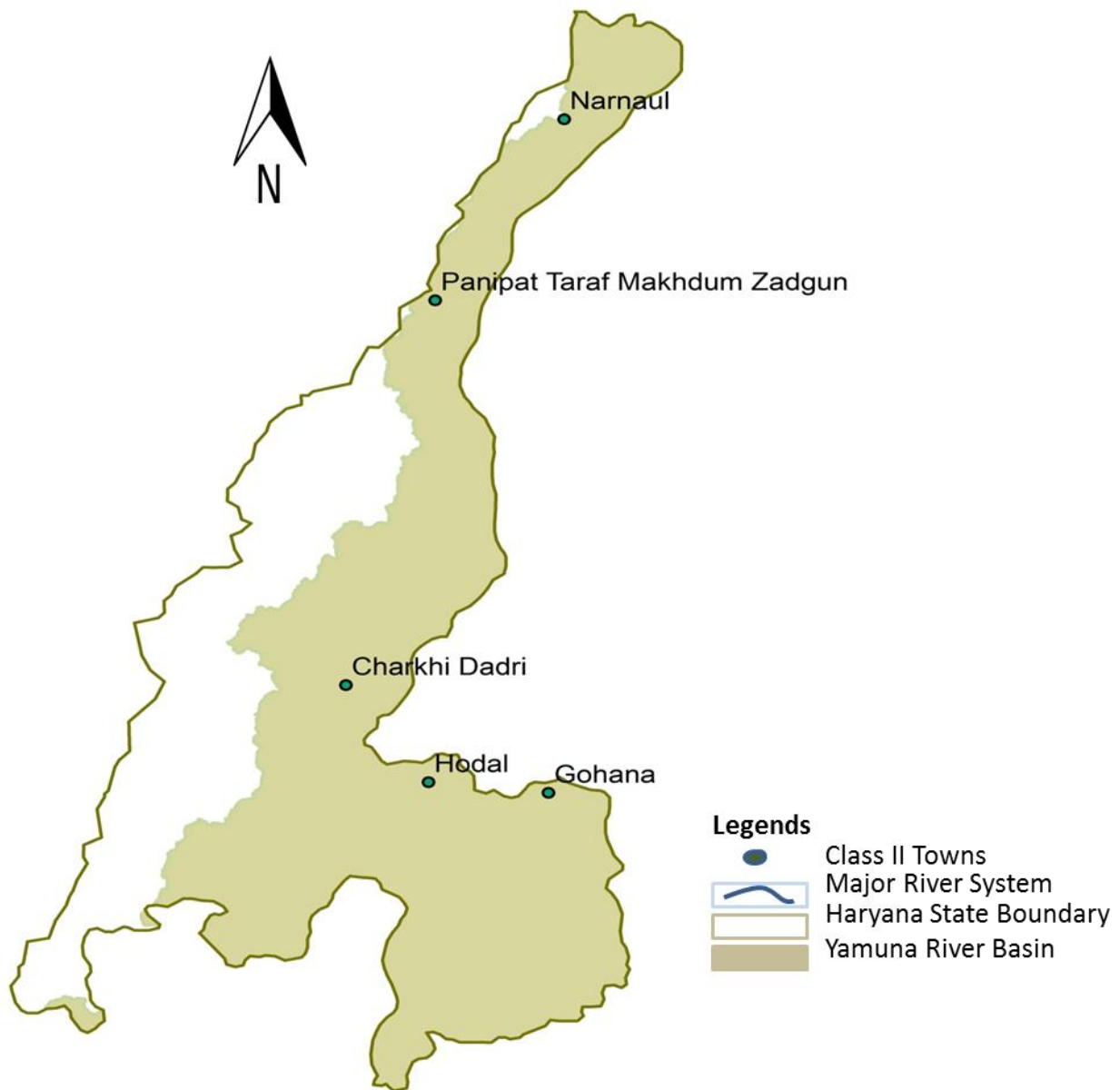


Figure 4: Class I Cities of Haryana in Ganga River Basin



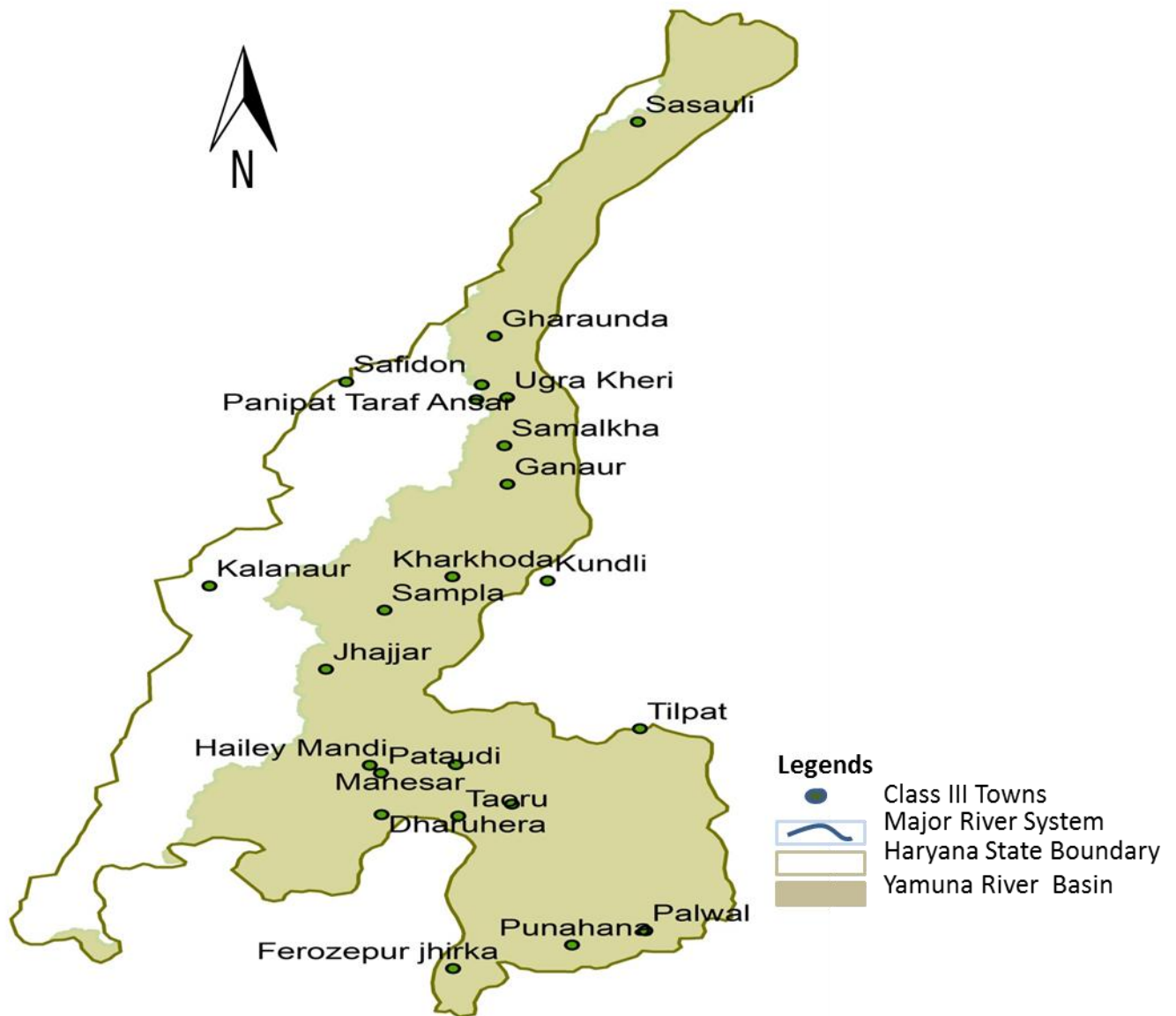


Figure 6: Class III Cities of Haryana in Ganga River Basin

## 4. Pollution Load

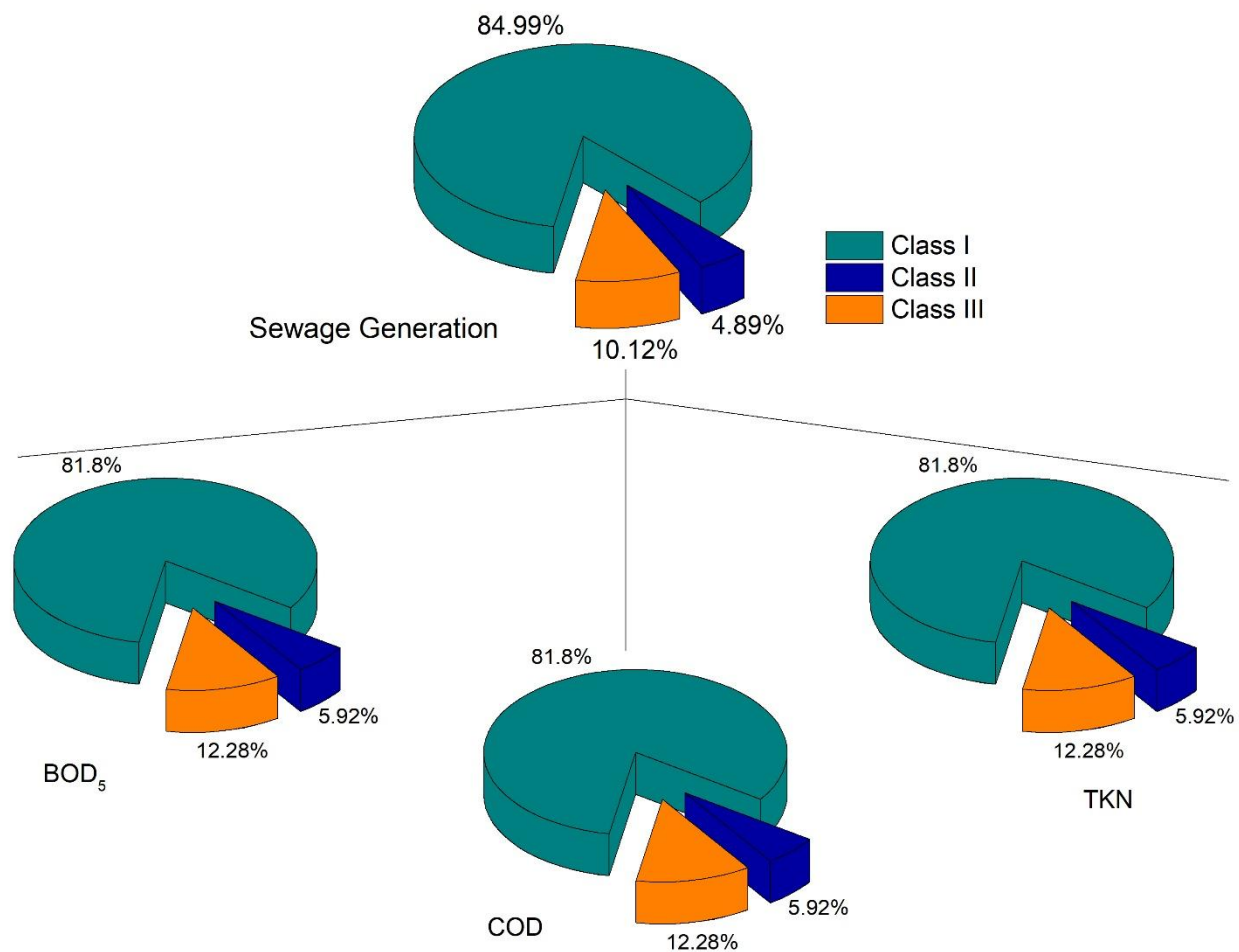
The major pollution load in the area of basin under the state is due to point and nonpoint sources. Discharges of untreated/partially treated sewage from urban centers, discharge from open drain carrying sewage, discharges from the tributaries and discharge of untreated/partially treated wastewater from industrial units are the major point sources that contribute to the pollution load in the state. The major cities contributing the wastewater discharge of approximately 239 MLD in river Yamuna are in Faridabad, Karnal, Panipat, Sonapat, Gurgaon (CPCB, 2013). The report published by CPCB in 2009 revealed that the total sewage generation of class I cities in whole Ganga basin is 15,305.55 MLD while its treatment capacity is only one third (32%) of the total sewage generation (4,886.28 MLD). The situation getting more critical in the class II towns as the difference between the sewage generation (1,083.85 MLD) and its treatment capacity (91.82 MLD) increased.

