

FINAL REPORT



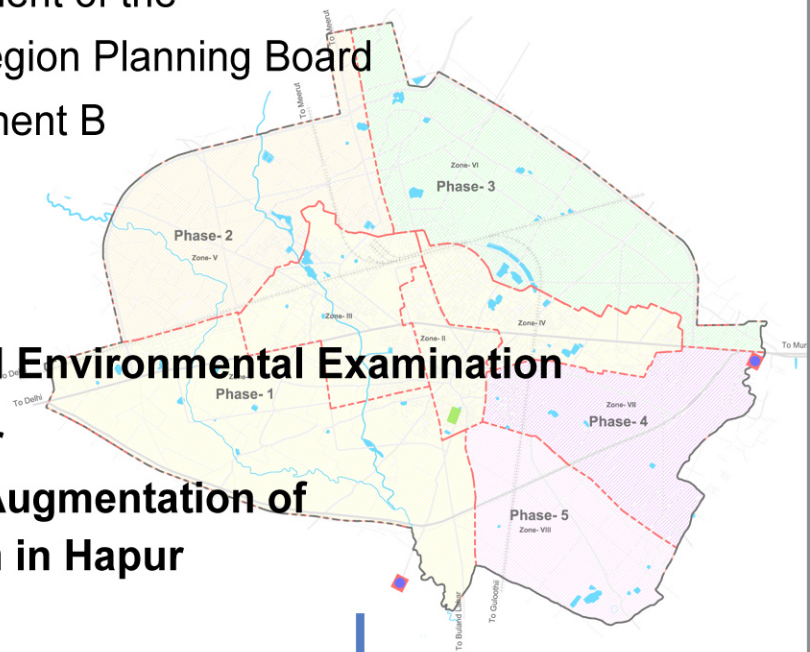
ADB

Asian Development Bank
National Capital Region Planning Board



Capacity Development of the
National Capital Region Planning Board
Package 2 Component B
TA No. 7055-IND

Volume II-F: Initial Environmental Examination
Project Report for
Rehabilitation & Augmentation of
Sewerage System in Hapur



WilburSmith
ASSOCIATES

July 2010

NCR Planning Board
Asian Development Bank

Capacity Development of the National Capital Region Planning Board (NCRPB) – Component B (TA No. 7055-IND)

Volume II F: Rehabilitation & Augmentation of Sewerage System
in Hapur

Initial Environmental Examination

July 2010



Abbreviations

ADB	:	Asian Development Bank
BOD	:	Biochemical Oxygen Demand
CMA	:	Counter Magnet Areas
COD	:	Chemical Oxygen Demand
CPHEEO	:	Central Public Health & Environmental Engineering Organization
DA	:	Development Authority
DFR	:	Draft Final Report
DPR	:	Detailed Project Report
EAF	:	Environmental Assessment Framework.
EC	:	Environmental Clearance
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
FGD	:	Focus Group Discussions
GoI	:	Government of India
GoUP	:	Government of Uttar Pradesh
HH	:	Household
HPDA	:	Hapur-Pilkhua Development Authority
IA	:	Implementing Agencies
IEE	:	Initial Environmental Examination
ISWM	:	Integrated Solid Waste Management
LPCD	:	Liters Per Capita per Day
MLD	:	Million Liters per Day
MPN	:	Most Probable Number
NCR	:	National Capital Region
NCRPB	:	National Capital Region Planning Board
NCT	:	National Capital Territory
NEERI	:	National Environment Engineering Research Institute
NGO	:	Non-governmental Organizations
NH	:	National Highway
RCC	:	Reinforced Cement Concrete
RF	:	Resettlement Framework
RP	:	Resettlement Plan
Rs.	:	Indian Rupees
RSDD	:	Regional Sustainable Development Department
SOI	:	Survey of India
SOR	:	Schedule of Rates
SPS	:	Sewage Pumping Station
STP	:	Sewerage Treatment Plant
TA	:	Technical Assistance
TOR	:	Terms of Reference
TSS	:	Total Suspended Solids
UP	:	Uttar Pradesh
uPVC	:	Unplasticized Polyvinyl Chloride
WSP	:	Waste Stabilization Pond

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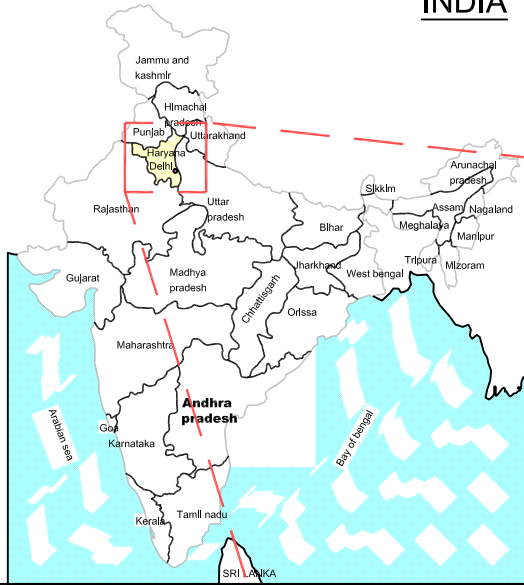
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1. INTRODUCTION

A. Background

1. Hapur Town is situated in Ghaziabad District of Uttar Pradesh State in Northern India. Ghaziabad District shares borders with the National Capital Territory Delhi. Owing to its location advantage close to Delhi and with good road connectivity, Hapur is a fast developing town. It is one of the important towns in NCR being developed to decongest National Capital Delhi by improving infrastructure with the aim of shifting some of the offices and establishments of Government of India. Location of Hapur is depicted in **Map 1-1**.
2. In Hapur, an underground sewerage system to collect, transport and dispose sewage was developed in 1970's. This was developed as a separate system catering only to wastewater, while the open drain system is provided for storm runoff. The sewerage system caters to wastewater generated from domestic, commercial and institutional areas but not industries. Due to old system and lack of proper maintenance, the sewerage system at present is almost defunct. Sewer lines are choked and are overflowing. Due to lack of free flow in the system, most of the sewers are discharging sewage into open drains. Since there is no sewage treatment facility, untreated sewage is discharged directly into a natural drain. .
3. Hapur was one of the sample towns selected by NCRPB for preparation of model project reports under this ADB TA. Accordingly the Master Plan for Sewerage System in Hapur was formulated and submitted in January 2009. In continuation, based on the recommendation of the Master Plan, this subproject for Sewerage System Improvement in Hapur has been formulated and the Detailed Project Report (DPR) has been prepared. NCR Planning Board, a statutory body of Ministry of Urban Development, Government of India, is a likely source of funding for the subproject in Hapur.
4. This Initial Environmental Examination (IEE) Report is prepared in accordance with NCRPB Environmental and Social Management System (ESMS) and Policy for project funding.

INDIA



Capacity Development of the NCRPB: Component B (ADB TA-7055)

Regional Setting of Hapur

Legend

- NCR
- State Boundary
- District Boundary
- District Hq.
- Counter Magnet Areas
- River / Stream

Bareilly

Hissar

Kota

Gwalior

Client:
**Asian Development Bank
National Capital Region Planning Board**

Consultant:
Wilbur Smith Associates

Drawn: Roopa
Date: April, 2010
Scale: NTS

Checked: NSS
Approved: NSS

Map 1-1



2. POLICY & LEGAL FRAMEWORK

A. Extent of IEE Study

5. The subproject implementation shall comply with the policies of Government of India (GoI), Government of Uttar Pradesh (GoUP) and procedures/policies of NCRPB. Government regulations and the NCRPB policy require that impacts of the development projects have to be identified at the beginning and mitigation measures be incorporated in the project to reduce those impacts to acceptable levels. This is generally done through the process of environmental impact assessment.

B. Government Law and Policies

6. The GoI EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.
7. Category A projects require EC from the national Ministry of Environment and Forests (MoEF). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MoEF prepares comprehensive Terms of Reference (ToR) for the EIA study. On completion of the study and review of the report by the EAC, MoEF considers the recommendation of the EAC and provides the EC if appropriate.
8. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares ToR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.
9. None of the components of this Sewerage Improvement Sub-project in Hapur falls under the ambit of the EIA Notification, and, therefore EC is not required.
10. *Other Environmental Regulations.* Development of Sewage Treatment Plant (STP) will attract the Water (Prevention and Control of Pollution) Act 1974, and the Air (Prevention and Control of Pollution) Act 1981 of Government of India. It requires that the project proponent should obtain “consent for establishment (CFE)” prior to start of construction of STP and “consent for operation (CFO)” before its operation from the Uttar Pradesh Pollution Control Board (UPPCB).

C. Environmental and Social Management System of NCRPB

11. Recognizing the importance of environmental and social issues that can arise in infrastructure projects, NCRPB has formulated an Environmental and Social Management Systems (ESMS) in line with Government and other multilateral agencies like ADB safeguard requirements for Financial Intermediaries (FIs). The ESMS provides an overall management system to NCRPB to identify, assess, and mitigate environmental and social issues that are likely to arise in projects funded by NCRPB. The ESMS outlines the policies, methods of assessments and procedures that will enable NCRPB to ensure that a project that it funds is developed in accordance with ESMS and is adequately protected from associated risks. Implementing Agencies (IAs) will have to comply with the ESMS and Policy.

1. Environmental Policy

12. *Policy Statement.* “National Capital Regional Planning Board (NCRPB) will continually strive to ensure and enhance effective environmental management practices in all its operations”. This is aimed to achieve through:

- Minimizing negative environmental (including health & safety) impacts in its operations and risks to the environment (particularly eco-sensitive areas and culturally important areas) and people who may be affected through formulating and implementing commensurate plans
- Ensuring that environmental safeguards - defined as requirements of applicable Indian environmental legislation and multilateral / bilateral funding agencies - are being adequately integrated by the project proponent / IA in the planning, design, construction prior to its financing and in its implementation during the operational phase.
- Ensuring that compliance to all applicable national and local environmental legislation.
- Encouraging that public and stakeholder consultation be carried out by the project proponent / IA and disclosing the required information in all stages of the project cycle.
- Integrating environmental risk into its overall internal risk management analysis.
- Including environmental management considerations in all aspects of operations and interactions with the project proponent / IAs in all stages of the project cycle.

13. This policy statement emphasizes NCRPB's sensitivity, concern and commitment to environmental safeguards. NCRPB will strive to ensure that the projects that it supports meets government policies and as well as of the bilateral/multilateral agencies such as ADB.

2. *Environmental Assessment Requirements*

14. The nature of the assessment required for a project depends on the significance of its likely environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. According to NCRPB ESMS, the projects are screened for their expected environmental impacts and are assigned to one of the following categories: E1, E2 or E3.

Table 2-1: Environmental Category

Environmental Scenario	NCRPB's Categorization	MOEFs Categorization	ADB Categorization
Significant impacts or in eco-sensitive area	E1	A	A
Limited impacts	E2	B1 or B2 or No Category	B
No impacts	E3	No Category	C

- (i) Significant impacts or in eco-sensitive areas (Category E1): If the project has significant adverse environmental impacts that are irreversible, diverse, or unprecedented, then it is regarded to have environmental scenario. These impacts may affect an area larger than the sites or facilities subject to physical works. These impacts will be considered significant if these are in eco-sensitive areas.
- (ii) Limited environmental impacts (Category E2): If the project has impacts that are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed.
- (iii) No environmental impacts (Category E3): If the project is likely to have minimal or no adverse environmental impacts, then it is regarded to have this environmental scenario.
15. The proposed subproject of Sewerage System Improvement in Hapur is likely to have some negative impacts including those typical impacts associated with the construction activity in urban areas and therefore classified as Category E2.
16. According to ESMS, E2 projects require carrying out Initial Environmental Examination (IEE) and preparation of IEE Report. This IEE report is prepared accordingly.

3. DESCRIPTION OF THE PROJECT

A. Project Need

17. Underground sewerage system, consisting of lateral sewers, pumping station and trunk sewers, was developed in 1970s. There was no sewage treatment facility developed. This sewerage system covers about 30 percent of the present town area. However, at present it is almost defunct, and most of the sewers are choked/blocked and damaged. Lack of proper maintenance and the old and dilapidated system are said to be the main reasons for present condition of the system. In the presently unsewered areas, most of the households are illegally connected their sewage outlets into open drains, and few dispose into septic tanks.
18. Indiscriminate disposal of solid waste into drains, roads and vacant plots are prevalent. Solid waste is also indiscriminately thrown into open/damaged manholes, leading to blocking of flow in underground sewers. Due to lack of maintenance, silt is accumulated at the bottom of the sewers causing hindrance to the flow. Due to these reasons most of the sewer lines are choked and are overflowing and discharging sewage into open drains. There are a number of places where sewers are illegally connected and discharging sewage into open drains. Almost all of the open drains in the city area are carrying sewage. Open drains too are choked with solid waste at many places leading accumulation of wastewater in drains and as well as low lying areas. Most of the areas in the old town are characterized by narrow streets and high density residential areas. The situation in these areas is very unhealthy with bad odour, and mosquito, fly and insect menace.
19. As a result of low collection and conveyance of sewage through the system, the total sewage reaches the sewage pumping station is very minimal, about 5-10 percent of design flow. Due to lack of sewage treatment facility, untreated sewage is pumped from sewage pumping station directly into Choyya Nala without any treatment, which ultimately meets River Kali in the south, about 5 km. However, except during monsoon, the Nala never reaches Kali due to very low flow. Most of the untreated wastewater is used for irrigation around Choyya Nala.
20. As the city is growing rapidly, the sewage generation will increase further in the future, further aggregating the existing situation.

B. Description of the Sub-project

21. **Table 3-1** shows the nature and size of the various components of the subproject. As indicated, there are three main elements: provision of a network to collect sewage from zones of I, II, III, IV (part), V (part), and VII (part) ; trunk and outfall sewers to transport waste to the STP; and a new STP to treat sewage to Indian legal standards.
22. The proposed sewerage system in Hapur will be a separate system catering both to grey water and sewage generated in the project area. This system will only cater to domestic, commercial and institutional establishments within the project area and will not cater to industries. Storm water is handled separately by open drain system, which is already in place and to which certain improvements are proposed in a parallel subproject.
23. Proposed sewerage rehabilitation and improvement subproject in Hapur is planned for 6 zones covering 2,907 ha (63 % of total area of 4,633 ha) area and will provide for 80 percent of the 2011 population and 66 percent of the 2041 population. This system will serve a population 0.27 million (2011 population) and 0.41 million (2041). Proposed subproject coverage is shown in **Map 3-1**. Design parameters considered to serve the coverage are listed below:
 - Design period of 30 years has been proposed for the DPR with base year as 2011 and design horizon year as 2041
 - The rate of water supply has been adopted as per the norms of CPHEEO manual as 135 lpcd at consumer end throughout the whole design period. 80 percent of the water supply has been considered as sewage flow into the sewerage system which works out 108 LPCD.
 - At places sewage-pumping station has been proposed to lift the sewage to nearby manhole or to the STP, from where it will flow by gravity.
 - Considering the normal availability of electricity in the town 16 hours per day pumping has been considered.
 - The STP will be modular such that planning will be for 2041 capacity but initially one module will be developed for year 2026 requirement or even less depending on techno economic criteria because sewer connectivity is at a low pace.

Table 3-1: Proposed Sewerage Infrastructure in Hapur

Infrastructure	Function	Description	Location
Sewage Treatment Plant (STP)	Treatment of sewage according to Indian wastewater discharge standards.	Proposed treatment process is based on Waste Stabilization Ponds (WSP), and capacity will be 25 Million Liters per Day (MLD) Components of the STP are: <ul style="list-style-type: none"> • Coarse Bar Screen • Fine Bar Screen • Grit Chamber • Anaerobic Ponds (of size 108m x 63m at top; 78m x 33m at bottom and 6m in depth) • Facultative Ponds ((of size 314m x 161m at top; 198m x 146m at bottom and 3m in depth) • Treated water sump & pumping station • Outfall sewer • Green belt around the site 	On 32.27 ha at Village Chatauli, located in the south of the town. Site is located adjacent to Choyya Nala. Treated wastewater will be utilized for irrigation around the site. Site is mostly under private ownership: 30.07 ha (private land) and 2.19 ha (government land)
Sewage Pumping Stations (SPS)	Collect & pump sewage to allow further flow which will limit the depth of sewers	2 sewage pumping stations are proposed, which will include the following: <ul style="list-style-type: none"> • Underground wet well • Pump house and pumps 	SPS -1 will be located at the terminal point within the STP premises SPS 2: This will be constructed on a government land parcel near MH 361.
Outfall Sewers	Transport sewage collected from trunk sewers from the town to the STP	1.5 km of Reinforced Cement Concrete (RCC) pipe of 1,400 mm diameter)	This pipe will be laid from Hapur Bye-pass to the STP along Choyya Nala. Pipe will be laid within the RoW of the drain, owned by Government
Trunk Sewer	Collect the sewage from network and convey it to the outfall sewer	7.23 km of Reinforced Cement Concrete (RCC) pipe of 300 to 1,100 mm diameter	Buried in a trench in the Right of Way (ROW) alongside the Choyya Nala and along the existing Chatauli Road.
Main & lateral sewers	Convey sewage from house connections to trunk sewers	Main sewers: 16 km of RCC pipe sewers of 250 to 450 mm diameter Lateral sewers: 112 km of RCC pipe sewers of 200	Sewers will extend throughout many parts of the town, where pipes for new secondary and tertiary sewer networks will be buried within or alongside

Infrastructure	Function	Description	Location
		mm diameter	roadways.
House connections	Collect the sewage from houses	Number of connections – about 44,000 This will be provided with uPVC pipes of 110 to 160 mm diameter	Sewers will be buried in trenches in the ROW of the roads

24. The sewer network will be of Reinforced Cement Concrete (RCC), and will be located alongside roads and streets, in the government-owned Right of Way (RoW). The proposed 112 km lateral sewers network will collect sewage from individual houses in 5 of 8 zones (**Map 3-2**). About 16 km of main sewers will collect and convey sewage to trunk sewers. These lateral and main sewers will be of small diameter (150 to 450 mm) and will be located in shallow trenches of 0.5 to 0.9 m wide and 1.5 m to 2 m in depth.
25. The 7.23 km trunk sewer will also be of RCC pipes. These sewers will be 500 to 1,200 mm in diameter and will be located alongside the main roads (**Map 3-3**), in trenches of 1 m to 1.5 m wide and 2 m to a maximum depth of 8 m.
26. Similarly, the outfall sewer of 0.53 m will convey sewage from trunk sewer to the STP at Chatauli. This will be of 1,400 mm diameter and will be of RCC. This pipe will be located along side of Choyya Nala within the Row. The size of trench will be of 1.8 m wide and about 6-7 m deep.
27. Design of network determined that there will be two pumping stations to provide for intermediate lifting in order to reduce the depth of sewers. Pumping stations are proposed in the town where the sewer depth exceeds 8 m. One of the two pumping stations will be located within the STP premises near the inlet. Second SPS will be developed on a government-owned land parcel.

28. The STP will be built on 32.27 ha of land adjacent to Choyya Nala in the south of the town (**Map 3-4**). The land at present is under agricultural use. STP will consists of three equally sized anaerobic ponds (of size 108m x 63m at top; 78m x 33m at bottom and 6m in depth), followed by two equally sized Facultative Ponds (of size 314m x 161m at top; 198m x 146m at bottom and 3m in depth) dug into the soil, each with slightly sloping sides and a flat bed



(**Map 3-5**). The anaerobic ponds of 6 m deep will be constructed partly in excavation (3.75 m) and partly by forming the embankment (2.25 m), and facultative ponds will be 3 m deep - 0.34 m in excavation and 2.66 m in embankment. A pumping station and a sump will be constructed to pump the treated water into treated effluent channel for further use by agricultural field around the site, and excess water will flow into Choyya Nala. This Nallah originates in the upstream of Hapur Town. This Nala meets river Kali, about 5 km south of Hapur. Green belt with plantations will be developed (layout of STP is at **Map 3-4**), and the site will be surrounded by security fence.

**Capacity Development of
the NCRPB: Component B
(ADB TA-7055)**

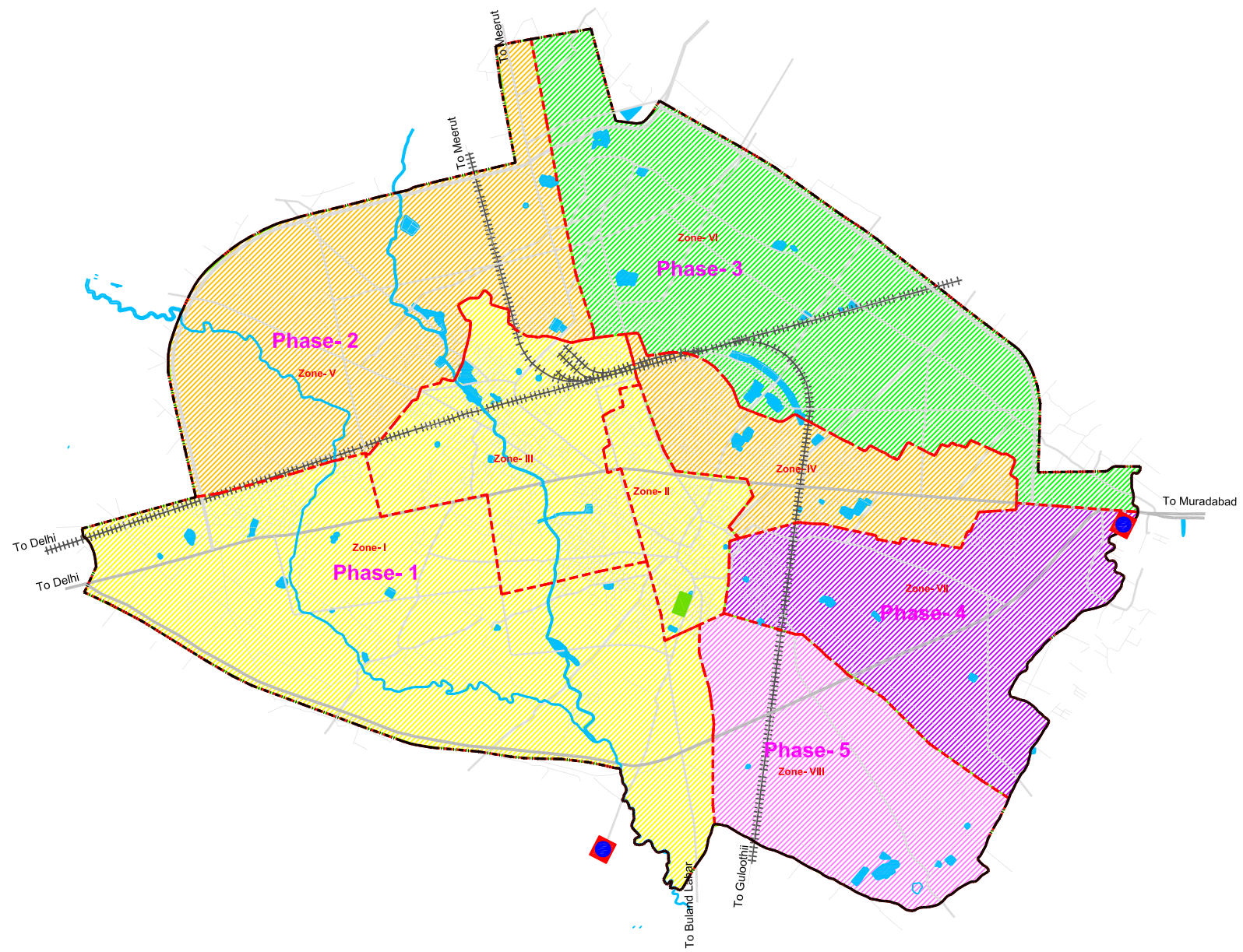
**Hapur
Proposed Sewerage Zones and Coverage**