The maximum sewage generated by class I cities and class II towns of Haryana are 592 and 34 MLD. The comparison of the total sewage generation and sewage treatment capacity of the class I cities and Class II towns of the states lying under Ganga basin has been represented in Figure 8. The trends of the data Haryana depicted that the maximum share of sewage generation (88.33%) is from class I cities followed by class II and III towns, 10.12 and 4.89%, respectively (Figure 7). The BOD and COD load for Class I cities, Class II and Class III towns are in the range of 81.8, 12.28 and 5.92%, respectively. The TKN load almost showing the same trend as BOD and COD load.

The assessment of the total water supply and total sewage generation of class I cities in the state revealed that the maximum sewage generation is in Faridabad 152.7 MLD, approximately 79.9% of the water supply. In case of the class II towns the sewage generation in Namaul is maximum 8.1 MLD, ~80.4% of its total water supply. The total BOD and COD load in Kg/day has been estimated on the per capita basis in Class I towns and its average are approximately 10.6 and 18.1 tons/day, respectively. The average BOD and COD load from the Class II towns is 1.7 and 2.9 tons/day, respectively whereas Class III towns contribute approximately 0.9 tons/day and 1.55 tons/day of BOD and COD, respectively. The maximum and minimum BOD and COD contributing cities in Class I towns are Faridabad and Jagadhri, respectively. In Class II towns maximum BOD and COD is from Namaul, whereas minimum BOD and COD are from Hodal. In class III towns maximum and minimum BOD and COD is from Jhajjar and Pataudi respectively.

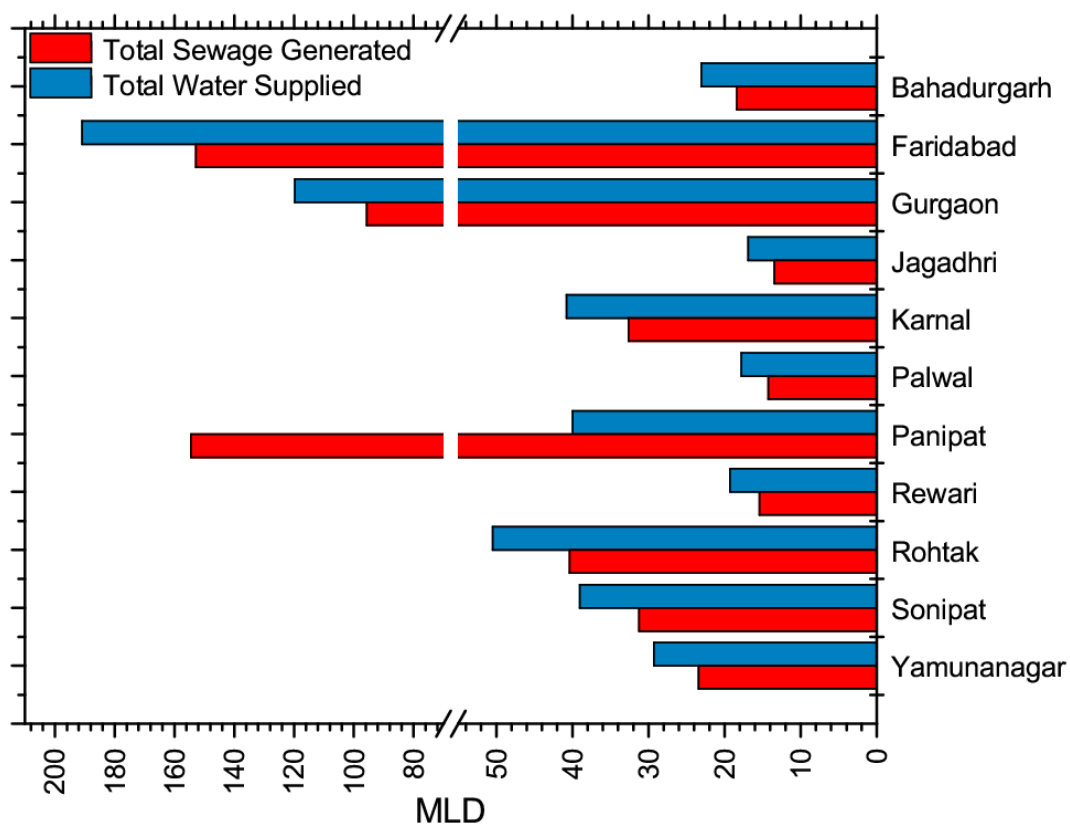
The total TKN in metric tons/day contributed by Class I, Class II and Class III towns are approximately 2.1, 0.33 and 0.15 tons/day, respectively. The maximum and minimum contribution of TKN from class I towns are from Faridabad and Jagadhri respectively. The maximum and minimum contribution of TKN from class II towns is from Namaul and Hodal,

respectively while the maximum and minimum contribution of TKN from class III towns is from Jhajjar and Pataudi, respectively. The estimates of total water supplied, total sewage generated, BOD, COD and TKN loads are summarized and illustrated in Figures (8-10) for class I cities and class II towns. The comparative account of all the classes (I, II and III) for its population, sewage generation, water supply and BOD, COD and TKN load are presented in Figure 11.

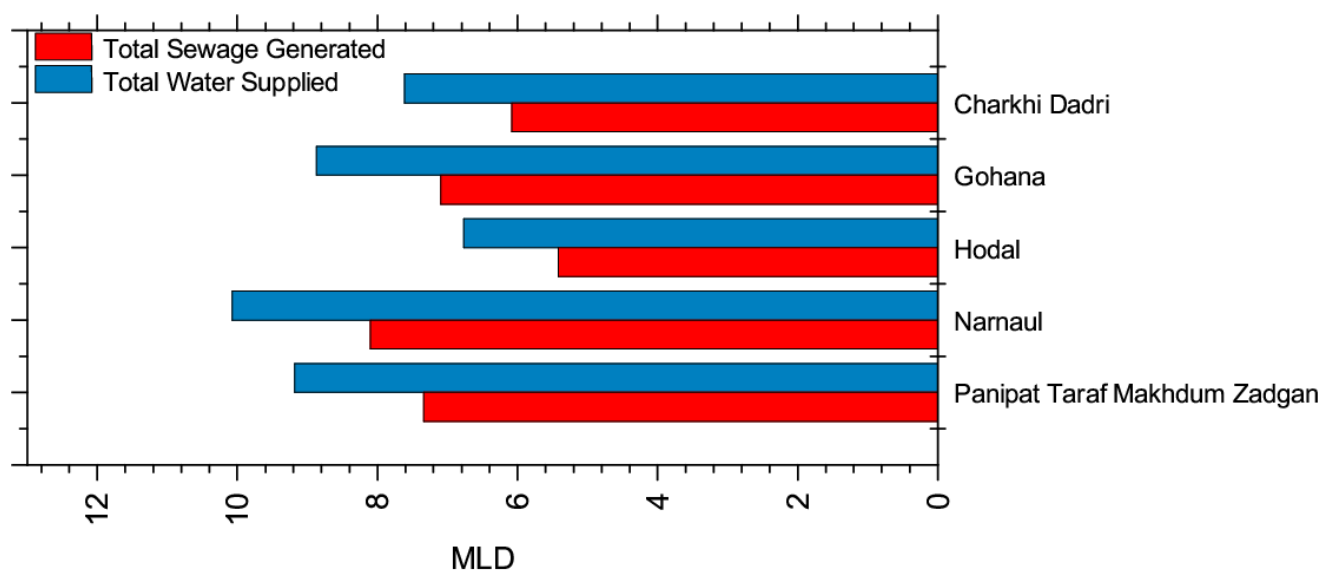


**Figure 7: Distribution of Pollution Load of Class I Cities and Class II, Class III Towns in Haryana**

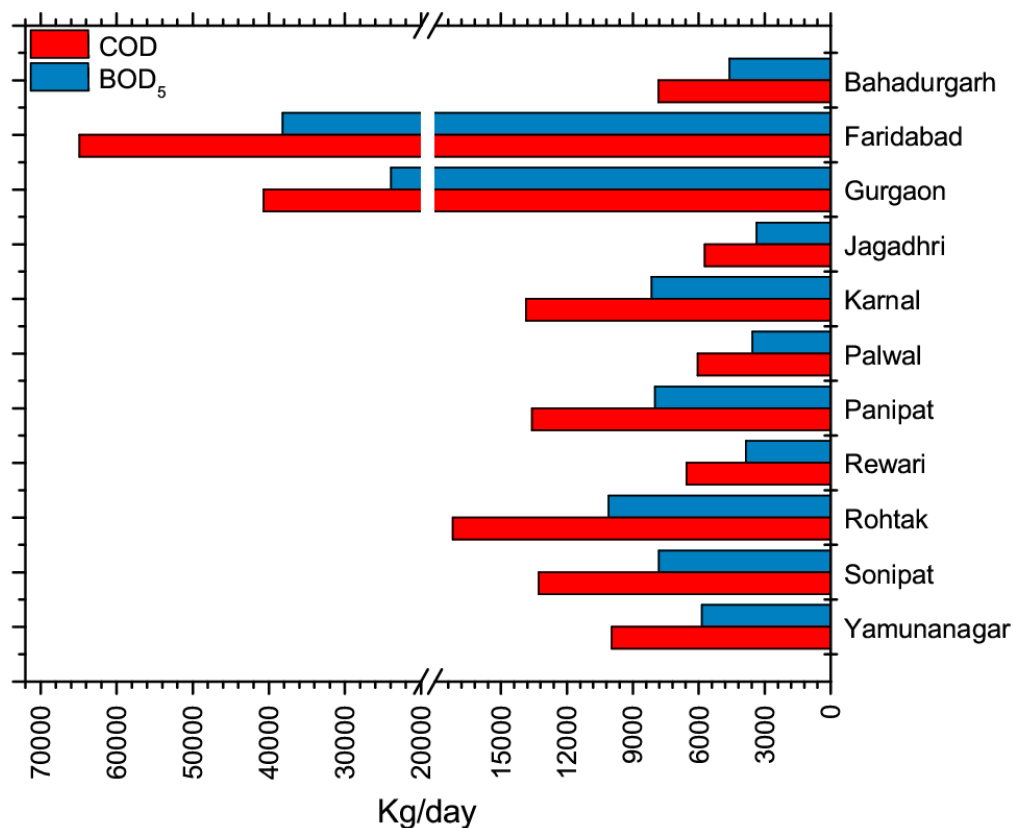




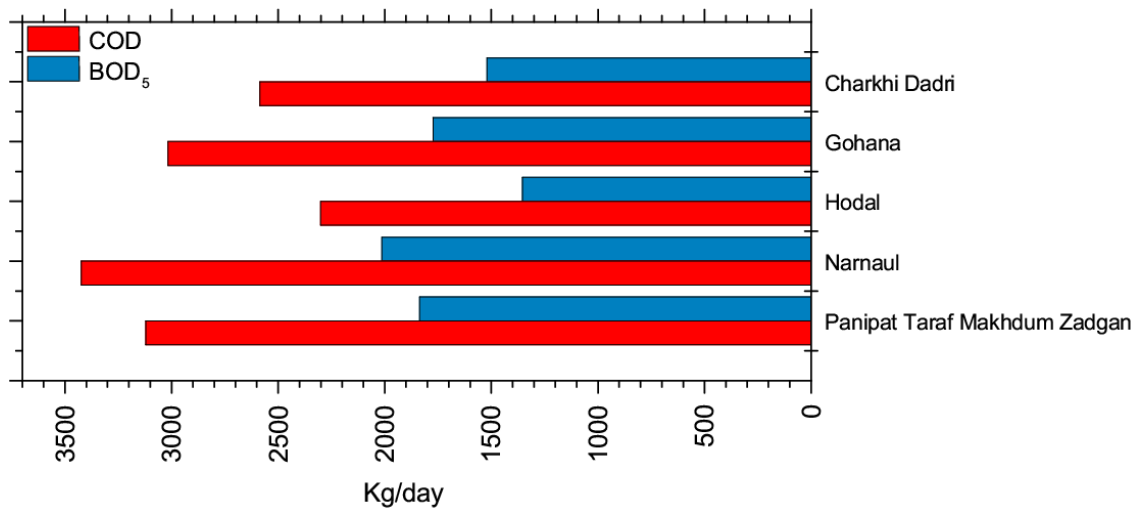
**Figure 8a: Assessment of Water Supply and Sewage Generation (MLD) in Class I Cities of Haryana in Ganga River Basin**