Legend

- Extended Master Plan Boundary
- National Highway
- Major Roads Existing & Proposed
- Minor Roads
- +++++ Railway Line
- Water Course
- Existing Pump House

Overlay Legend

- - - - - Zone Boundary
- Zone-VI** Zone Number
- Phase 1 (Zone I, II & III)
- Phase 2 (Zone IV & V)
- Phase 3 (Zone VI)
- Phase 4 (Zone VII)
- Phase 5 (Zone VIII)
- Proposed STP & Pump House



Client
**Asian Development Bank
National Capital Region Planning Board**

Consultant
Wilbur Smith Associates

Drawn: SK
Date: April, 2010
Checked: NSS
Approved: NSS

Scale: 0 250 500 750 1000 1250 1500 Metres

Map 3-1



Capacity Development of
the NCRPB: Component B
(ADB TA-7055)

Hapur
Proposed Sewer Network

Legend

- Master Plan Boundary
- Municipal Boundary
- Zone Boundary
- Road
- Railway Line

Overlay Legend

- Proposed Sewer Network



Client:
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National Capital Region Planning Board

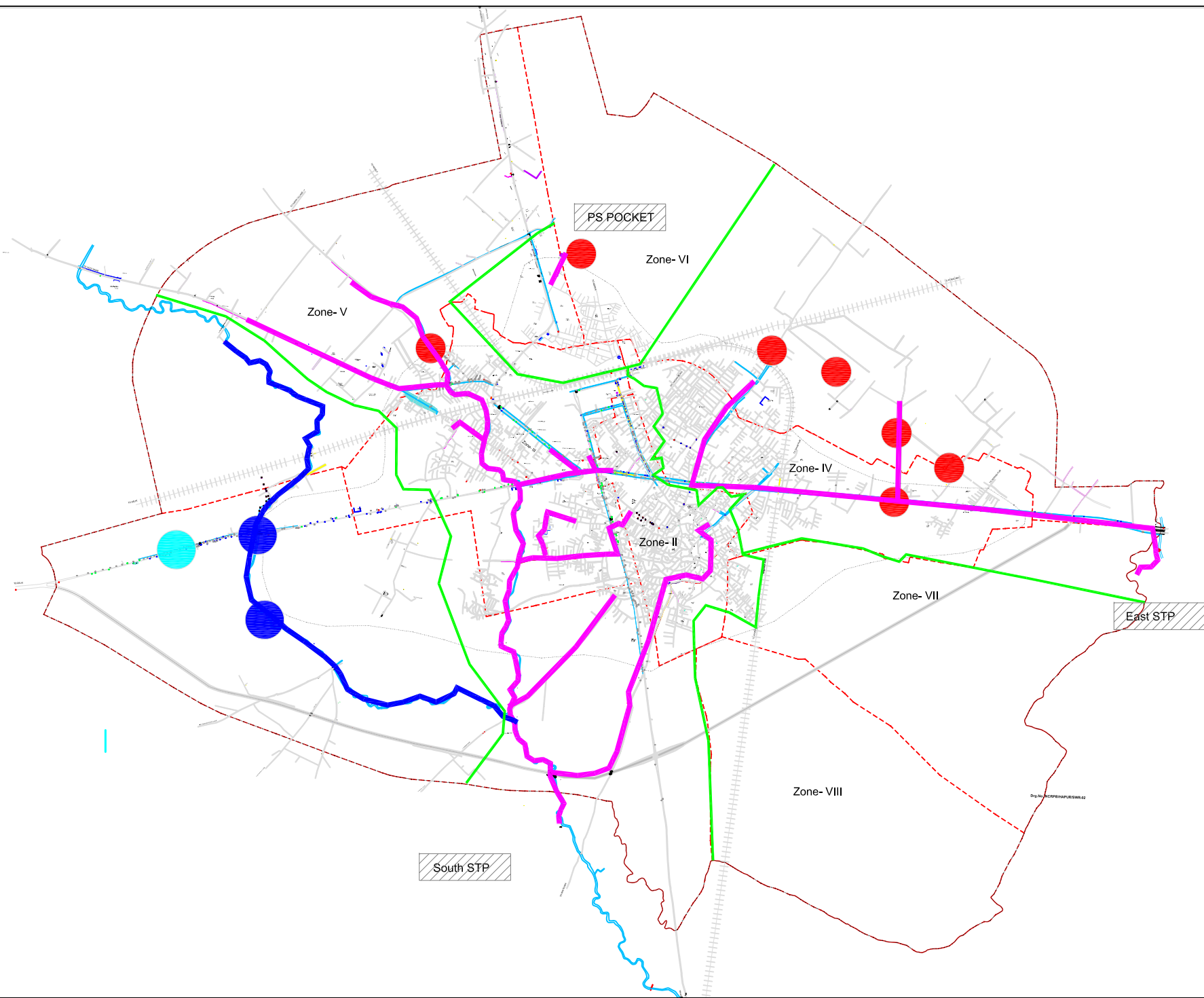
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Wilbur Smith Associates

Drawn: SK
Date: April 2010
Scale: 0 10 20 40 60 Meters

Checked: NSS
Approved: NSS

Capacity Development of the NCRPB: Component B (ADB TA-7055)

Hapur
Proposed Alignment of Trunk /Outfall Sewer



- Legend**
- Master Plan Boundary
 - Municipal Boundary
 - Zone Boundary
 - Road
 - Railway Line

- Overlay Legend**
- Sewer Boundary
 - Proposed Sewer Mains
 - Proposed Sewer Mains In HPDA Area
 - Proposed Pumping Stations
 - Proposed connecting MH In HPDA Area

Client
Asian Development Bank
National Capital Region Planning Board

Consultant
Wilbur Smith Associates

Checked By: _____
Date: July 2012
Approved By: _____

Scale:

Map 3-3

Capacity Development of the NCRPB: Component B (ADB TA-7055)

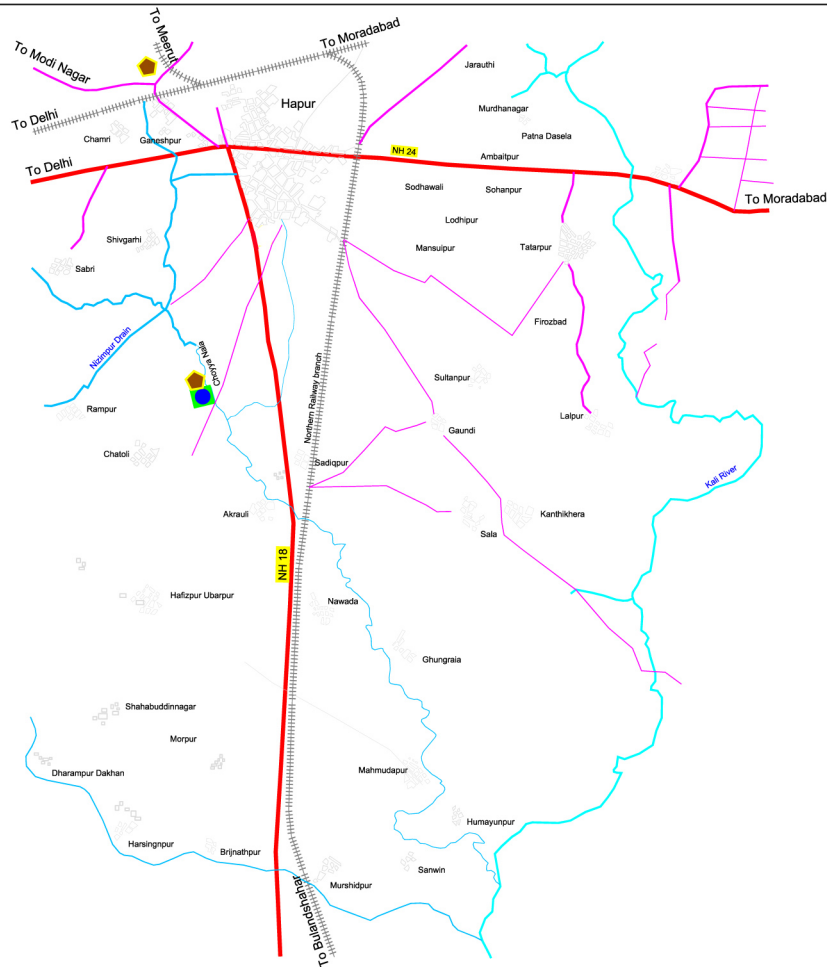
Hapur
Location of STP

Legend

-  National Highway
-  Other Roads
-  Railway Line
-  River, Drain

Overlay Legend

-  STP Site
-  Sewerage Pumping Station



Client:

Asian Development Bank
National Capital Region Planning Board

Consultant:

Wilbur Smith Associates

Drawn: SK
Date: August, 2009
Scale: NTS

Checked: ARA
Approved: NSS






Map 2-4



Capacity Development of the NCRPB: Component B (ADB TA-7055)

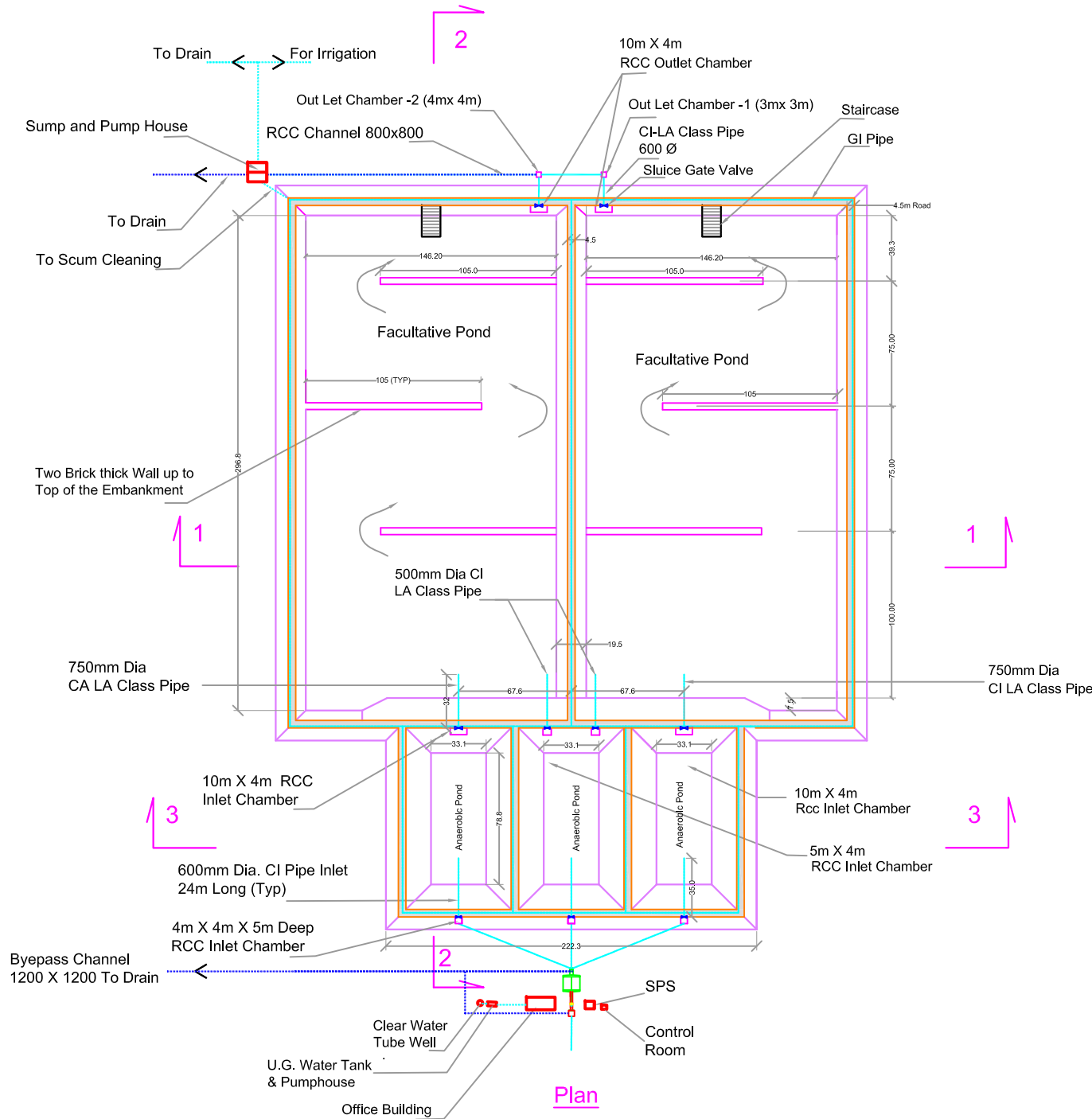
Hapur
STP - Design

Legend

-  Roads
-  Pipe Line
-  Channel
-  Building
-  Sluice Gate Valve

Schedule of Structures / Buildings:

Sl.No.	Description	Size
1	Inlet Chamber	3.5m X 3.5m
2	Coarse Screen Channel	4.0m X 1.30m
3	Fine Screen Channel	4.65m x 2.0m-2nos
4	Grit Chamber	9.00m X 9.00m - 2,nos
5	Anaerobic Pond	33.1m x 78.8m (@Bottom, 63.1 x 108.8m at Top and 58.1 x 103.8m at Water Level)
6	Facultative Pond	146.2 x 296.8m (@Bottom, 161.2 X 313.8m at Top and 156.2 x 306.8m at Water Level)
7	Distribution Chamber	1.5m X 5.1m, 1.5x1.5m 3 Nos
8	Inlet to Anaerobic Pond	4.00x4.00m-3 Nos
9	Inlet to Facultative Pond	5.0mx4.0m- 2 Nos. and 10.0x4.0 2 Nos
10	Outlet to Facultative Pond	10.0mx4.0m- 2 Nos.
11	Outlet Chamber 1 and 2	3.0mx3.0m and 4.0x4.0m
12	Office	17.2mx7.5m
13	Control Room	5.5m x 4.5m
14	Sump for Effluent Pump	11.5m x 11.5x 4.0m
15	High Pressure Pump House	11.5m x 4.5m
16	750mm CI LA Pipe	Length 360m
17	500mm CI LA Pipe	Length 50m
18	600mm CI LA Pipe	Length 70m
19	High Pressure Pump House	4.0m X 3.5m
20	Partion Wall in Ponds	105.0m x 6 Nos.
21	GI Pipe 50mm for Scum	2200m



Plan

Client:
**Asian Development Bank
National Capital Region Planning Board**

Consultant:
Willbur Smith Associates

Drawn: SK
Date: April, 2010




Checked: NSS
Approved: NSS

Scale: 







Capacity Development of the NCRPB: Component B (ADB TA-7055)

Hapur
Layout of STP

Legend

-  Existing BT Road
-  Existing Katcha Track
-  Existing Drain

Overlay Legend

-  Proposed Road at Ground Level
-  Proposed Road on Embankment
-  Proposed Approach Road to Embankment
-  Barbed Wire Fencing
-  Proposed Drain
-  Green Area

Quantity of Works:

- Proposed Road at Ground Level-1244 m
- Proposed Road Leading to Embankment-135 m
- Proposed Road on Embankment-2260 m
- Barbed Wire Fencing - 2050m
- Green Area-9.5 Hect.
- Total Land Area-24.74 Hect.
- Drain -1200x1200 =400m
800x700=600m
600x600=800m
400x300=350m

Client:

**Asian Development Bank
National Capital Region Planning Board**

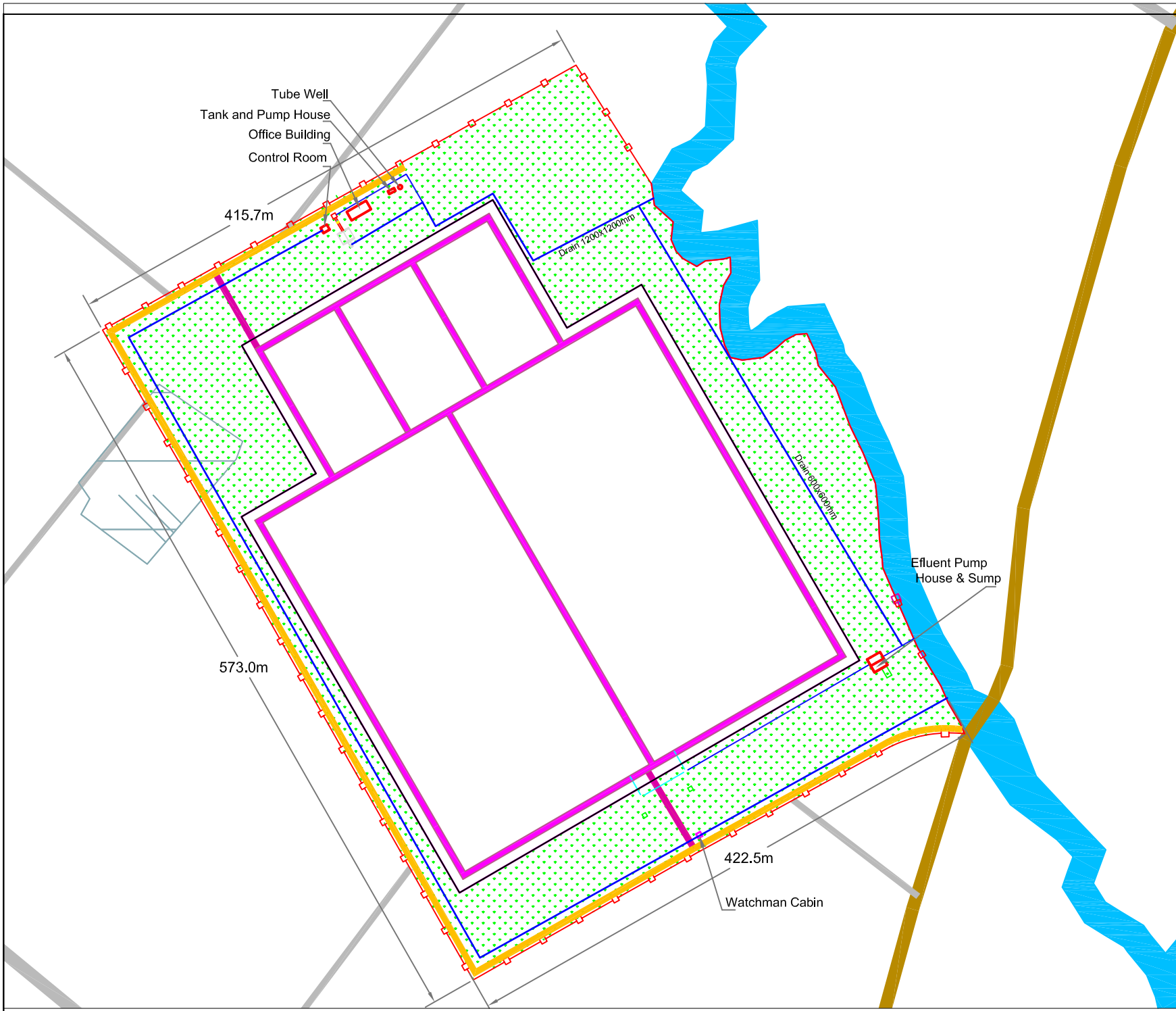
Consultant:

Wilbur Smith Associates

Drawn: SK
Date: April, 2010
Scale: NTS

Checked: NSS
Approved: NSS

Map 3-6



C. Estimated Cost and Implementation Schedule

29. Estimated cost of the subproject for rehabilitation and augmentation of sewerage system in Hapur is Rs. 1,160 million. Construction of STP will take about 6 months and laying of sewer network will take up to upto 2 years.

4. DESCRIPTION OF ENVIRONMENT

A. Physical Resources

1. Location

30. Hapur Town is in Ghaziabad District of Uttar Pradesh State in north India. Geographically, Hapur is situated at 28° 44' N latitude and 77° 47' E Longitude. Hapur Town is situated at about 54 Km east of Delhi, and 432 km west of the State Capital, Lucknow. The district headquarter and fast growing city of Ghaziabad is situated about 36 km east of Hapur. Town is well connected with important cities of the country; two National Highways (NH 24 - Delhi-Lucknow-Muradabad Road, and NH 18 - Meerut-Bulandsahar Road) passes through Hapur city. Two branches of northern railway pass through Hapur Town.
31. The population of Hapur Town as per census 2001 was 211,983. Hapur Municipality (Hapur Nagar Palika Parishad) was established in 1982. At present, the municipal area of Hapur is 1,401 ha (14 sq. km).

2. Topography, soil and geology

32. The town has almost flat topography except a small portion in the south, which is a marginally higher than the general ground level. The general slope of the town is from north to south. The difference between the maximum and minimum ground levels is about 3 m - varies from 213 to 210 m above mean sea level. The depth of groundwater in the town varies from 9-12 m. The town is located in the catchment area of the Ganges River, the most important and perennial river of India, flowing at a distance of 30 km east of the town. River Kali, a tributary of River Ganges, flows in the eastern outskirts of the town in the north-south direction. Hapur Town drains into this Kali River. The general nature of the soil is sand mixed with clay.