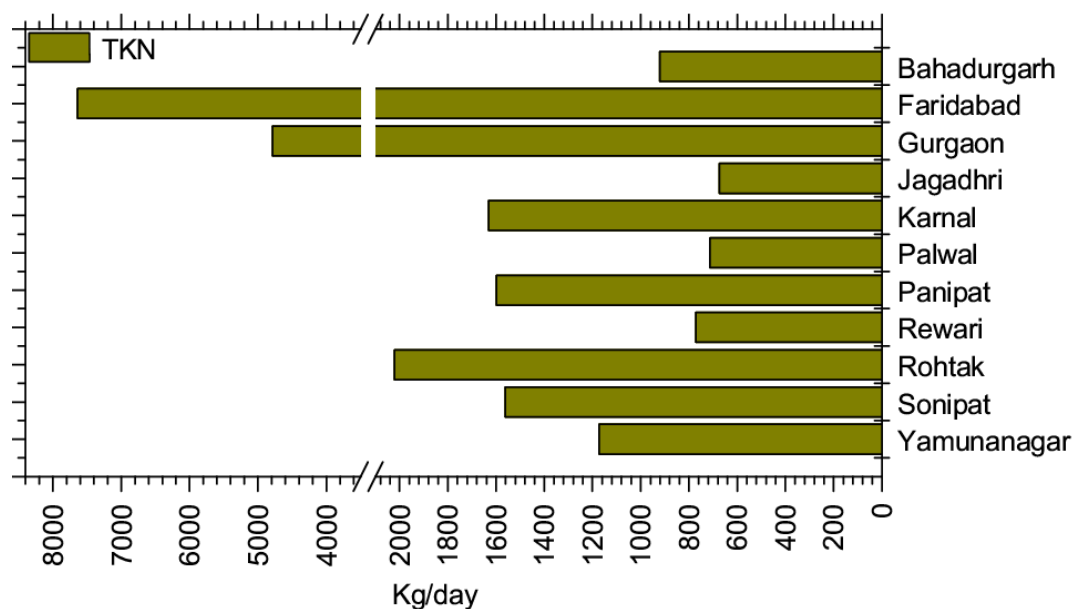
**Figure 8b: Assessment of Water Supply and Sewage Generation (MLD) in Class II Cities of Haryana in Ganga River Basin**



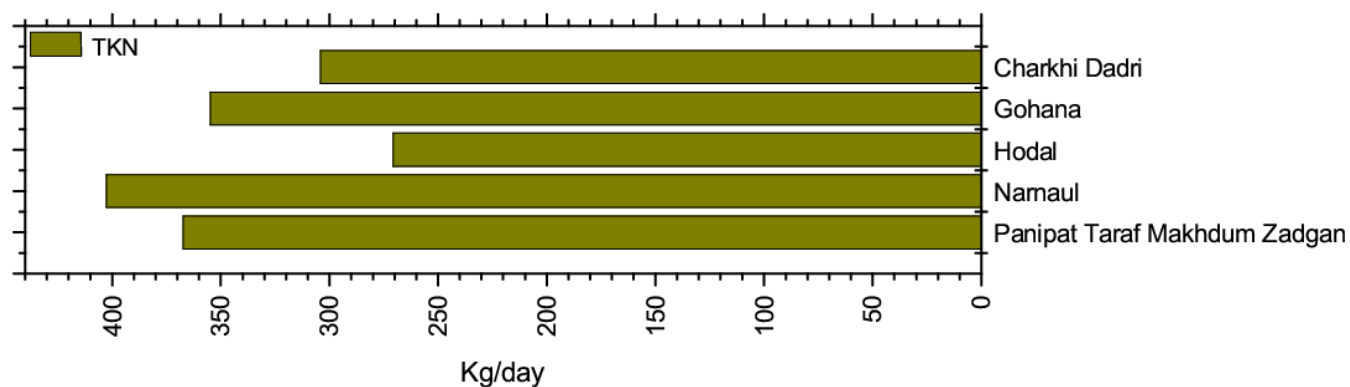
**Figure 9a: Assessment of Organic Pollution Load (kg/day) from Class I Cities of Haryana in Ganga River Basin**



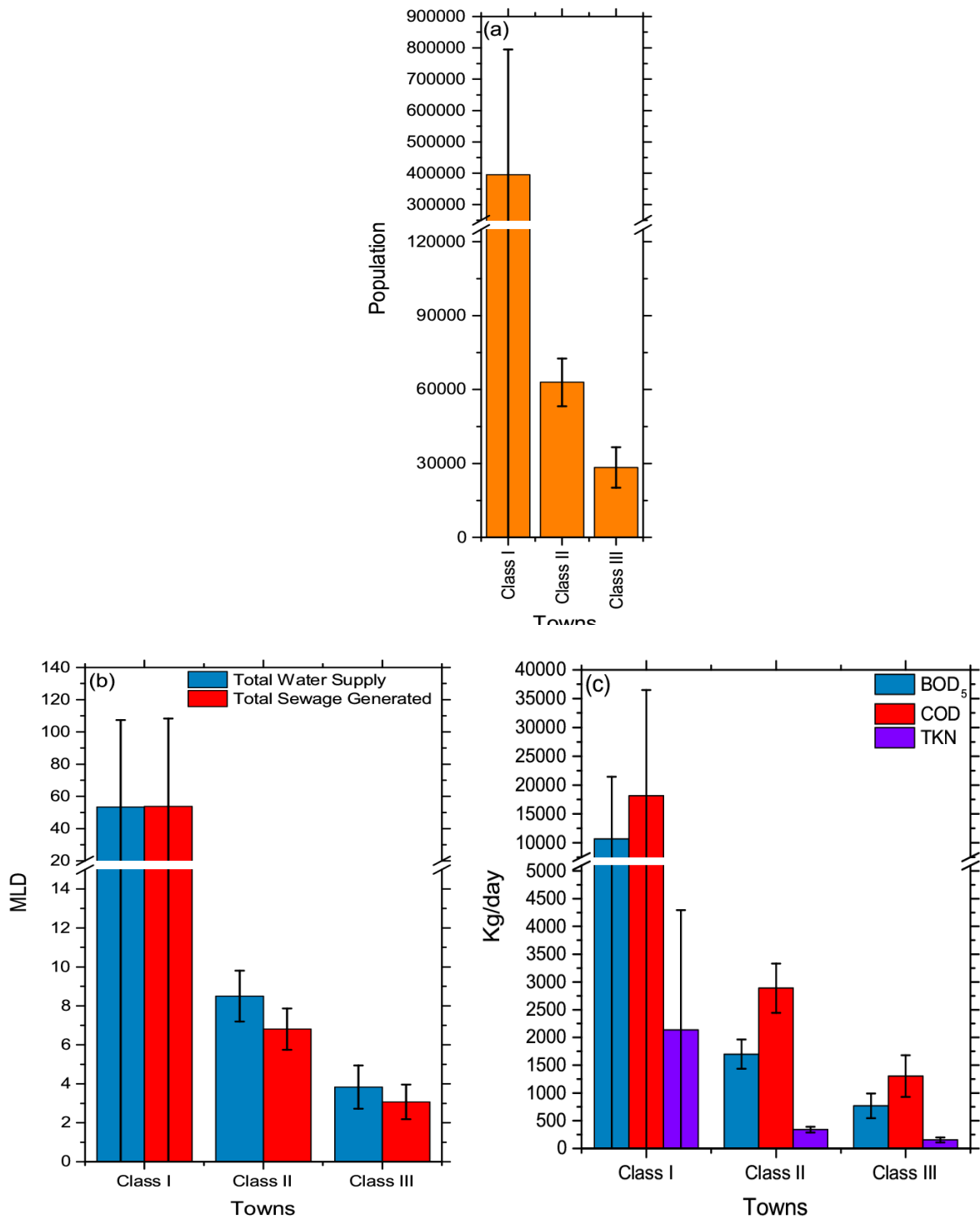
**Figure 9b: Assessment of Organic Pollution Load (kg/day) from Class II Cities of Haryana in Ganga River Basin**



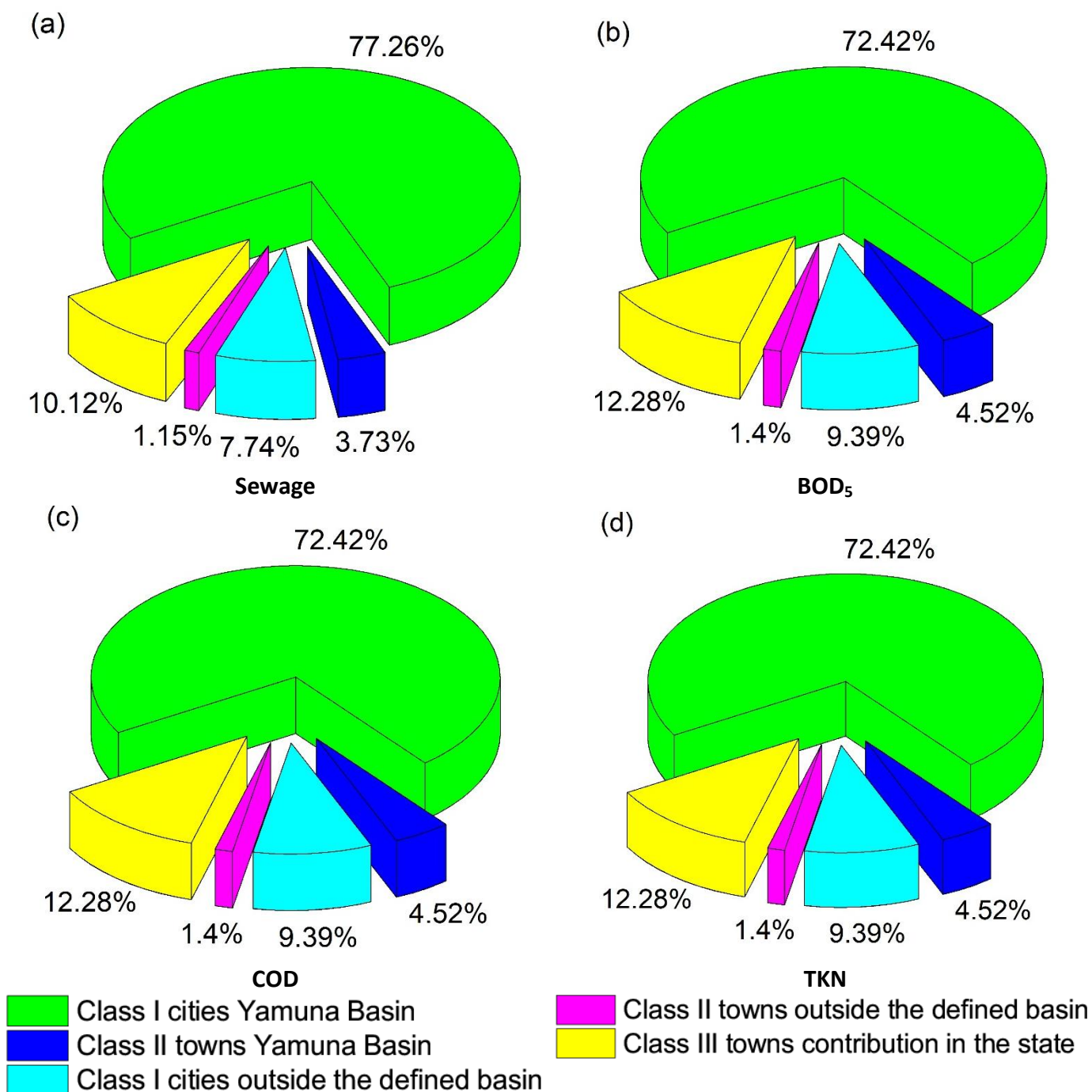
**Figure 10a: Assessment of TKN Load (kg/day) from Class I Cities of Haryana in Ganga River Basin**



**Figure 10b: Assessment of TKN Load (kg/day) from Class II Cities of Haryana in Ganga River Basin**



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



**Figure 12 (a-d): Pollution load of Class I Cities and Class II, Class III Towns in the Major Basins in the State: (a) Sewage Generation; (b) BOD<sub>5</sub>; (c) COD; (d) TKN**

The results of the pollution load of Class I cities, Class II and Class III towns under the major basins of river Ganga in the state has been evaluated (Figure 12a-d) and the results revealed

that the percentage of the total sewage generation is maximum in the Class I cities situated along the main stem of Yamuna (77.26%). The Class I cities and Class II towns outside the major defined basins combinedly release 8.99% of waste water. The percentage sewage generation by Class III towns of the entire state is 10.12% of the total sewage generated by the state.