3. Climate

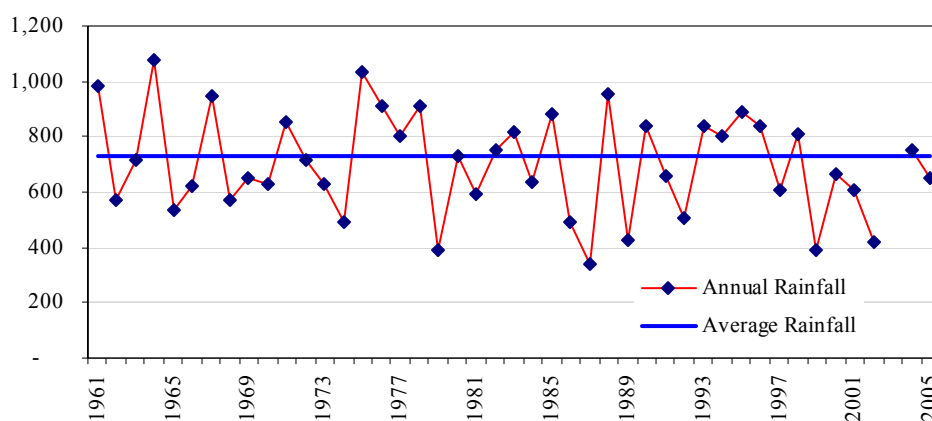
33. Typical humid subtropical climate of north India prevails in Hapur, with high variation between summer and winter temperatures and precipitation. There are three distinct seasons – first of which is the monsoon season - hot and humid season from mid-June to September. Second season, winter, is the cool and dry season from October to March. The third phase, summer, is characterized by hot and dry weather which prevails from April to mid-June. The average temperature ranges from a minimum of 1.8oC to a maximum of 44.9oC; occasional extremes may in the ranges of 0.6oC to 47oC. Predominant winds are from north, northwest and west. Extreme temperatures have ranged from –0.6 °C to 47 °C. Annual average rainfall is 732 mm.

34. Rains in Hapur are mainly concentrated in monsoon season. The region receives rainfall mainly under the influence of southwest monsoon from July to September. Over 75 percent of the total rainfall is received during the month from July to September and the remaining rainfall is received during December to February. The annual average rainfall is 745 mm.

Table 4-1: Rainfall Pattern in Panipat (2004-2008)

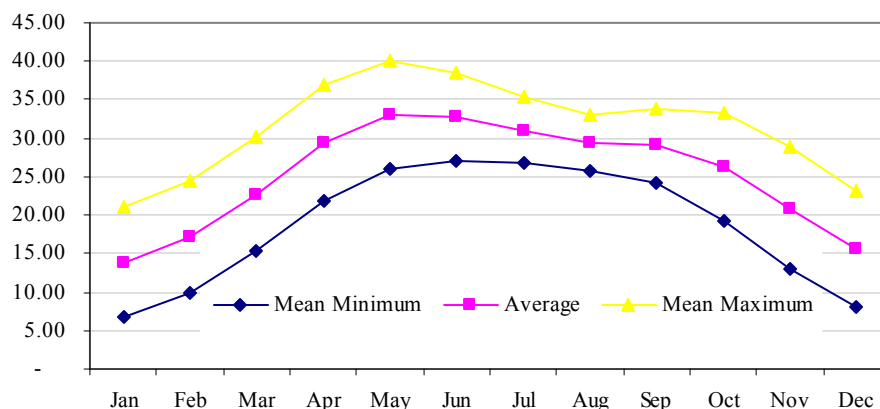
Month	Rainfall (mm)					
	Normal	2004	2005	2006	2007	2008
January	20.5	7.8	0	0	0	NA
February	20.6	0	23.9	0	45	NA
March	17.4	0	19	NA	64	NA
April	5.8	30.4	0	0	0	NA
May	12.8	75	0	0	0	NA
June	43.8	20.6	80.5	34.2	64.1	16.4
July	216.5	36.8	185.7	250.5	84.1	124.4
August	234.5	520.6	57.9	20.4	99.8	58.1
September	129.2	50.4	284.2	114	4.7	8.7
October	34.1	12.6	0	16	0	0
November	4.3	0	0	0	NA	2
December	6.1	0	0	0	0	NA
Total	745.6	754.2	651.2	-	-	-

Figure 1: Long-term Annual Rainfall Pattern of Hapur (in millimeter)



35. Owing to its sub-tropical continental monsoon climate with hot summers and cold winters, Hapur experiences large variations in temperature across the year. May and June experiences high temperatures and the lowest is recorded in the months of December and January. **Figure 2** depicts the monthly averages of minimum, mean and maximum temperature.
36. Winds predominantly blow from north, north-west and west direction, followed by east and south-east direction.

Figure 2: Average Monthly Temperature (in Degrees Centigrade)



4. Air Quality

37. There are no data on ambient air quality in Hapur Town, which is not subject to monitoring by the Uttar Pradesh Pollution Control Board (UPPCB) as there are no major industries. Dry weather coupled with dusty roads, particulate matter is likely to be high, particularly during summer months. Traffic is the only significant pollutant, so levels of oxides of sulphur and nitrogen are likely to be well within the National Ambient Air Quality Standards (NAAQS)..

5. Surface Water

38. The town is located in the catchment area of the Ganges River, the most important and perennial river of India. River Kali, a tributary of River Ganges, flows in the eastern outskirts of the town at Tatarpur Village, in the north-south direction. Hapur Town drains ultimately into Kali River. Most of the town drains into Choyya Nala flowing through the town, which meets Kali River about 10 km south of the town. River Kali ultimately meets the Ganges far downstream.

39. Due to seasonal and low rainfall concentrated for short duration, drains carry mostly the wastewater. Absence of proper sewerage system is one of the main reasons for wastewater entering into the drains and reaching River Kali, and then ultimately to the Ganges. The main drain of Hapur, Chhoya Nala enters the town from north. The Nala enters into the town with polluted water, which it received mainly from Dheerkukheda industrial area, and other habitations upstream of Hapur. Once it enters Hapur, due to lack of sewerage system, the domestic wastewater – including sewage in some



cases, is discharges into the drains through network of drains. Another drain – known as Circular Drain, carries wastewater from a part of the town and drains directly into Kali River on the eastern outskirts. Indiscriminate disposal of solid waste into the drains is prevalent. Chocking, blocking and overflowing of drains is common. The drains, due to accumulation of wastewater, acts as mosquito breeding grounds and giving rise to diseases.

40. Following **Table 4-2** shows the water quality of Choyya Nala at two locations as per a sample test conducted in October 2009. It clearly establishes that the Nala carries wastewater with high BOD levels.

Table 4-2: Water Quality of Choyya Nala

S. No	Parameters	Sample1(in the City)	Sample2 (City outskirts)
1	BOD.,	117.30	107.20
2	COD	221.00	210.00
3	pH	6.85	7.00
4	Color	Gray	Gray
5	Total Suspended solids	446.00	450.00
6	Oil and Grease	306	289.00
7	Nitrate as NO3	72.82	67.571
8	Sulphate,as SO4	27.98	31.240
9	Floride,as F	4.00	4.00
10	Total Hardness,as CaCO3	612.25	580.86
11	Phosphates,as PO4	42.77	30.24
12	Cloride,as Cl	329.06	289.00
13	Total Dissolved solid	1170.00	1044.00

6. Groundwater

41. Hapur is located in Central Gangetic Alluvium of quaternary age. The alluvium comprises of clay mixed kankar and fine and medium sand. The ground water in the area occurs under the unconfined to semi confined conditions. Groundwater is the prime and only source of water supply to Hapur Town. Following is a brief on groundwater situation in Hapur as provided in the “Appraisal Note of Hapur Water Supply Reorganization Scheme” submitted for finance under centrally sponsored UIDSSMT scheme (this is presently under implementation). This was prepared by Uttar Pradesh Jal Nigam (UPJN). No background data/results of the study were available.

“ As per the subsurface configuration study of the nearby area, the saturated/tapped granular zones occur between the depth ranges of 70 - 100 meter below ground level. Yield of tube wells is 750-1,000 LPM. Depth of tube wells is about 110 meters. As per study and evaluation of chemical analysis results, it has been found that the formation water of upper and middle aquifer is potable. The chemical analysis results of the tube wells upto the depth of 110 meter below ground level indicate fresh/potable water”.

B. Ecological Resources

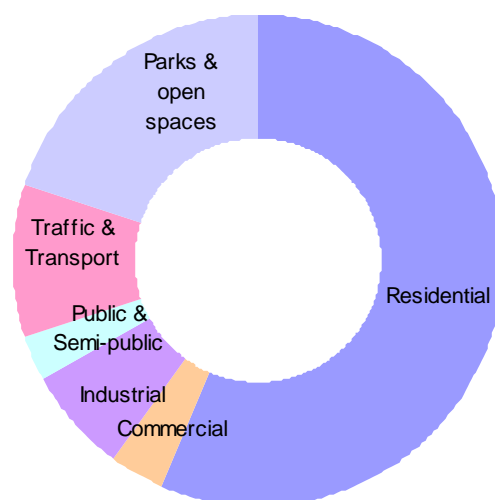
42. There are no forests or any other environmental sensitive locations in or near Hapur. Although due to its location close to the National Capital Delhi is fast attracting various developments, Hapur region is predominantly an agricultural based economy. Hapur Town is an urban area surrounded by land that was converted for agricultural use many years ago. There is no remaining natural habitat in the town, and the flora is limited to artificially planted trees and shrubs, and the fauna comprises domesticated animals plus other species able to live close to man.

C. Economic Development

1. Land Use

43. The area of Hapur Town within the municipal boundary is 14.01 sq. km, while the Hapur Master Plan covers an area of 46.33 sq. km. In the total Master Plan area only about 15 percent is inhabited and the remaining is mostly agricultural and vacant land. Hapur is one of the towns of NCR being developed to decongest National Capital Delhi by improving infrastructure with the aim of shifting some of the offices and establishments of Government of India. Owing to its location advantage close to Delhi and with good road connectivity, Hapur is a fast developing town. It is a much sought-after destination for setting up of educational and professional institutes. There are a number of educational institutions including, medical and engineering colleges, technical training institutes, etc in Hapur.
44. The town is developing mainly in two directions – linear development can be observed on both sides of Bulandsahar Road towards south and along Delhi- Muradabad National Highway towards east. The Hapur-Pilkua Development Authority, which regulates the development activities, is presently developing land areas between Bulandshahar Road and NH 24 in the western part of the town. These include development of residential layouts, and a Leather Park and IT Park for industrial development.
45. As depicted in the following figure, as per the 2005 Master Plan of Hapur, nearly half of the total area is provided to the residential use. Industrial land use is about 6.7 percent. However, the actual growth of the town has been not on the lines of projections made in the Master Plan. The projected population considered in Master Plan for 2005 was 450,000 while the census 2001 put the actual population only 211,493.

Figure 3: Land Use as per 2005 Master Plan



2. *Industry & Agriculture*

46. Owing to vast agriculturally rich hinter land, Hapur has traditionally been an important commercial and agricultural trade centre in western Uttar Pradesh region. It is the main centre for trade and export of agricultural produce in the region, and houses a big Agricultural Produce Market, mainly trading in Grains, Joggery and Potato. Hapur also has one of the biggest grain storage facility in the country – there are six big solos of the Ministry of Food and Agriculture, Government of India, which act as a reserve for essential food grains.
47. There are no major industries in Hapur. However, there is a number of small scale engineering industries in the town to cater to the demands of its agriculturally dominant vast hinter land. Most of these industrial units are into manufacturing and repair of farm equipments and oil expellers. There are a number of cold storage units for storing of agricultural produce like potatoes. There are also some units manufacturing sewing machines.
48. Owing to fertile agricultural lands and good availability of groundwater, agricultural activity is very active. Although the land within the town limit is converted to developmental purposes, there are vast hinterlands starting from town skirts which agriculturally rich. Varieties of crops are cultivates here including paddy, vegetables, pulses, sugan cane etc.

3. *Infrastructure*

49. *Water Supply.* Two agencies are involved in provision of water supply service in Hapur; while the state line agency Uttar Pradesh Jal Nigam (UPJN) is responsible for development of new infrastructure and all capital works, the Hapur Municipality is

responsible for its day-to-day operation and maintenance. Piped water supply system in the town was provided in the town in 1950s, and expanded subsequently to cover expanding areas. However, at present, this water supply system serves only 60 percent of the total population. Groundwater is the principle and only source of water. Groundwater is abstracted from 18 tube wells, and supplied through distribution system – water from about 60 percent of tube wells are pumped to over head reservoirs for supply through distribution system, and from the remaining tube well water is directly pumped into distribution system and supplied. Groundwater quality is good, and water is disinfected with chlorine prior to supply.