The BOD, COD and TKN load contributed by Class I cities of the main stem of Yamuna is 72.42%. The Class II and Class III towns of the state imparted around 4.52% and 12.69% respectively of the total BOD, COD, and TKN load. The details of the BOD and COD load in the state are presented in Figure 12b and c.

## 5. Conclusions:

River Yamuna is the one of the main tributaries of River Ganga flows in the Indo-Gangetic plains. Yamuna flows from Yamunotri to Allahabad, and merge with river Ganga. During her course from Yamunotri to Allahabad, it passes through Himachal Pradesh, Uttarakhand, Haryana, Delhi and Uttar Pradesh. The catchment of the river addressed the load of 11 Class I cities, 5 Class II towns and 21 Class III towns, directly or indirectly. The scenario of water quality in the system is varies from bad to worse base on the spatial and temporal alterations. The multitudinous problems are also arising during lean season due to the continuous discharge of untreated and/or partially treated sewage and industrial wastewater.

The maximum sewage generation is in the Class I cities (77.26%) followed by Class III (10.12%) and Class II towns (7.74%). Pollution load (BOD, COD and TKN load) also follows the same trend with maximum values for Class I cities. Faridabad and Namaulare the Class I and Class II towns showing maximum amount of sewage generation in comparison to their water supply. The maximum BOD, COD and TKN contributing Class I cities, Class II and III towns are Faridabad, Namauland Jhajjar respectably. All calculations related to pollution load were done on per capita basis. There is lack of real data (drains, water supply, etc.) for the Haryana state and real data collection is suggested to be done for more accurate pollution situation.

## References

1. CPCB (2013). Pollution Assessment: River Ganga. [Accessed April 26, 2014 from: [http://cpcb.nic.in/upload/NewItems/NewItem\\_203\\_Ganga\\_report.pdf](http://cpcb.nic.in/upload/NewItems/NewItem_203_Ganga_report.pdf)].
2. Jain S.K., Agarwal, P.K. and Singh, V.P. (2007). Hydrology and Water Resources of India. Springer Netherlands, p 358.
3. Parua, P.K. (2009). The Ganga: Water Use in the Indian Subcontinent. DOI 10.1007/978-90-481-3103-Springer Netherlands.
4. Water Resources Information System (WRIS)- Wiki ([http://india-wris.nrsc.gov.in/wrpinfo/index.php?title=Main\\_Page](http://india-wris.nrsc.gov.in/wrpinfo/index.php?title=Main_Page))
5. CPCB (2009). Status of Water Supply, Wastewater Generation and Treatment in Class-I Cities & Class-II Towns of India.

## **Appendix-1**

### **Compilation of Data Sheets of Water Balance & Pollution Load (Domestic) of Major Class I Cities/Towns in Haryana**



| <b>Water Balance &amp; Pollution Load (Domestic) Data Sheet</b> |                                                                      |     |                       |               |
|-----------------------------------------------------------------|----------------------------------------------------------------------|-----|-----------------------|---------------|
| <b>City: BahadurGarh</b>                                        |                                                                      |     | <b>State: Haryana</b> |               |
| <b>S. No.</b>                                                   | <b>Items</b>                                                         |     |                       | <b>Value</b>  |
| 1                                                               | Total Area (sq km)                                                   | :   |                       | 29.50         |
| 2                                                               | Population as in 2011                                                | :   |                       | 170767        |
| 3                                                               | Population Growth Rate as in 2011 (%)                                | :   |                       | 29.44         |
| 4                                                               | Total Number of Wards                                                | :   |                       | 31            |
| 5                                                               | Population per Ward (Thousands)                                      | :   |                       | 5509          |
| 6                                                               | Total Number of Household as in 2011                                 | :   |                       | 34910         |
| 7                                                               | Number of Household per Ward                                         | :   |                       | 1126          |
| 8                                                               | Surface Water Supply (MLD)                                           | :   |                       | NA            |
| 9                                                               | Ground Water (GW) Supply (MLD)                                       | :   |                       | NA            |
| 10                                                              | Number of Bore Wells                                                 | :   |                       | NA            |
| 11                                                              | Ground Water Extraction per Bore Well (MLD)                          | :   |                       | NA            |
| 12                                                              | Number of Hand Pumps/ Tube wells                                     | :   |                       | NA            |
| 13                                                              | Ground Water Extraction per Hand Pump (lpcd)                         | :   |                       | 500           |
| 14                                                              | Number of Pumping Stations for Water Supply                          | :   |                       | NIL           |
| 15                                                              | Total Pumping Capacity (MLD)                                         | :   |                       | NA            |
| 17                                                              | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :   |                       | 23.1          |
| 18                                                              | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :   |                       | 135.0         |
| 19                                                              | Total Sewage Generation (MLD)*                                       | :   |                       | 18.4          |
| 20                                                              | Per Capita Sewage Generation (lpcd)                                  | :   |                       | 108.0         |
| 21                                                              | Sewage Collection (MLD)                                              | :   |                       | NA            |
| 22                                                              | Percentage of Sewage Collection (%)                                  | :   |                       | NA            |
| 23                                                              | Number of STPs                                                       | :   |                       | 3.0           |
| 24                                                              | Total Installed Capacity of STPs under GAP I & II (MLD)              | :   |                       | 18.0          |
| 25                                                              | Current Utilized Capacity of STPs (MLD)                              | :   |                       | NA            |
| 26                                                              | Percentage Utilization of Installed Capacity (%)                     | :   |                       | NA            |
| 27                                                              | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :   |                       | 1.0           |
| 28                                                              | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD | :                     | NA            |
|                                                                 |                                                                      | COD | :                     | NA            |
|                                                                 |                                                                      | TKN | :                     | NA            |
| 29                                                              | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD | :                     | 4610.7        |
|                                                                 |                                                                      | COD | :                     | 7838.2        |
|                                                                 |                                                                      | TKN | :                     | 922.1         |
| 30                                                              | Wastewater Disposal Means                                            | :   |                       | RiverDisposal |
| 31                                                              | Name of River/Streams for Wastewater Disposal                        | :   |                       | Yamuna River  |
| 32                                                              | Number of Drains/Nallah for Wastewater Disposal                      | :   |                       | 2             |
| 33                                                              | Number of Water Bodies                                               | :   |                       | NA            |
| 34                                                              | Gross Area of Water Bodies (Hectare)                                 | :   |                       | NA            |
| 35                                                              | Area of Water Bodies as % of Total Area                              | :   |                       | <<< 1         |

| <b>Water Balance &amp; Pollution Load (Domestic) Data Sheet</b> |                                                                      |                  |                       |                |
|-----------------------------------------------------------------|----------------------------------------------------------------------|------------------|-----------------------|----------------|
| <b>City: Faridabad</b>                                          |                                                                      |                  | <b>State: Haryana</b> |                |
| <b>S. No.</b>                                                   | <b>Items</b>                                                         |                  |                       | <b>Value</b>   |
| 1                                                               | Total Area (sq km)                                                   | :                |                       | 204.00         |
| 2                                                               | Population as in 2011                                                | :                |                       | 1414050        |
| 3                                                               | Population Growth Rate as in 2011 (%)                                | :                |                       | 33.91          |
| 4                                                               | Total Number of Wards                                                | :                |                       | 35             |
| 5                                                               | Population per Ward (Thousands)                                      | :                |                       | 40401          |
| 6                                                               | Total Number of Household as in 2011                                 | :                |                       | 290675         |
| 7                                                               | Number of Household per Ward                                         | :                |                       | 8305           |
| 8                                                               | Surface Water Supply (MLD)                                           | :                |                       | NA             |
| 9                                                               | Ground Water (GW) Supply (MLD)                                       | :                |                       | NA             |
| 10                                                              | Number of Bore Wells                                                 | :                |                       | NA             |
| 11                                                              | Ground Water Extraction per Bore Well (MLD)                          | :                |                       | NA             |
| 12                                                              | Number of Hand Pumps/ Tubewells                                      | :                |                       | NA             |
| 13                                                              | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                       | 500            |
| 14                                                              | Number of Pumping Stations for Water Supply                          | :                |                       | NA             |
| 15                                                              | Total Pumping Capacity (MLD)                                         | :                |                       | NA             |
| 16                                                              | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                       | NA             |
| 17                                                              | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                       | 190.90         |
| 18                                                              | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                       | 135.00         |
| 19                                                              | Total Sewage Generation (MLD)*                                       | :                |                       | 152.72         |
| 20                                                              | Per Capita Sewage Generation (lpcd)                                  | :                |                       | 108.00         |
| 21                                                              | Sewage Collection (MLD)                                              | :                |                       | 142.3          |
| 22                                                              | Percentage of Sewage Collection (%)                                  | :                |                       | NA             |
| 23                                                              | Number of STPs                                                       | :                |                       | 4.0            |
| 24                                                              | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                       | NA             |
| 25                                                              | Current Utilized Capacity of STPs (MLD)                              | :                |                       | NA             |
| 26                                                              | Percentage Utilization of Installed Capacity (%)                     | :                |                       | NA             |
| 27                                                              | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                       | NA             |
| 28                                                              | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :                     | NA             |
|                                                                 |                                                                      | COD              | :                     | NA             |
|                                                                 |                                                                      | TKN              | :                     | NA             |
| 29                                                              | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :                     | 38179.4        |
|                                                                 |                                                                      | COD              | :                     | 64904.9        |
|                                                                 |                                                                      | TKN              | :                     | 7635.9         |
| 30                                                              | Wastewater Disposal Means                                            | :                |                       | River Disposal |
| 31                                                              | Name of River/Streams for Wastewater Disposal                        | :                |                       | Yamuna River   |
| 32                                                              | Number of Drains/Nallah for Wastewater Disposal                      | :                |                       | 4              |
| 33                                                              | Number of Water Bodies                                               | :                |                       | 4              |
| 34                                                              | Gross Area of Water Bodies (Hectare)                                 | :                |                       | NA             |
| 35                                                              | Area of Water Bodies as % of Total Area                              | :                |                       | <<< 1          |

| Water Balance & Pollution Load (Domestic) Data Sheet |                                                                      |                  |                |              |
|------------------------------------------------------|----------------------------------------------------------------------|------------------|----------------|--------------|
| City: Gurgaon                                        |                                                                      |                  | State: Haryana |              |
| S. No.                                               | Items                                                                |                  |                | Value        |
| 1                                                    | Total Area (sq km)                                                   | :                |                | 184.59       |
| 2                                                    | Population as in 2011                                                | :                |                | 886519       |
| 3                                                    | Population Growth Rate as in 2011 (%)                                | :                |                | 340.30       |
| 4                                                    | Total Number of Wards                                                | :                |                | 74           |
| 5                                                    | Population per Ward (Thousands)                                      | :                |                | 11980        |
| 6                                                    | Total Number of Household as in 2011                                 | :                |                | 208229       |
| 7                                                    | Number of Household per Ward                                         | :                |                | 2814         |
| 8                                                    | Surface Water Supply (MLD)                                           | :                |                | NA           |
| 9                                                    | Ground Water (GW) Supply (MLD)                                       | :                |                | NA           |
| 10                                                   | Number of Bore Wells                                                 | :                |                | NA           |
| 11                                                   | Ground Water Extraction per Bore Well (MLD)                          | :                |                | NA           |
| 12                                                   | Number of Hand Pumps/ Tubewells                                      | :                |                | NA           |
| 13                                                   | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                | 500          |
| 14                                                   | Number of Pumping Stations for Water Supply                          | :                |                | NA           |
| 15                                                   | Total Pumping Capacity (MLD)                                         | :                |                | NA           |
| 17                                                   | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                | 119.7        |
| 18                                                   | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                | 135.0        |
| 19                                                   | Total Sewage Generation (MLD)*                                       | :                |                | 95.7         |
| 20                                                   | Per Capita Sewage Generation (lpcd)                                  | :                |                | 108.0        |
| 21                                                   | Sewage Collection (MLD)                                              | :                |                | NA           |
| 22                                                   | Percentage of Sewage Collection (%)                                  | :                |                | NA           |
| 23                                                   | Number of STPs                                                       | :                |                | 3.0          |
| 24                                                   | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                | 148.0        |
| 25                                                   | Current Utilized Capacity of STPs (MLD)                              | :                |                | NA           |
| 26                                                   | Percentage Utilization of Installed Capacity (%)                     | :                |                | NA           |
| 27                                                   | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                | NA           |
| 28                                                   | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :              | NA           |
|                                                      |                                                                      | COD              | :              | NA           |
|                                                      |                                                                      | TKN              | :              | NA           |
| 29                                                   | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :              | 23936.0      |
|                                                      |                                                                      | COD              | :              | 40691.2      |
|                                                      |                                                                      | TKN              | :              | 4787.2       |
| 30                                                   | Wastewater Disposal Means                                            | :                |                | River        |
| 31                                                   | Name of River/Streams for Wastewater Disposal                        | :                |                | Yamuna River |
| 32                                                   | Number of Drains/Nallah for Wastewater Disposal                      | :                |                | 4.0          |
| 33                                                   | Number of Water Bodies                                               | :                |                | 7.0          |
| 34                                                   | Gross Area of Water Bodies (Hectare)                                 | :                |                | NA           |
| 35                                                   | Area of Water Bodies as % of Total Area                              | :                |                | <<< 1        |

| Water Balance & Pollution Load (Domestic) Data Sheet |                                                                      |                  |                |              |
|------------------------------------------------------|----------------------------------------------------------------------|------------------|----------------|--------------|
| City: Jagadhari                                      |                                                                      |                  | State: Haryana |              |
| S. No.                                               | Items                                                                |                  |                | Value        |
| 1                                                    | Total Area (sq km)                                                   | :                |                | 24.80        |
| 2                                                    | Population as in 2011                                                | :                |                | 124894       |
| 3                                                    | Population Growth Rate as in 2011 (%)                                | :                |                | 23.30        |
| 4                                                    | Total Number of Wards                                                | :                |                | 31           |
| 5                                                    | Population per Ward (Thousands)                                      | :                |                | 4029         |
| 6                                                    | Total Number of Household as in 2011                                 | :                |                | 26716        |
| 7                                                    | Number of Household per Ward                                         | :                |                | 862          |
| 8                                                    | Surface Water Supply (MLD)                                           | :                |                | NA           |
| 9                                                    | Ground Water (GW) Supply (MLD)                                       | :                |                | NA           |
| 10                                                   | Number of Bore Wells                                                 | :                |                | NA           |
| 11                                                   | Ground Water Extraction per Bore Well (MLD)                          | :                |                | NA           |
| 12                                                   | Number of Hand Pumps/ Tubewells                                      | :                |                | NA           |
| 13                                                   | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                | 500          |
| 14                                                   | Number of Pumping Stations for Water Supply                          | :                |                | NA           |
| 15                                                   | Total Pumping Capacity (MLD)                                         | :                |                | NA           |
| 16                                                   | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                | NA           |
| 17                                                   | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                | 16.9         |
| 18                                                   | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                | 135          |
| 19                                                   | Total Sewage Generation (MLD)*                                       | :                |                | 13.49        |
| 20                                                   | Per Capita Sewage Generation (lpcd)                                  | :                |                | 108          |
| 21                                                   | Sewage Collection (MLD)                                              | :                |                | NA           |
| 22                                                   | Percentage of Sewage Collection (%)                                  | :                |                | NA           |
| 23                                                   | Number of STPs                                                       | :                |                | NA           |
| 24                                                   | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                | NA           |
| 25                                                   | Current Utilized Capacity of STPs (MLD)                              | :                |                | NA           |
| 26                                                   | Percentage Utilization of Installed Capacity (%)                     | :                |                | NA           |
| 27                                                   | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                | NA           |
| 28                                                   | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :              | NA           |
|                                                      |                                                                      | COD              | :              | NA           |
|                                                      |                                                                      | TKN              | :              | NA           |
| 29                                                   | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :              | 3372.1       |
|                                                      |                                                                      | COD              | :              | 5732.6       |
|                                                      |                                                                      | TKN              | :              | 674.4        |
| 30                                                   | Wastewater Disposal Means                                            | :                |                | River        |
| 31                                                   | Name of River/Streams for Wastewater Disposal                        | :                |                | Yamuna River |
| 32                                                   | Number of Drains/Nallah for Wastewater Disposal                      | :                |                | 1            |
| 33                                                   | Number of Water Bodies                                               | :                |                | NA           |
| 34                                                   | Gross Area of Water Bodies (Hectare)                                 | :                |                | NA           |
| 35                                                   | Area of Water Bodies as % of Total Area                              | :                |                | <<< 1        |

| Water Balance & Pollution Load (Domestic) Data Sheet |                                                                      |                  |                |                |
|------------------------------------------------------|----------------------------------------------------------------------|------------------|----------------|----------------|
| City: Karnal                                         |                                                                      |                  | State: Haryana |                |
| S. No.                                               | Items                                                                |                  |                | Value          |
| 1                                                    | Total Area (sq km)                                                   | :                |                | 29.46          |
| 2                                                    | Population as in 2011                                                | :                |                | 302140         |
| 3                                                    | Population Growth Rate as in 2011 (%)                                | :                |                | 36.57          |
| 4                                                    | Total Number of Wards                                                | :                |                | 20             |
| 5                                                    | Population per Ward (Thousands)                                      | :                |                | 15,107         |
| 6                                                    | Total Number of Household as in 2011                                 | :                |                | 63280          |
| 7                                                    | Number of Household per Ward                                         | :                |                | 11062          |
| 8                                                    | Surface Water Supply (MLD)                                           | :                |                | NA             |
| 9                                                    | Ground Water (GW) Supply (MLD)                                       | :                |                | NA             |
| 10                                                   | Number of Bore Wells                                                 | :                |                | NA             |
| 11                                                   | Ground Water Extraction per Bore Well (MLD)                          | :                |                | NA             |
| 12                                                   | Number of Hand Pumps/ Tubewells                                      | :                |                | NA             |
| 13                                                   | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                | 500            |
| 14                                                   | Number of Pumping Stations for Water Supply                          | :                |                | NA             |
| 15                                                   | Total Pumping Capacity (MLD)                                         | :                |                | NA             |
| 16                                                   | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                | NA             |
| 17                                                   | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                | 40.79          |
| 18                                                   | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                | 135.00         |
| 19                                                   | Total Sewage Generation (MLD)*                                       | :                |                | 32.63          |
| 20                                                   | Per Capita Sewage Generation (lpcd)                                  | :                |                | 108.00         |
| 21                                                   | Sewage Collection (MLD)                                              | :                |                | 30.84          |
| 22                                                   | Percentage of Sewage Collection (%)                                  | :                |                | NA             |
| 23                                                   | Number of STPs                                                       | :                |                | 2.0            |
| 24                                                   | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                | 48.0           |
| 25                                                   | Current Utilized Capacity of STPs (MLD)                              | :                |                | NA             |
| 26                                                   | Percentage Utilization of Installed Capacity (%)                     | :                |                | NA             |
| 27                                                   | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                | NA             |
| 28                                                   | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :              | NA             |
|                                                      |                                                                      | COD              | :              | NA             |
|                                                      |                                                                      | TKN              | :              | NA             |
| 29                                                   | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :              | 8157.8         |
|                                                      |                                                                      | COD              | :              | 13868.2        |
|                                                      |                                                                      | TKN              | :              | 1631.6         |
| 30                                                   | Wastewater Disposal Means                                            | :                |                | River Disposal |
| 31                                                   | Name of River/Streams for Wastewater Disposal                        | :                |                | Yamuna River   |
| 32                                                   | Number of Drains/Nallah for Wastewater Disposal                      | :                |                | 1              |
| 33                                                   | Number of Water Bodies                                               | :                |                | NA             |
| 34                                                   | Gross Area of Water Bodies (Hectare)                                 | :                |                | NA             |
| 35                                                   | Area of Water Bodies as % of Total Area                              | :                |                | <<< 1          |

| <b>Water Balance &amp; Pollution Load (Domestic) Data Sheet</b> |                                                                      |                  |                       |                |
|-----------------------------------------------------------------|----------------------------------------------------------------------|------------------|-----------------------|----------------|
| <b>City: Palwal</b>                                             |                                                                      |                  | <b>State: Haryana</b> |                |
| <b>S. No.</b>                                                   | <b>Items</b>                                                         |                  |                       | <b>Value</b>   |
| 1                                                               | Total Area (sq km)                                                   | :                |                       | 8.42           |
| 2                                                               | Population as in 2011                                                | :                |                       | 131926         |
| 3                                                               | Population Growth Rate as in 2011 (%)                                | :                |                       | 30.98          |
| 4                                                               | Total Number of Wards                                                | :                |                       | 32             |
| 5                                                               | Population per Ward (Thousands)                                      | :                |                       | 4,123          |
| 6                                                               | Total Number of Household as in 2011                                 | :                |                       | 23742          |
| 7                                                               | Number of Household per Ward                                         | :                |                       | 742            |
| 8                                                               | Surface Water Supply (MLD)                                           | :                |                       | NA             |
| 9                                                               | Ground Water (GW) Supply (MLD)                                       | :                |                       | NA             |
| 10                                                              | Number of Bore Wells                                                 | :                |                       | NA             |
| 11                                                              | Ground Water Extraction per Bore Well (MLD)                          | :                |                       | NA             |
| 12                                                              | Number of Hand Pumps/ Tube wells                                     | :                |                       | NA             |
| 13                                                              | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                       | 500            |
| 14                                                              | Number of Pumping Stations for Water Supply                          | :                |                       | NA             |
| 15                                                              | Total Pumping Capacity (MLD)                                         | :                |                       | NA             |
| 16                                                              | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                       | NA             |
| 17                                                              | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                       | 17.81          |
| 18                                                              | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                       | 135.00         |
| 19                                                              | Total Sewage Generation (MLD)*                                       | :                |                       | 14.25          |
| 20                                                              | Per Capita Sewage Generation (lpcd)                                  | :                |                       | 108.00         |
| 21                                                              | Sewage Collection (MLD)                                              | :                |                       | NA             |
| 22                                                              | Percentage of Sewage Collection (%)                                  | :                |                       | NA             |
| 23                                                              | Number of STPs                                                       | :                |                       | 1              |
| 24                                                              | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                       | 9              |
| 25                                                              | Current Utilized Capacity of STPs (MLD)                              | :                |                       | 9              |
| 26                                                              | Percentage Utilization of Installed Capacity (%)                     | :                |                       | NA             |
| 27                                                              | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                       | NA             |
| 28                                                              | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :                     | NA             |
|                                                                 |                                                                      | COD              | :                     | NA             |
|                                                                 |                                                                      | TKN              | :                     | NA             |
| 29                                                              | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :                     | 3562.0         |
|                                                                 |                                                                      | COD              | :                     | 6055.4         |
|                                                                 |                                                                      | TKN              | :                     | 712.4          |
| 30                                                              | Wastewater Disposal Means                                            | :                |                       | River Disposal |
| 31                                                              | Name of River/Streams for Wastewater Disposal                        | :                |                       | Yamuna River   |
| 32                                                              | Number of Drains/Nallah for Wastewater Disposal                      | :                |                       | 2              |
| 33                                                              | Number of Water Bodies                                               | :                |                       | NA             |
| 34                                                              | Gross Area of Water Bodies (Hectare)                                 | :                |                       | NA             |
| 35                                                              | Area of Water Bodies as % of Total Area                              | :                |                       | <<< 1          |