50. Water is supplied to the consumers for about an hour every day. The rate of water supply is about 100 liters per capita per day (LPCD), less than the CPHEEO stipulated norm of 135 LPCD. The Municipality has provided 14,000 individual house service connections and 150 public stand posts. In addition, there are 810 hand pumps for drawing of groundwater for use by households, mostly to serve the areas unserved by the piped water supply system.
51. *Sewerage System.* UPJN carries out all new and capital works while the Hapur Municipality operates and maintains the sewerage system in the town. Underground sewerage system, consisting of lateral sewers, pumping station and trunk sewers, was developed in 1970s. There was no sewage treatment facility developed. This system at present covers about 30 percent of the town area, but it is almost defunct. In the remaining areas, people use septic tanks (for sewage disposal) and open drains (for sullage) and some households illegally dispose wastewater including sewage into open drains. Few households resort to open defecation.
52. Most of the sewer lines are choked and are overflowing. Due to lack free flow in the system, most of the sewers are discharging sewage into open drains. Almost all of the open drains in the congested city area are carrying sewage. As a result, the total sewage reaches the sewage pumping station is very minimal. At present pumping is done for 2 hours a day with one pump operating against installed capacity of four pumps. The sewage reaching sewage pumping station is hardly 5-10 percent of design flow. Since there is no sewage treatment facility, sewage pumped from SPS is discharged directly into Choyya Nala and this untreated wastewater is used for irrigation.
53. *Solid Waste Management.* About 65-75 tons of municipal solid waste is generated in the town. There is no door-to-door collection system in the town and the waste is collected through dust bins. Hapur municipality collects nearly 50 percent of the waste. Indiscriminate disposal of solid waste into drains, roads and vacant plots is prevalent. In most of the areas drains are choked with solid waste, and surroundings are very unhygienic. There is no proper disposal site in Hapur, and the waste is disposed along the roads on outskirts. Due to crude open dumping the areas have become filthy and unhygienic.
54. *Storm Water Drainage.* Open drainage system is provided in the town to cater for collection and conveyance of storm water during rains. This open drain network consisting of primary, secondary and tertiary drains. Tertiary drains collect water from various streets

and disposes in to secondary drains, which are further connected to primary drains, and to natural stream. There are four main drains in Panipat including Choyya Nala, which a small tributary of Kali River. Two primary drains dispose into Choyya Nala, which ultimately discharges into Kali River in the southern side, while another primary drains disposes directly into Kali River in the eastern outskirts of the town. In the absence of proper functioning sewerage system, drain carries mostly wastewater including sewage. Due to encroachment of streams and flood plains, during monsoon rains, few areas experiences flooding.

4. *Transportation*

55. Town is well connected with other parts of the state and country. Two National Highways (NH 24 - Delhi-Lucknow-Muradabad Road, and NH 18 - Meerut-Bulandsahar Road) pass through Town. Hapur is well connected with railway and is a railway junction. Two branches of Northern Railway network – Hapur Branch and Ghaziabad-Moradabad Brach, pass through the town.
56. Except in the newly developed areas in the outer areas of the town, most of roads in the town are narrow and more congested (with both traffic and pedestrians), and the roads are not well maintained. Most of the internal roads in the old city are constructed with cement concrete blocks.
57. There are regular bus services to its hinterland and other towns and cities in the neighboring states operated by both by state-run and private transport services. Being a small town there is no public transport facility with in the town. Commuters mainly depend on IPT modes of Auto Rickhwas and Cycle Rishwas, besides the private vehicles for intra-city travel.

D. Social and Cultural Resources

1. Demography

58. According to the national census the population of Hapur was 211,983 in 2001, increased from 146,591 in 1991, recording a growth rate of 44.6 percent over the decade, much higher than the urban growth rate of the country. The decades of 1971-81 and 1981-91 also experienced similar growth rates. Gross average density is increased from 105 persons per hectare in 1991 to 151 in 2001. The total population in Master Plan area of Hapur is according to 2001 Census is 354,148. Following Table shows the population growth of the town within the municipal limits.

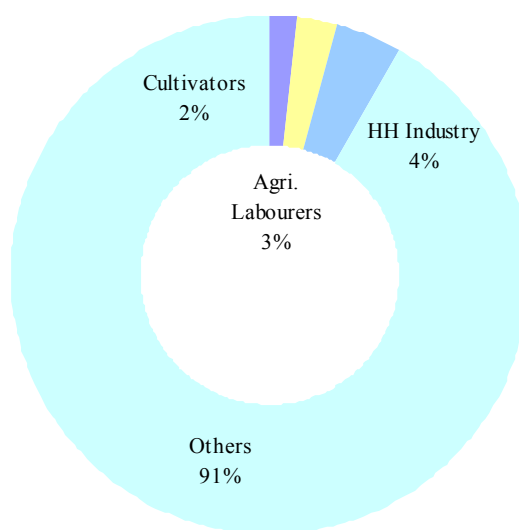
Table 4-3: Population Growth of Hapur

Year	Population	Decadal Growth Rate (%)
1951	49,260	-
1961	55,248	12.16
1971	71,266	28.99
1981	102,837	44.30
1991	146,591	42.55
2001	211,983	44.61

Source: Census of India

59. Overall literacy is 68%, reported at 77% for males and 59% for females, which is considerably higher than literacy in the state as a whole, which is 57% overall, and 70.2% for males and 43% for females. The sex ratio is significantly below the natural 1:1 ratio, being 873 females per 1000 males, lower than both the state and national averages (898 and 929 respectively).
60. According to the census, in 2001 workforce participation rate (WPR) in Hapur was 28 percent. As shown in the following figure, 91 percent of the total workforce is engaged in trade & commerce sector and other service sectors. About 5 percent are engaged in primary sector (agricultural related).

Figure 4: Occupational Structure



61. Majority of people in Hapur are Hindus and the remainder are mainly Muslims. Almost all people speak the national language of Hindi. A few also speak English. Scheduled tribe population in the town is negligible; around 29% of the population belongs to scheduled castes (SC).

2. *History Culture and Tourism*

62. Hapur is a very old town and there are various accounts in the public domain on how the town is named as 'Hapur'. It is said that King Harischandra was established the town of Hapur and some say that Shree Haridutt of Meerut-Bulandhshahar established and named it as Hapur, and there is also a story that Hapur name is derived from the word 'Hapar', which means garden.

63. There are no notable historic or cultural sites in Hapur. A wall was constructed around the town with five gates for entry-exit - Delhi Gate, Meerut Gate, Garh Mukteshwar Gate, Kothy Gate and Sikandra Gate. However, at present only some remains can be seen, and almost everything was destroyed. Mughal Emperor Aurangazeb constructed a mosque (named as Jama Masjid) in Hapur in 1670. The town has no tourism significance.

5. ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

A. Physical Resources

64. ADB Environmental Assessment Guidelines stipulates that an IEE should evaluate impacts due to the location, design, construction and operation of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the project should be identified, and mitigation is devised for any negative impacts. Following sections evaluate impacts of the proposed rehabilitation and augmentation of sewerage system in Hapur.

B. Construction Impacts

65. Proposed sewerage system subproject in Hapur
- (i) Laying of sewer network in zones I, II, III, IV, V and VII of the City and conveying the sewage to the proposed STP. This will include: 0.535 km of RCC Trunk sewers of 1,400 mm diameter; 7.23 km of RCC trunk sewers of 500 to 1,200 mm diameter; main sewers of 16 km RCC of 250 to 450 mm diameter, and lateral sewers for 111 km (RCC sewers of 200 mm diameter)
 - (ii) Construction of three sewage pumping stations with raw sewage sump, pumps, and electrical equipment;
 - (iii) Construction of Waster Stabilization Pond based 25 MLD Sewage Treatment Plant with three Anaerobic Ponds and two facultative ponds
 - (iv) Provision of 44,000 domestic sewer connections with uPVC pipes of 110 to 160 mm diameter

1. Construction Method

66. *Construction of Sewage Treatment Plant.* Provision of a Sewage Treatment Plant will involve construction of the following structures on 24 ha of land in the south of the Town, adjacent to Choyya Nala.:
- Three anaerobic ponds of size 108m x 63m at top; 78m x 33m at bottom and 6m in depth, including 3.75 m in cutting and 2.25 m formed by all-round embankment
 - Two facultative ponds of size 314m x 161m at top; 198m x 146m at bottom and 3m in depth, including 0.34 m in cutting and 2.66 m formed by all-round embankment
 - Pump stations and pipes with valves to transfer material between ponds;

- Sump, and pumping stations and treated effluent channel to discharge the treated wastewater for irrigation purpose around the site.
61. Although the STP site is fairly large the construction will be straightforward, involving mainly simple excavation. The ponds will be dug by backhoe diggers and bulldozers. Since the ponds are designed partly in cutting and partly in embankment most of the excavated soil will be utilized. Pitching will then be provided to bottom and side slopes of the pond, which will consists of 75 mm thick base with brick ballast concrete, over which a brick floor will be prepared with first class bricks in cement mortar.
 67. Construction material will be brought to the site on truck and will be stored in the STP premises. Construction material like sand and aggregate will be sourced from nearest licensed quarries.
 68. *Laying of sewers (tertiary, lateral and trunk sewers).* Most of the sewers will be buried in trenches immediately adjacent to roads, in the un-used area within the ROW. In narrower roads, where this area is occupied by drains or the edges of shops and houses etc, the trenches will be dug into the edge of the road. Trenches will be dug using a backhoe digger (mainly in wider roads), supplemented by manual digging (in narrow roads,). Larger diameter main sewers and secondary sewers will be located in the larger roads where there is generally sufficient space at the edge of the road. Excavated soil will be placed nearby, after which a bed in plain cement concrete (PCC) of 100-200 mm depth will be developed beneath to the sewer. Sand and aggregate will be sourced from nearest quarries and brought to site on trucks, and PCC will be prepared using concrete mixers on site. The sewers (brought to site on trucks and stored on unused land nearby) will be placed in the trench manually. Sewers will be joined by hand, after which the excavated soil will be refilled in the trench around and on top of the sewer for support and protection. Refilled soil will be compacted by a vibrating plate compressor, after which the road will be restore.
 69. The lateral sewers will be located generally in smaller narrower roads, some of which have no available space at the edge because of the presence of municipal drains, into the ROW. In these places it may be necessary to break open the surface of the road manually, after which the trench and sewer will be constructed as described above. On completion a bitumen/concrete layer will be re-applied to the surface to repair the road.
 70. Sewers are normally covered by a minimum of 1-1.2 m and to a maximum of 8 m of soil (due to sewer gradient at some sections, however average cover will be around 2 m) on top, 200 mm stone aggregate bed beneath, and a clearance of 200 mm is left between the sewer and each side of the trench to provide working space and to allow backfilling. Sizes of trenches will be: 0.5 to 0.9 m wide and 1.5 m to 2 m in depth for lateral and main sewers (150 and 450 mm); 1 m to 1.5 m wide and 2 m to a maximum depth of 8 m for trunk sewers (500 to 1,200 mm diameter), and 1.8 m wide and about 6-7 m deep for outfall sewer.