| <b>Water Balance &amp; Pollution Load (Domestic) Data Sheet</b> |                                                                      |                  |                       |                |
|-----------------------------------------------------------------|----------------------------------------------------------------------|------------------|-----------------------|----------------|
| <b>City: Panipat</b>                                            |                                                                      |                  | <b>State: Haryana</b> |                |
| <b>S. No.</b>                                                   | <b>Items</b>                                                         |                  |                       | <b>Value</b>   |
| 1                                                               | Total Area (sq km)                                                   | :                |                       | 21.86          |
| 2                                                               | Population as in 2011                                                | :                |                       | 295970         |
| 3                                                               | Population Growth Rate as in 2011 (%)                                | :                |                       | 10.07          |
| 4                                                               | Total Number of Wards                                                | :                |                       | 24             |
| 5                                                               | Population per Ward (Thousands)                                      | :                |                       | 12,332         |
| 6                                                               | Total Number of Household as in 2011                                 | :                |                       | 60905          |
| 7                                                               | Number of Household per Ward                                         | :                |                       | 2538           |
| 8                                                               | Surface Water Supply (MLD)                                           | :                |                       | NA             |
| 9                                                               | Ground Water (GW) Supply (MLD)                                       | :                |                       | NA             |
| 10                                                              | Number of Bore Wells                                                 | :                |                       | NA             |
| 11                                                              | Ground Water Extraction per Bore Well (MLD)                          | :                |                       | NA             |
| 12                                                              | Number of Hand Pumps/ Tube wells                                     | :                |                       | NA             |
| 13                                                              | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                       | 500            |
| 14                                                              | Number of Pumping Stations for Water Supply                          | :                |                       | 2              |
| 15                                                              | Total Pumping Capacity (MLD)                                         | :                |                       | NA             |
| 16                                                              | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                       | NA             |
| 17                                                              | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                       | 40.0           |
| 18                                                              | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                       | 135.0          |
| 19                                                              | Total Sewage Generation (MLD)*                                       | :                |                       | 154.4          |
| 20                                                              | Per Capita Sewage Generation (lpcd)                                  | :                |                       | 88.2           |
| 21                                                              | Sewage Collection (MLD)                                              | :                |                       | NA             |
| 22                                                              | Percentage of Sewage Collection (%)                                  | :                |                       | NA             |
| 23                                                              | Number of STPs                                                       | :                |                       | 2              |
| 24                                                              | Total Installed Capacity of STPs under GAP & YAP I & II (MLD)        | :                |                       | 45             |
| 25                                                              | Current Utilized Capacity of STPs (MLD)                              | :                |                       | 45.0           |
| 26                                                              | Percentage Utilization of Installed Capacity (%)                     | :                |                       | NA             |
| 27                                                              | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                       | NA             |
| 28                                                              | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :                     | NA             |
|                                                                 |                                                                      | COD              | :                     | NA             |
|                                                                 |                                                                      | TKN              | :                     | NA             |
| 29                                                              | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :                     | 7991.2         |
|                                                                 |                                                                      | COD              | :                     | 13585.0        |
|                                                                 |                                                                      | TKN              | :                     | 1598.2         |
| 30                                                              | Wastewater Disposal Means                                            | :                |                       | River Disposal |
| 31                                                              | Name of River/Streams for Wastewater Disposal                        | :                |                       | Yamuna River   |
| 32                                                              | Number of Drains/Nallah for Wastewater Disposal                      | :                |                       | 2              |
| 33                                                              | Number of Water Bodies                                               | :                |                       | 3              |
| 34                                                              | Gross Area of Water Bodies (Hectare)                                 | :                |                       | NA             |
| 35                                                              | Area of Water Bodies as % of Total Area                              | :                |                       | <<< 1          |

| Water Balance & Pollution Load (Domestic) Data Sheet |                                                                      |                  |                |                |
|------------------------------------------------------|----------------------------------------------------------------------|------------------|----------------|----------------|
| City: Rewari                                         |                                                                      |                  | State: Haryana |                |
| S. No.                                               | Items                                                                |                  |                | Value          |
| 1                                                    | Total Area (sq km)                                                   | :                |                | 22.50          |
| 2                                                    | Population as in 2011                                                | :                |                | 143021         |
| 3                                                    | Population Growth Rate as in 2011 (%)                                | :                |                | 42.05          |
| 4                                                    | Total Number of Wards                                                | :                |                | 31             |
| 5                                                    | Population per Ward (Thousands)                                      | :                |                | 4614           |
| 6                                                    | Total Number of Household as in 2011                                 | :                |                | 28702          |
| 7                                                    | Number of Household per Ward                                         | :                |                | 926            |
| 8                                                    | Surface Water Supply (MLD)                                           | :                |                | NA             |
| 9                                                    | Ground Water (GW) Supply (MLD)                                       | :                |                | NA             |
| 10                                                   | Number of Bore Wells                                                 | :                |                | NA             |
| 11                                                   | Ground Water Extraction per Bore Well (MLD)                          | :                |                | NA             |
| 12                                                   | Number of Hand Pumps/ Tubewells                                      | :                |                | NA             |
| 13                                                   | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                | 500            |
| 14                                                   | Number of Pumping Stations for Water Supply                          | :                |                | NA             |
| 15                                                   | Total Pumping Capacity (MLD)                                         | :                |                | NA             |
| 17                                                   | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                | 19.3           |
| 18                                                   | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                | 135.0          |
| 19                                                   | Total Sewage Generation (MLD)*                                       | :                |                | 15.4           |
| 20                                                   | Per Capita Sewage Generation (lpcd)                                  | :                |                | 108.0          |
| 21                                                   | Sewage Collection (MLD)                                              | :                |                | NA             |
| 22                                                   | Percentage of Sewage Collection (%)                                  | :                |                | NA             |
| 23                                                   | Number of STPs                                                       | :                |                | NA             |
| 24                                                   | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                | NA             |
| 25                                                   | Current Utilized Capacity of STPs (MLD)                              | :                |                | NA             |
| 26                                                   | Percentage Utilization of Installed Capacity (%)                     | :                |                | NA             |
| 27                                                   | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                | NA             |
| 28                                                   | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :              | NA             |
|                                                      |                                                                      | COD              | :              | NA             |
|                                                      |                                                                      | TKN              | :              | NA             |
| 29                                                   | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :              | 3861.6         |
|                                                      |                                                                      | COD              | :              | 6564.7         |
|                                                      |                                                                      | TKN              | :              | 772.3          |
| 30                                                   | Wastewater Disposal Means                                            | :                |                | River Disposal |
| 31                                                   | Name of River/Streams for Wastewater Disposal                        | :                |                | Yamuna River   |
| 32                                                   | Number of Drains/Nallah for Wastewater Disposal                      | :                |                | NA             |
| 33                                                   | Number of Water Bodies                                               | :                |                | NA             |
| 34                                                   | Gross Area of Water Bodies (Hectare)                                 | :                |                | NA             |
| 35                                                   | Area of Water Bodies as % of Total Area                              | :                |                | <<< 1          |



| Water Balance & Pollution Load (Domestic) Data Sheet |                                                                      |                  |                |                |
|------------------------------------------------------|----------------------------------------------------------------------|------------------|----------------|----------------|
| City: Rohtak                                         |                                                                      |                  | State: Haryana |                |
| S. No.                                               | Items                                                                |                  |                | Value          |
| 1                                                    | Total Area (sq km)                                                   | :                |                | 72.18          |
| 2                                                    | Population as in 2011                                                | :                |                | 374292         |
| 3                                                    | Population Growth Rate as in 2011 (%)                                | :                |                | 27.06          |
| 4                                                    | Total Number of Wards                                                | :                |                | 31             |
| 5                                                    | Population per Ward (Thousands)                                      | :                |                | 12074          |
| 6                                                    | Total Number of Household as in 2011                                 | :                |                | 75528          |
| 7                                                    | Number of Household per Ward                                         | :                |                | 2436           |
| 8                                                    | Surface Water Supply (MLD)                                           | :                |                | NA             |
| 9                                                    | Ground Water (GW) Supply (MLD)                                       | :                |                | NA             |
| 10                                                   | Number of Bore Wells                                                 | :                |                | NA             |
| 11                                                   | Ground Water Extraction per Bore Well (MLD)                          | :                |                | NA             |
| 12                                                   | Number of Hand Pumps/ Tubewells                                      | :                |                | NA             |
| 13                                                   | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                | 500            |
| 14                                                   | Number of Pumping Stations for Water Supply                          | :                |                | NA             |
| 15                                                   | Total Pumping Capacity (MLD)                                         | :                |                | NA             |
| 16                                                   | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                | NA             |
| 17                                                   | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                | 50.5           |
| 18                                                   | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                | 135.0          |
| 19                                                   | Total Sewage Generation (MLD)*                                       | :                |                | 40.4           |
| 20                                                   | Per Capita Sewage Generation (lpcd)                                  | :                |                | 108.0          |
| 21                                                   | Sewage Collection (MLD)                                              | :                |                | NA             |
| 22                                                   | Percentage of Sewage Collection (%)                                  | :                |                | NA             |
| 23                                                   | Number of STPs                                                       | :                |                | 3              |
| 24                                                   | Total Installed Capacity of STPs under GAP & YAP I & II (MLD)        | :                |                | 20             |
| 25                                                   | Current Utilized Capacity of STPs (MLD)                              | :                |                | NA             |
| 26                                                   | Percentage Utilization of Installed Capacity (%)                     | :                |                | NA             |
| 27                                                   | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                | 16.0           |
| 28                                                   | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :              | NA             |
|                                                      |                                                                      | COD              | :              | NA             |
|                                                      |                                                                      | TKN              | :              | NA             |
| 29                                                   | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :              | 10105.9        |
|                                                      |                                                                      | COD              | :              | 17180.0        |
|                                                      |                                                                      | TKN              | :              | 2021.2         |
| 30                                                   | Wastewater Disposal Means                                            | :                |                | River Disposal |
| 31                                                   | Name of River/Streams for Wastewater Disposal                        | :                |                | Yamuna River   |
| 32                                                   | Number of Drains/Nallah for Wastewater Disposal                      | :                |                | 2              |
| 33                                                   | Number of Water Bodies                                               | :                |                | 4              |
| 34                                                   | Gross Area of Water Bodies (Hectare)                                 | :                |                | 6.88           |
| 35                                                   | Area of Water Bodies as % of Total Area                              | :                |                | <<< 1          |

| Water Balance & Pollution Load (Domestic) Data Sheet |                                                                      |                  |                |                |
|------------------------------------------------------|----------------------------------------------------------------------|------------------|----------------|----------------|
| City: Sonipat                                        |                                                                      |                  | State: Haryana |                |
| S. No.                                               | Items                                                                |                  |                | Value          |
| 1                                                    | Total Area (sq km)                                                   | :                |                | 42.61          |
| 2                                                    | Population as in 2011                                                | :                |                | 289333         |
| 3                                                    | Population Growth Rate as in 2011 (%)                                | :                |                | 28.55          |
| 4                                                    | Total Number of Wards                                                | :                |                | 31             |
| 5                                                    | Population per Ward (Thousands)                                      | :                |                | 9,333          |
| 6                                                    | Total Number of Household as in 2011                                 | :                |                | 57740          |
| 7                                                    | Number of Household per Ward                                         | :                |                | 1863           |
| 8                                                    | Surface Water Supply (MLD)                                           | :                |                | NA             |
| 9                                                    | Ground Water (GW) Supply (MLD)                                       | :                |                | NA             |
| 10                                                   | Number of Bore Wells                                                 | :                |                | NA             |
| 11                                                   | Ground Water Extraction per Bore Well (MLD)                          | :                |                | NA             |
| 12                                                   | Number of Hand Pumps/ Tubewells                                      | :                |                | NA             |
| 13                                                   | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                | 500            |
| 14                                                   | Number of Pumping Stations for Water Supply                          | :                |                | NA             |
| 15                                                   | Total Pumping Capacity (MLD)                                         | :                |                | NA             |
| 16                                                   | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                | NA             |
| 17                                                   | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                | 39.06          |
| 18                                                   | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                | 135.00         |
| 19                                                   | Total Sewage Generation (MLD)*                                       | :                |                | 31.25          |
| 20                                                   | Per Capita Sewage Generation (lpcd)                                  | :                |                | 108.00         |
| 21                                                   | Sewage Collection (MLD)                                              | :                |                | NA             |
| 22                                                   | Percentage of Sewage Collection (%)                                  | :                |                | NA             |
| 23                                                   | Number of STPs                                                       | :                |                | 1              |
| 24                                                   | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                | 30             |
| 25                                                   | Current Utilized Capacity of STPs (MLD)                              | :                |                | 30             |
| 26                                                   | Percentage Utilization of Installed Capacity (%)                     | :                |                | NA             |
| 27                                                   | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                | NA             |
| 28                                                   | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :              | NA             |
|                                                      |                                                                      | COD              | :              | NA             |
|                                                      |                                                                      | TKN              | :              | NA             |
| 29                                                   | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :              | 7812.0         |
|                                                      |                                                                      | COD              | :              | 13280.4        |
|                                                      |                                                                      | TKN              | :              | 1562.4         |
| 30                                                   | Wastewater Disposal Means                                            | :                |                | River Disposal |
| 31                                                   | Name of River/Streams for Wastewater Disposal                        | :                |                | Yamuna River   |
| 32                                                   | Number of Drains/Nallah for Wastewater Disposal                      | :                |                | 1              |
| 33                                                   | Number of Water Bodies                                               | :                |                | NA             |
| 34                                                   | Gross Area of Water Bodies (Hectare)                                 | :                |                | NA             |
| 35                                                   | Area of Water Bodies as % of Total Area                              | :                |                | <<< 1          |

| <b>Water Balance &amp; Pollution Load (Domestic) Data Sheet</b> |                                                                      |                  |                       |                |
|-----------------------------------------------------------------|----------------------------------------------------------------------|------------------|-----------------------|----------------|
| <b>City: Yamunanagar</b>                                        |                                                                      |                  | <b>State: Haryana</b> |                |
| <b>S. No.</b>                                                   | <b>Items</b>                                                         |                  |                       | <b>Value</b>   |
| 1                                                               | Total Area (sq km)                                                   | :                |                       | 16.48          |
| 2                                                               | Population as in 2011                                                | :                |                       | 217071         |
| 3                                                               | Population Growth Rate as in 2011 (%)                                | :                |                       | 14.43          |
| 4                                                               | Total Number of Wards                                                | :                |                       | 31             |
| 5                                                               | Population per Ward (Thousands)                                      | :                |                       | 7002           |
| 6                                                               | Total Number of Household as in 2011                                 | :                |                       | 45351          |
| 7                                                               | Number of Household per Ward                                         | :                |                       | 1463           |
| 8                                                               | Surface Water Supply (MLD)                                           | :                |                       | NA             |
| 9                                                               | Ground Water (GW) Supply (MLD)                                       | :                |                       | NA             |
| 10                                                              | Number of Bore Wells                                                 | :                |                       | NA             |
| 11                                                              | Ground Water Extraction per Bore Well (MLD)                          | :                |                       | NA             |
| 12                                                              | Number of Hand Pumps/ Tubewells                                      | :                |                       | NA             |
| 13                                                              | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                       | 500            |
| 14                                                              | Number of Pumping Stations for Water Supply                          | :                |                       | NA             |
| 15                                                              | Total Pumping Capacity (MLD)                                         | :                |                       | NA             |
| 17                                                              | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                       | 29.3           |
| 18                                                              | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                       | 135.0          |
| 19                                                              | Total Sewage Generation (MLD)*                                       | :                |                       | 23.4           |
| 20                                                              | Per Capita Sewage Generation (lpcd)                                  | :                |                       | 108.0          |
| 21                                                              | Sewage Collection (MLD)                                              | :                |                       | NA             |
| 22                                                              | Percentage of Sewage Collection (%)                                  | :                |                       | NA             |
| 23                                                              | Number of STPs                                                       | :                |                       | 2              |
| 24                                                              | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                       | 35             |
| 25                                                              | Current Utilized Capacity of STPs (MLD)                              | :                |                       | 35.0           |
| 26                                                              | Percentage Utilization of Installed Capacity (%)                     | :                |                       | NA             |
| 27                                                              | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                       | NA             |
| 28                                                              | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :                     | NA             |
|                                                                 |                                                                      | COD              | :                     | NA             |
|                                                                 |                                                                      | TKN              | :                     | NA             |
| 29                                                              | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :                     | 5860.9         |
|                                                                 |                                                                      | COD              | :                     | 9963.6         |
|                                                                 |                                                                      | TKN              | :                     | 1172.2         |
| 30                                                              | Wastewater Disposal Means                                            | :                |                       | River Disposal |
| 31                                                              | Name of River/Streams for Wastewater Disposal                        | :                |                       | Yamuna River   |
| 32                                                              | Number of Drains/Nallah for Wastewater Disposal                      | :                |                       | 4              |
| 33                                                              | Number of Water Bodies                                               | :                |                       | 2              |
| 34                                                              | Gross Area of Water Bodies (Hectare)                                 | :                |                       | 3.70           |
| 35                                                              | Area of Water Bodies as % of Total Area                              | :                |                       | <<< 1          |

## **Appendix-2**

### **Compilation of Data Sheets of Water Balance & Pollution Load (Domestic) of Major Class I Cities/Towns in Haryana**

Class II towns list

| Water Balance & Pollution Load (Domestic) Data Sheet |                                                                      |                  |                |                |
|------------------------------------------------------|----------------------------------------------------------------------|------------------|----------------|----------------|
| City :Charkhi Dadri                                  |                                                                      |                  | State: Haryana |                |
| S. No.                                               | Items                                                                |                  |                | Value          |
| 1                                                    | Total Area (sq km)                                                   | :                |                | 5.42           |
| 2                                                    | Population as in 2011                                                | :                |                | 56337          |
| 3                                                    | Population Growth Rate as in 2011 (%)                                | :                |                | 25.49          |
| 4                                                    | Total Number of Wards                                                | :                |                | 19             |
| 5                                                    | Population per Ward (Thousands)                                      | :                |                | 2965           |
| 6                                                    | Total Number of Household as in 2011                                 | :                |                | 11074          |
| 7                                                    | Number of Household per Ward                                         | :                |                | 583            |
| 8                                                    | Surface Water Supply (MLD)                                           | :                |                | NA             |
| 9                                                    | Ground Water (GW) Supply (MLD)                                       | :                |                | NA             |
| 10                                                   | Number of Bore Wells                                                 | :                |                | NA             |
| 11                                                   | Ground Water Extraction per Bore Well (MLD)                          | :                |                | NA             |
| 12                                                   | Number of Hand Pumps/ Tubewells                                      | :                |                | NA             |
| 13                                                   | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                | 500            |
| 14                                                   | Number of Pumping Stations for Water Supply                          | :                |                | NA             |
| 15                                                   | Total Pumping Capacity (MLD)                                         | :                |                | NA             |
| 16                                                   | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                | NA             |
| 17                                                   | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                | 7.61           |
| 18                                                   | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                | 135            |
| 19                                                   | Total Sewage Generation (MLD)*                                       | :                |                | 6.08           |
| 20                                                   | Per Capita Sewage Generation (lpcd)                                  | :                |                | 108            |
| 21                                                   | Sewage Collection (MLD)                                              | :                |                | NA             |
| 22                                                   | Percentage of Sewage Collection (%)                                  | :                |                | NA             |
| 23                                                   | Number of STPs                                                       | :                |                | 1              |
| 24                                                   | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                | 9              |
| 25                                                   | Current Utilized Capacity of STPs (MLD)                              | :                |                | 5.9            |
| 26                                                   | Percentage Utilization of Installed Capacity (%)                     | :                |                | NA             |
| 27                                                   | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                | NA             |
| 28                                                   | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :              | NA             |
|                                                      |                                                                      | COD              | :              | NA             |
|                                                      |                                                                      | TKN              | :              | NA             |
| 29                                                   | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :              | 1521.1         |
|                                                      |                                                                      | COD              | :              | 2585.9         |
|                                                      |                                                                      | TKN              | :              | 304.2          |
| 30                                                   | Wastewater Disposal Means                                            | :                |                | River Disposal |
| 31                                                   | Name of River/Streams for Wastewater Disposal                        | :                |                | Yamuna River   |
| 32                                                   | Number of Drains/Nallah for Wastewater Disposal                      | :                |                | 1              |
| 33                                                   | Number of Water Bodies                                               | :                |                | NA             |
| 34                                                   | Gross Area of Water Bodies (Hectare)                                 | :                |                | NA             |
| 35                                                   | Area of Water Bodies as % of Total Area                              | :                |                | <<< 1          |

| <b>Water Balance &amp; Pollution Load (Domestic) Data Sheet</b> |                                                                      |                  |                       |                |
|-----------------------------------------------------------------|----------------------------------------------------------------------|------------------|-----------------------|----------------|
| <b>City: Gohana</b>                                             |                                                                      |                  | <b>State: Haryana</b> |                |
| <b>S. No.</b>                                                   | <b>Items</b>                                                         |                  |                       | <b>Value</b>   |
| 1                                                               | Total Area (sq km)                                                   | :                |                       | 11.51          |
| 2                                                               | Population as in 2011                                                | :                |                       | 65708          |
| 3                                                               | Population Growth Rate as in 2011 (%)                                | :                |                       | 35.39          |
| 4                                                               | Total Number of Wards                                                | :                |                       | 21             |
| 5                                                               | Population per Ward (Thousands)                                      | :                |                       | 3,129          |
| 6                                                               | Total Number of Household as in 2011                                 | :                |                       | 12477          |
| 7                                                               | Number of Household per Ward                                         | :                |                       | 594            |
| 8                                                               | Surface Water Supply (MLD)                                           | :                |                       | NA             |
| 9                                                               | Ground Water (GW) Supply (MLD)                                       | :                |                       | NA             |
| 10                                                              | Number of Bore Wells                                                 | :                |                       | NA             |
| 11                                                              | Ground Water Extraction per Bore Well (MLD)                          | :                |                       | NA             |
| 12                                                              | Number of Hand Pumps/ Tubewells                                      | :                |                       | NA             |
| 13                                                              | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                       | 500            |
| 14                                                              | Number of Pumping Stations for Water Supply                          | :                |                       | NA             |
| 15                                                              | Total Pumping Capacity (MLD)                                         | :                |                       | NA             |
| 16                                                              | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                       | NA             |
| 17                                                              | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                       | 8.87           |
| 18                                                              | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                       | 135.00         |
| 19                                                              | Total Sewage Generation (MLD)*                                       | :                |                       | 7.10           |
| 20                                                              | Per Capita Sewage Generation (lpcd)                                  | :                |                       | 108.00         |
| 21                                                              | Sewage Collection (MLD)                                              | :                |                       | NA             |
| 22                                                              | Percentage of Sewage Collection (%)                                  | :                |                       | NA             |
| 23                                                              | Number of STPs                                                       | :                |                       | NA             |
| 24                                                              | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                       | NA             |
| 25                                                              | Current Utilized Capacity of STPs (MLD)                              | :                |                       | NA             |
| 26                                                              | Percentage Utilization of Installed Capacity (%)                     | :                |                       | NA             |
| 27                                                              | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                       | NA             |
| 28                                                              | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :                     | NA             |
|                                                                 |                                                                      | COD              | :                     | NA             |
|                                                                 |                                                                      | TKN              | :                     | NA             |
| 29                                                              | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :                     | 1774.1         |
|                                                                 |                                                                      | COD              | :                     | 3016.0         |
|                                                                 |                                                                      | TKN              | :                     | 354.8          |
| 30                                                              | Wastewater Disposal Means                                            | :                |                       | River Disposal |
| 31                                                              | Name of River/Streams for Wastewater Disposal                        | :                |                       | Yamuna River   |
| 32                                                              | Number of Drains/Nallah for Wastewater Disposal                      | :                |                       | NA             |
| 33                                                              | Number of Water Bodies                                               | :                |                       | NA             |
| 34                                                              | Gross Area of Water Bodies (Hectare)                                 | :                |                       | NA             |
| 35                                                              | Area of Water Bodies as % of Total Area                              | :                |                       | <<< 1          |