71. Manholes and inspection chambers will be constructed where required on the network. The size of manholes varies from 900 mm to 1,800 mm in diameter and 1.5 m to 8 m in depth.
72. *Construction of Pump houses and sumps.* Two new sewage pumping stations required for intermediate sewage lifting will be constructed on government owned land parcels. Each pumping station will involve construction of an underground sump to receive wastewater, and a pump house of top or adjacent to the sump to house pumping apparatus. Size of the sumps will vary from 3.5 m to 19.5 m in diameter and depth will be 2.2 m. The largest sump cum pump house will be located at the inlet of the STP. For sump construction, a cavity of sizes approximately 10m², 20 m² and 300 m² ca and 2.5 m deep will be excavated by back hoe and soil will be loaded on to trucks for disposal. Metal reinforcing rods will be incased in wooden/steel shuttering and concrete will be poured in, and this process is repeated to gradually to create sump from RCC. Surfaces will be smoothed and finished from inside. Pumping station will be constructed in brick masonry walls and RCC roof.
73. Foundations for the small pump houses will be dug by backhoe, and concrete and aggregate will be tipped in to create the foundations and floor. The brick sides and roof will then be built and pumps will be brought in on trucks and placed inside the pump house by crane/manually.

2. *Impacts on Physical Resources*

74. Sewer network construction work will involve more extensive excavation and as all the work will be located in an urban area, the impacts are likely to be more significant. It is estimated that the trench excavation for sewers will generate around 325,217 m³ of soil. After construction, a part of the trench will be occupied by the sewer and 100-150 mm thick base beneath it, and in the remaining portion excavated soil will be backfilled on top and sides of the sewers. This means that most of the soil will be retained for refilling the trench, and an estimate about 38,372 m³ of waste material will be left over. There will therefore be quite large physical changes at the construction sites, and this quantity of waste could not be dumped without causing further physical impacts (on air quality, topography, soil quality, etc) at the point of disposal. However, this could be avoided by utilization of soil for any beneficial purposes. The topography of the town is almost flat, and there are many areas which face problem in draining the rain water due to lack of slope. Surplus soil can be utilized to raise the ground level to drain off the rainwater into the drains at necessary locations to avoid water accumulation. Therefore the following measures shall be followed:
 - Utilize soil for filling up low level areas to raise the ground level
 - Utilize soil in construction activities
 - Establish criteria on pre-determining disposal areas prior to excavation works, approving, and monitoring users of the excess spoil
 - Limit use for non-productive area reclamation purposes, and shall not be used in areas near wetlands or protected bodies of water; and
 - Include clauses on the contractor's contract such as:
 - Plan the work to ensure that all earthworks are conducted during the dry

season,

- Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather; and
- Use tarpaulins to cover spoils and other loose material when transported by truck.

75. The work will almost certainly be conducted in the dry season, so there is also a lot of potential for the creation of dust, from the excavation of dry soil and its storage, backfilling and removal for disposal. Action will therefore be needed to reduce physical impacts at both the construction and disposal sites, by controlling dust and reducing the amount of material to be dumped. The Contractor should therefore be required to:

- Cover or damp down by water spray on the excavated mounds of soil to control dust generation;
- Bring the material (aggregate and sand) as and when required;
- Ensure speedy completion of work – trench excavation, laying of sewer and refilling, to remove surplus soil as soon as possible;
- Use tarpaulins to cover loose material that is transported to and from the site by truck.

76. In the towns many of inner roads are of cement concrete. As most of these roads are narrow, it is necessary that the sewers are laid into the road requiring cutting/breaking open of cement concrete road. This activity will certainly generate noise and vibrations. The following measures therefore shall be implemented to reduce the impact:

- Provide prior information to the local public about the work schedule
- Do not conduct noise generating activities in the night
- Ensure that there are no old and sensitive buildings that may be in risk due to use pneumatic drills
- Employ manual methods, where required

77. The other physical impact commonly associated with excavation is effects on surface and groundwater drainage and quality. Depth of excavation for laying of sewers may normally be 1.5-2.0 m, but in some cases, the depth of the trench required may be as high as 8 m. As the depth of water table in the city is deep (more than 20 m) the trench excavation may not interfere with the groundwater drainage. Rainfall in Hapur is limited and concentrated during the monsoon months of July-September. During the rains, there is possibility of water accumulation in open trenches excavated for sewers. The contractor therefore shall implement the following:

- Avoid scheduling of excavation work place during the monsoon months
- Complete sewer laying work in excavated stretches and refill before onset of monsoon
- In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil and ensure that drains are not blocked

with excavated soil

78. Physical impacts will also be reduced by the method of working, whereby the network will probably be constructed by small teams working on short lengths at a time, so that impacts will be mainly localised and short in duration. Physical impacts are also mainly temporary as trenches will be refilled and compacted after sewers are installed, and any disturbed road surfaces will be repaired. Normally work at any stretch – including trenching, sewer laying and refilling, will take about a week. Because of these factors and the mitigation measures proposed above, impacts on the physical environment are not expected to be of major significance.
79. Excavation at STP site will generate nearly 71,897 m³ of soil, of which nearly 64,356 m³ will be utilized in formation of embankment for the ponds. The remaining soil will also be utilized in construction at STP premises itself, therefore there is no likely to be surplus soil from the STP site, which needs disposal. Construction of sumps at new pumping stations will also generate surplus soil, however it will be much less than what is generated in case of sewer construction and this soil can be disposed or utilized without any impacts.
80. Further as these works will be confined to site premises, the physical impacts will be limited. Nevertheless, the Contractor should be required to:
- Reduce dust by removing waste soil as soon as it is excavated;
 - Damp down soil to reduce dust in windy weather;
 - Use tarpaulins to cover waste soil when transported on trucks for disposal;
 - Bring the material (aggregate, sand, etc) as and when required, and cover the material with tarpaulin when transported on truck to sites
81. Development of STP on agriculturally fertile land will lead to loss precious fertile top soil. Total area of the site is 25 ha, and therefore the top soil of about 1 ft depth (0.3 m) may removed separately and preserved for use within the site for plantations, and the surplus soil may be given into surrounding farmers.
82. Excavation can affect local drainage patterns if surface and groundwater collects in voids as they are being dug, but this should also not be a problem as the work will almost certainly be conducted in the dry season.
83. Construction work also requires significant quantities of construction material like sand and aggregate. In Hapur sand is sourced from River Ganges. Therefore it is important that this sand be obtained with out causing any impacts on the environment. Therefore:
- Obtain sand and other mining material required for construction from quarries licensed by the Directorate of Geology and Mining, Government of Uttar Pradesh.

3. *Impact on Ecological Resources*

84. There are no significant ecological resources in the town (protected areas or rare or important species or habitats), so the constructions should have no ecological impacts. Roadside trees should not be removed unnecessarily to build the trenches, and to mitigate any such losses the Contractor should be required to plant and maintain two new trees (of the same species) for each one that is removed.

4. *Impact on Economic Development*

85. The Sewage Treatment Plant will be constructed over a private land of 25 ha, which is presently under agricultural use. The acquisition of private land is necessitated due to non-availability of suitable government land. Moreover, this site was earmarked in the Hapur Master Plan 2005 for development of sewage treatment facility considering the technical suitability. This site is located in a comparatively lower elevation in the south of the town. Site is located at about 5 km from the centre of the town and is within regulated area of Hapur-Pilkua Development Authority.
86. The resettlement issues related to Involuntary Resettlement were assessed by a parallel process of resettlement planning and will be compensated by measures set out in detail in the Resettlement Framework. Therefore it is necessary that:
- Resettlement Plan prepared for the subproject is implemented in full and all its recommendations are complied with.
87. During the sewer construction, particularly in narrow streets and streets with on street commercial activities, there may be temporary disruption or relocation of hawkers and vendors.
88. Sewer network construction will be conducted in the ROW of existing roads (either adjacent to the road, or beneath the road surface in narrower streets). There should thus be no need to acquire land from private owners, so there should be no direct effect on the income or assets of landowners, or the livelihoods of tenants.
89. Although most of the work will not require land acquisition it could still have economic impacts, if the presence of trenches, excavated material, workers and machinery discourage customers from visiting shops and other businesses, which lose income as a result. These losses however will be short in duration as work at any one site should be completed in about week. Implementation of the following best construction measures will reduce the inconvenience and disturbance to the public:
- Informing all residents and businesses about the nature and duration of any work well in advance so that they can make preparations if necessary;
 - Requiring contractors employed to conduct these works to provide wooden

walkways across trenches for pedestrians and metal sheets where vehicle access is required;

- Increasing workforce to complete the work in a short period

90. During the construction of linear components like sewers, the other infrastructure and services may be affected. It is therefore required to implement following measures to avoid or minimize the impact during construction:

- Identify the services to be affected in each zone and notify the respective agencies (BSNL and UPSEB) about the construction work and if there is any need for shifting
- Coordinate with respective agencies in provide prior information to public about the disruption in services during construction; this can be announced via mass communication systems like local/vernacular news papers.
- Provide alternative arrangement for disrupted services if required; for example, in case of water supply being affected for more than a day, alternative water supply shall be ensured through tankers.

91. Transport is another type of infrastructure that will be affected by the sewer construction work, as in the narrower streets there is not enough space for excavated soil to be piled off the road. The road itself may also be excavated in places where there is no available land to locate sewers alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. Following measure can potentially avoid traffic disruptions:

- Conduct work during light traffic
- Plan work such that trench excavation, sewer laying, and refilling including compacting, at a stretch is completed in a minimum possible time
- Provide for immediate consolidation of backfilling material to desired compaction to avoid future settlement risk - this will allow immediate road restoration and therefore will avoid disturbance to the traffic movement
- Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line
- In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions
- In case of closure of important roads, provide information to the public through media – daily news papers and local cable television (TV) services, about the need and schedule of road closure, and alternative routes
- At all works sites public information/caution boards shall be provided - information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.

92. It is inevitable that there will be an increase in the number of heavy vehicles in the town (particularly trucks carrying construction materials and removing waste), and this could disrupt traffic and other activities. These impacts will therefore need to be mitigated by:
- Careful planning of transportation (material and waste) routes in coordination with the Traffic Police to avoid sensitive areas as far as possible, including narrow streets, congested roads, and other important area
 - Scheduling the transportation of waste to avoid peak traffic periods
93. There should be no effects on other features with economic implications (such as infrastructure, industry and commerce), as there are none of these facilities on these sites. There should also be no effects on traffic or transport, as all of the other works will be conducted on small parcels of government land.

5. *Impact on Social and Cultural Resources*

94. There are no notable or prominent social, historic and cultural resources in Hapur. Jama Masjid is the only historic place in Hapur and however, the subproject will not interfere with this site.
95. The sewer network construction works likely to disturb some modern-day social and cultural resources, such as schools, hospitals, temples etc. Impacts will include noise, dust, and interrupted access for pedestrians and vehicles. Mitigation will therefore be needed to protect these resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through several of the measures recommended above, including:
- Avoiding working at sensitive times,
 - Limiting dust by removing waste soil quickly, bringing sand to site only when necessary, covering and watering stockpiles, and covering soil and sand when carried on trucks;
 - Increasing the workforce in sensitive areas to complete the work quickly;
 - Providing wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required (including access to houses);
 - Using modern vehicles and machinery with standard adaptations to reduce noise and exhaust emissions, and ensuring they are maintained to manufacturers' specifications.
96. There is invariably a safety risk when substantial construction such as this is conducted in an urban area, and precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to formulate and implement health and safety measures at construction sites, which should include such measures as:
- Following standard and safe procedures for all activities – such as provision of shoring in trenches where required in deeper trenches of more than 2 m

- Consulting the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills for cutting roads;
 - Excluding the public from the site – enclosing the construction area, warning boards and sign boards
 - Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks etc);
 - On/off-site Health and Safety Training for all site personnel;
 - Maintaining accidents reports and records
97. There could again be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to local people, the Contractor should be required to employ as much of his labour force as possible from the local communities in the vicinity of construction sites. Drawing of majority of workforce from local communities will avoid problems that can occur if workers are imported, including social conflicts and issues of health and sanitation due to labour camps. If temporary labour camps are to be provided; Contractor should ensure that they are maintained well with proper water supply and sanitation facilities.