| <b>Water Balance &amp; Pollution Load (Domestic) Data Sheet</b> |                                                                      |                  |                       |                |
|-----------------------------------------------------------------|----------------------------------------------------------------------|------------------|-----------------------|----------------|
| <b>City: Hodal</b>                                              |                                                                      |                  | <b>State: Haryana</b> |                |
| <b>S. No.</b>                                                   | <b>Items</b>                                                         |                  |                       | <b>Value</b>   |
| 1                                                               | Total Area (sq km)                                                   | :                |                       | 5.39           |
| 2                                                               | Population as in 2011                                                | :                |                       | 50143          |
| 3                                                               | Population Growth Rate as in 2011 (%)                                | :                |                       | 30.89          |
| 4                                                               | Total Number of Wards                                                | :                |                       | 17             |
| 5                                                               | Population per Ward (Thousands)                                      | :                |                       | 2,950          |
| 6                                                               | Total Number of Household as in 2011                                 | :                |                       | 8579           |
| 7                                                               | Number of Household per Ward                                         | :                |                       | 505            |
| 8                                                               | Surface Water Supply (MLD)                                           | :                |                       | NA             |
| 9                                                               | Ground Water (GW) Supply (MLD)                                       | :                |                       | NA             |
| 10                                                              | Number of Bore Wells                                                 | :                |                       | NA             |
| 11                                                              | Ground Water Extraction per Bore Well (MLD)                          | :                |                       | NA             |
| 12                                                              | Number of Hand Pumps/ Tubewells                                      | :                |                       | NA             |
| 13                                                              | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                       | 500            |
| 14                                                              | Number of Pumping Stations for Water Supply                          | :                |                       | NA             |
| 15                                                              | Total Pumping Capacity (MLD)                                         | :                |                       | NA             |
| 16                                                              | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                       | NA             |
| 17                                                              | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                       | 6.77           |
| 18                                                              | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                       | 135            |
| 19                                                              | Total Sewage Generation (MLD)*                                       | :                |                       | 5.42           |
| 20                                                              | Per Capita Sewage Generation (lpcd)                                  | :                |                       | 108.00         |
| 21                                                              | Sewage Collection (MLD)                                              | :                |                       | NA             |
| 22                                                              | Percentage of Sewage Collection (%)                                  | :                |                       | NA             |
| 23                                                              | Number of STPs                                                       | :                |                       | NA             |
| 24                                                              | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                       | NA             |
| 25                                                              | Current Utilized Capacity of STPs (MLD)                              | :                |                       | NA             |
| 26                                                              | Percentage Utilization of Installed Capacity (%)                     | :                |                       | NA             |
| 27                                                              | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                       | NA             |
| 28                                                              | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :                     | NA             |
|                                                                 |                                                                      | COD              | :                     | NA             |
|                                                                 |                                                                      | TKN              | :                     | NA             |
| 29                                                              | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :                     | 1353.9         |
|                                                                 |                                                                      | COD              | :                     | 2301.6         |
|                                                                 |                                                                      | TKN              | :                     | 270.8          |
| 30                                                              | Wastewater Disposal Means                                            | :                |                       | River Disposal |
| 31                                                              | Name of River/Streams for Wastewater Disposal                        | :                |                       | Yamuna River   |
| 32                                                              | Number of Drains/Nallah for Wastewater Disposal                      | :                |                       | NA             |
| 33                                                              | Number of Water Bodies                                               | :                |                       | NA             |
| 34                                                              | Gross Area of Water Bodies (Hectare)                                 | :                |                       | NA             |
| 35                                                              | Area of Water Bodies as % of Total Area                              | :                |                       | <<< 1          |

| <b>Water Balance &amp; Pollution Load (Domestic) Data Sheet</b> |                                                                      |                  |                       |                |
|-----------------------------------------------------------------|----------------------------------------------------------------------|------------------|-----------------------|----------------|
| <b>City: Narnaul</b>                                            |                                                                      |                  | <b>State: Haryana</b> |                |
| <b>S. No.</b>                                                   | <b>Items</b>                                                         |                  |                       | <b>Value</b>   |
| 1                                                               | Total Area (sq km)                                                   | :                |                       | 12.67          |
| 2                                                               | Population as in 2011                                                | :                |                       | 74581          |
| 3                                                               | Population Growth Rate as in 2011 (%)                                | :                |                       | 20.14          |
| 4                                                               | Total Number of Wards                                                | :                |                       | 23             |
| 5                                                               | Population per Ward (Thousands)                                      | :                |                       | 3,243          |
| 6                                                               | Total Number of Household as in 2011                                 | :                |                       | 13990          |
| 7                                                               | Number of Household per Ward                                         | :                |                       | 608            |
| 8                                                               | Surface Water Supply (MLD)                                           | :                |                       | NA             |
| 9                                                               | Ground Water (GW) Supply (MLD)                                       | :                |                       | NA             |
| 10                                                              | Number of Bore Wells                                                 | :                |                       | NA             |
| 11                                                              | Ground Water Extraction per Bore Well (MLD)                          | :                |                       | NA             |
| 12                                                              | Number of Hand Pumps/ Tubewells                                      | :                |                       | NA             |
| 13                                                              | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                       | 500            |
| 14                                                              | Number of Pumping Stations for Water Supply                          | :                |                       | NA             |
| 15                                                              | Total Pumping Capacity (MLD)                                         | :                |                       | NA             |
| 16                                                              | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                       | NA             |
| 17                                                              | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                       | 10.07          |
| 18                                                              | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                       | 135            |
| 19                                                              | Total Sewage Generation (MLD)*                                       | :                |                       | 8.1            |
| 20                                                              | Per Capita Sewage Generation (lpcd)                                  | :                |                       | 108            |
| 21                                                              | Sewage Collection (MLD)                                              | :                |                       | NA             |
| 22                                                              | Percentage of Sewage Collection (%)                                  | :                |                       | NA             |
| 23                                                              | Number of STPs                                                       | :                |                       | NA             |
| 24                                                              | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                       | NA             |
| 25                                                              | Current Utilized Capacity of STPs (MLD)                              | :                |                       | NA             |
| 26                                                              | Percentage Utilization of Installed Capacity (%)                     | :                |                       | NA             |
| 27                                                              | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                       | NA             |
| 28                                                              | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :                     | NA             |
|                                                                 |                                                                      | COD              | :                     | NA             |
|                                                                 |                                                                      | TKN              | :                     | NA             |
| 29                                                              | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :                     | 2013.7         |
|                                                                 |                                                                      | COD              | :                     | 3423.3         |
|                                                                 |                                                                      | TKN              | :                     | 402.7          |
| 30                                                              | Wastewater Disposal Means                                            | :                |                       | River Disposal |
| 31                                                              | Name of River/Streams for Wastewater Disposal                        | :                |                       | Yamuna River   |
| 32                                                              | Number of Drains/Nallah for Wastewater Disposal                      | :                |                       | NA             |
| 33                                                              | Number of Water Bodies                                               | :                |                       | NA             |
| 34                                                              | Gross Area of Water Bodies (Hectare)                                 | :                |                       | NA             |
| 35                                                              | Area of Water Bodies as % of Total Area                              | :                |                       | <<< 1          |



| Water Balance & Pollution Load (Domestic) Data Sheet |                                                                      |                  |                |                |
|------------------------------------------------------|----------------------------------------------------------------------|------------------|----------------|----------------|
| City: Panipat TarafMakhdumZadgan                     |                                                                      |                  | State: Haryana |                |
| S. No.                                               | Items                                                                |                  |                | Value          |
| 1                                                    | Total Area (sq km)                                                   | :                |                | 6.54           |
| 2                                                    | Population as in 2011                                                | :                |                | 67998          |
| 3                                                    | Population Growth Rate as in 2011 (%)                                | :                |                | 93.42          |
| 4                                                    | Total Number of Wards                                                | :                |                | 1              |
| 5                                                    | Population per Ward (Thousands)                                      | :                |                | 67,998         |
| 6                                                    | Total Number of Household as in 2011                                 | :                |                | 14066          |
| 7                                                    | Number of Household per Ward                                         | :                |                | 14066          |
| 8                                                    | Surface Water Supply (MLD)                                           | :                |                | NA             |
| 9                                                    | Ground Water (GW) Supply (MLD)                                       | :                |                | NA             |
| 10                                                   | Number of Bore Wells                                                 | :                |                | NA             |
| 11                                                   | Ground Water Extraction per Bore Well (MLD)                          | :                |                | NA             |
| 12                                                   | Number of Hand Pumps/ Tubewells                                      | :                |                | NA             |
| 13                                                   | Ground Water Extraction per Hand Pump (lpcd)                         | :                |                | 500            |
| 14                                                   | Number of Pumping Stations for Water Supply                          | :                |                | NA             |
| 15                                                   | Total Pumping Capacity (MLD)                                         | :                |                | NA             |
| 16                                                   | Average Water Supply Rate from ULB Sources (lpcd)                    | :                |                | NA             |
| 17                                                   | Total Water Supply from ULB and Non-ULB Sources (MLD)                | :                |                | 9.18           |
| 18                                                   | Average Water Supply Rate from ULB & Non-ULB Sources (lpcd)          | :                |                | 135.00         |
| 19                                                   | Total Sewage Generation (MLD)*                                       | :                |                | 7.34           |
| 20                                                   | Per Capita Sewage Generation (lpcd)                                  | :                |                | 108.00         |
| 21                                                   | Sewage Collection (MLD)                                              | :                |                | NA             |
| 22                                                   | Percentage of Sewage Collection (%)                                  | :                |                | NA             |
| 23                                                   | Number of STPs                                                       | :                |                | NA             |
| 24                                                   | Total Installed Capacity of STPs under GAP I & II (MLD)              | :                |                | NA             |
| 25                                                   | Current Utilized Capacity of STPs (MLD)                              | :                |                | NA             |
| 26                                                   | Percentage Utilization of Installed Capacity (%)                     | :                |                | NA             |
| 27                                                   | Capacity of STPs Sanctioned under JNNURM & Others (MLD)              | :                |                | NA             |
| 28                                                   | Pollution Load (Domestic) (Method 1: Actual Flow) (kg/d)             | BOD <sub>5</sub> | :              | NA             |
|                                                      |                                                                      | COD              | :              | NA             |
|                                                      |                                                                      | TKN              | :              | NA             |
| 29                                                   | Pollution Load (Domestic) (Method 2: Per Capita Contribution) (kg/d) | BOD <sub>5</sub> | :              | 1835.9         |
|                                                      |                                                                      | COD              | :              | 3121.1         |
|                                                      |                                                                      | TKN              | :              | 367.2          |
| 30                                                   | Wastewater Disposal Means                                            | :                |                | River Disposal |
| 31                                                   | Name of River/Streams for Wastewater Disposal                        | :                |                | Yamuna River   |
| 32                                                   | Number of Drains/Nallah for Wastewater Disposal                      | :                |                | NA             |
| 33                                                   | Number of Water Bodies                                               | :                |                | NA             |
| 34                                                   | Gross Area of Water Bodies (Hectare)                                 | :                |                | NA             |
| 35                                                   | Area of Water Bodies as % of Total Area                              | :                |                | <<< 1          |