C. Operation Impacts & Mitigation Measures

1. Operational Activities

98. The new sewerage system provided during the first phase of investment will collect and treat all surface water, domestic wastewater and sewage produced by the town in the municipal limits and in few populated areas adjacent to the municipal limits. This system will collect 20 MLD of raw sewage from the serviced area in year 2013 and about 25 MLD in 2021 and will transport the same safely to the Sewage Treatment Plan for treatment and safe disposal. The proposed stabilization pond based sewage treatment process is a recommended¹ and proven one for warmer climatic areas like Hapur, and the discharge after treatment will comply with Indian wastewater standards (**Table 5-1**). The treated wastewater will mostly be used for irrigating the agricultural lands around the site. A channel or pipeline will be laid from the STP outlet into agricultural field, from where the farmers can take water for irrigation. The surplus will be discharged into Choyya Nala flowing adjacent to the STP site. Choyya Nala joins River Kali in the downstream about 5 km south of the site.

¹ CPHEEO Manual on Sewerage states that .” under many situations in warm climate countries pond systems are cheaper to construct and operate compared to conventional methods (like Activated Sludge Process). They also do not require skilled operational staff and their performance do not fluctuate from day-to-day. The only disadvantage of the pond systems is the relatively large land requirement, but this is some time over-emphasized”.

Table 5-1: Raw and Treated Sewage Characteristics

Parameter	Raw Sewage (Typical values)	Treated Water (Standards for disposal into inland water)
pH	6.8 to 7.5	5.5 to 9.0
BOD in mg/l	200	30
COD in mg/l	450	250
TSS in mg/l	400	<100

BOD – Biochemical Oxygen Demand; COD – Chemical Oxygen Demand; TSS – Total Suspended Solids

99. The sewer pipes will not function without maintenance, as silt inevitably collects in areas of low flow over time. The project will therefore provide equipment for cleaning the sewers, including buckets and winches to remove silt via the inspection manholes, and diesel-fuelled pumps to remove blockages (jetting machines).

102. Piped sewers are not 100% watertight and leaks can occur at joints. Any repairs will be conducted by sealing off the affected sewer and pumping the contents into tankers, after which the faulty section will be exposed and repaired following the same basic procedure as when the sewer was built. Trenches will be dug around the faulty section and the leaking joint will be re-sealed, or the pipe will be removed and replaced. Leaks and overflows from the sewerage system can cause contamination of soil, groundwater, and surface water.

103. At the STP, sewage sludge will need to be removed from the anaerobic ponds every two years. It is estimated that the total quantity of sludge that will be removed from each pond will be 2,897 m³ for every two years. De-sludging activity will be conducted every eight months, one pond at a time, which will generate 2,897 m³ of sludge. Removal of sludge from the ponds is a simple process. Ponds are allowed to dry out naturally and the solid sludge is removed by manual digging. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer and farmers are normally allowed to remove the dry material for application to their land.

2. *Physical Resources*

100. The provision of an effective sewerage system in the town should improve the physical appearance and condition of these areas because raw sewage from the town will no longer be discharged to open drains and the nallahs. This measure and the fact that there will be fewer septic tanks and less sewage discharged to drains, should also improve the appearance of the town and the quality of surface water drainage and groundwater. Clearly there will be significant improvements once the whole town is connected to new sewer system.

101. There could also be physical benefits from the operating STP as the treated water will be provided for irrigation and sewage sludge that is removed periodically from the treatment ponds is provided to farmers and applied to fields, as it will improve soil structure and

fertility. There could be a useful cost-recovery element if a system was established to sell this material to farmers, so this should be considered by the implementing agency.

102. There are also certain environmental risks from the operating system, most notably from leaking sewer pipes as untreated faecal material can damage human health and contaminate both soil and groundwater. It will be imperative therefore that the agency responsible for operating the sewerage system (i.e. Hapur Nagar Palika) establishes a procedure to routinely check the operation and integrity of the sewers, and to implement rapid and effective repairs where necessary. If trenches are dug to locate and repair leaks or remove and replace lengths of pipe, the work will follow the same procedure as occurred when the infrastructure was provided. However the impacts should be much less significant as the work will be infrequent, and will affect individual small locations for short periods only. Work will not be conducted during rainfall so there will be no effect on drainage, and the excavated soil will be replaced in the trench so there will be no waste. Physical impacts should thus be negligible.
103. Partially treated effluent not meeting the stipulated disposal standards from an STP if discharged to a nearby water body, may degrade the water quality and pollute it. However, considering the technology chosen, which has simple process and perfectly suitable for warmer climates like Hapur, there is no risk envisaged. Moreover, it requires no major operational process and skilled operational staff and the performance do not fluctuate from day-to-day. The system involves no power requirement, and therefore power supply breakdowns, will not have any impact. The following measures are to be included in the design and operation procedures of the STP to avoid any risk of reduction in treatment efficiency.
- Operation of STP with its designed efficiency to treat the sewage to the disposal standards for irrigation use notified by Central Pollution Control Board (CPCB)
 - Supply/selling of treated wastewater to farmers (delivering through a lined drain/pipelines) to irrigate their fields. This would provide water and plant nutrients and thus improve agricultural productivity and farm incomes, as well as allowing further cost-recovery by the Implementing Agency. The efficiency of this WSP based STP varies depending on the temperature. The maximum efficiency will be during summers (output BOD 10-15 mg/l) and minimum during winters (output BOD 40-75 mg/l). While this STP would meet the disposal standards for irrigation use (<100 mg/l) throughout the year, it will meet the stringent inland water disposal standards in two seasons (<30 mg/l) except during winters. Since there is a great demand for irrigation water in winter, it is unlikely that water is disposed into Choyya Nala, therefore no impacts envisaged
 - To manage power supply breakdowns it will be provided with back-up power (generator set).
104. This should be operated in conjunction with a scheme to sell inert sewage sludge as a farm fertilizer as recommended above, and some of the capacity building and training provided by the project should focus on providing the Implementing Agency with the skills to operate these measures. This should be preceded by bacteriological tests to confirm that

the treatment methods render all dried sludge and effluent free from enteric bacteria and pathogens, so that it is safe to humans, animals and crops.

105. An important impact is the odour nuisance from anaerobic ponds, typically due to hydrogen sulphide. Odour is not generally a problem if the anaerobic ponds are properly designed. Various measures are integrated into design to minimize the odour nuisance:
- Proper design of anaerobic ponds as per the standards and recommendations on standard operating procedures² for implementing agencies
 - Location of site ideally away from habitations. There is no development within the 300 m boundary of the site
 - Ideally located in the south of Hapur considering the predominant wind direction of north, northwest followed by west
 - A minimum distance of 300 m is maintained between the nearest dwellings of Chatauli Village; a temple and a school which are away from the village are located safely at about 300 m from the boundary of the site. Further the layout plan of the STP is devised such that there is a maximum distance between these places and the potential odour generating units (anaerobic ponds). With this the minimum distance to nearest dwelling is over 500 m
 - A thick green buffer zone around the facility is provided
 - Development control over future development around the site
106. Leaks and overflows from the sewerage system can cause contamination of soil, groundwater, and surface water. Depending on the elevation of groundwater, leaks in gravity mains may also allow groundwater into the sewer system, increasing the volume of wastewater requiring treatment and potentially causing flooding and treatment bypass. However, considering the depth of groundwater table in Hapur (20 m), this impact is not envisaged.
107. Overflows occur when the collection system cannot manage the volume of wastewater, for example due to high flows during rain events or as the result of power loss, equipment malfunctions, or blockages. The excess flows may contain raw sewage, industrial wastewater, and polluted runoff. However, as the system designed is a separate system only to cater wastewater no such event is envisaged. In Hapur, storm runoff is collected and disposed through a separate open drain network system.
108. The following measures, however, needs to be included to to prevent, minimize, and control leaks and overflows:

² The design shall strictly follow the design-elements as prescribed by CPHEEO sewerage manual. In design this shall include: adherence to Bureau of Indian Standard (BIS) values for organic loading of ponds with respect to plant location (Hapur), and other parameters like detention time and hydraulic flow regimes. At the start of operation and during the operation, the IA shall follow strictly the procedures suggested by CPHEEO manual (Section 15.5).

- Limit the sewer depth where possible (e.g., by avoiding routes under streets with heavy traffic).
- For shallower sewers, use small inspection chambers in lieu of manholes;
- Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize entry of garbage and silt into the system;
- Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation;
- Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas
- Establish routine maintenance program, including:
 - Development of an inventory of system components, with information including age, construction materials, drainage areas served, elevations, etc.;
 - Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. Cleaning activities may require removal of tree roots and other identified obstructions;
 - Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and
 - Monitoring of sewer flow to identify potential inflows and outflows
- Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);
- Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
- When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

3. *Ecological Resources*

109. Although the new sewerage system will improve the environment of the town, there are unlikely to be significant ecological benefits as there are no natural habitats or rare or important species.

4. *Economic Development*

110. Although repairs to the sewer network could result in shops losing some business if access is difficult for customers whilst the work is carried out, any losses will be small and short-lived and will probably be at the level of normal business fluctuations. It should therefore not be necessary to compensate for such losses. Nevertheless simple steps should be taken to reduce the inconvenience of the works, including:

- Informing all residents and businesses about the nature and duration of any repair work well in advance so that they can make preparations if necessary;
- Requiring contractors employed to conduct these works to provide wooden walkways across trenches for pedestrians and metal sheets where vehicle access is required;
- Consulting the local police regarding any such work so that it can be planned to avoid traffic disruption as far as possible, and road diversions can be organised if necessary.

111. As noted above, a by-product of the scheme could be to provide economic improvements in the agricultural sector if sewage sludge and treated wastewater provide farmers with a safe and affordable source of organic fertilizer, and crop yields increase as a result. The completed scheme should also contribute to improvements in environmental and community health in the town, which could provide some knock-on benefits to business from healthier workers and consumers.

5. *Social and Cultural Resources*

112. Repair work could cause some temporary disruption of activities at sites of social and cultural importance such as schools, hospitals, temples, etc, so at these locations the same precautions as employed during the construction period should be adopted. These include:

- Consulting the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
- Completing work in these areas quickly;
- Providing wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required;

113. The responsible authorities will employ local contractors to conduct repairs of the sewer network, and contractors should be required to operate the same kinds of Health and Safety procedures as used in the construction phase to protect workers and the public.
114. The use of local contractors will provide economic benefits to the companies and the workers they employ. There is however little prospect of directing these benefits to persons affected by any maintenance or repair works as contractors will utilise their existing workforce. To provide at least some economic benefits to affected communities, unskilled persons employed to maintain and operate the STP should be residents of the neighbouring area.
115. The citizens of the town will be the major beneficiaries of the new sewerage system, as human waste from those areas served by the new network will be removed rapidly and treated to an acceptable standard. This should improve the environment of these areas should deliver major improvements in individual and community health and well-being. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

D. Environmental Impacts & Mitigation: Location and Design

116. ADB Environmental Assessment Guidelines require that an IEE should evaluate impacts due to the location, design, construction and operation of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the projects are identified, and mitigation is devised for any negative impacts. This has been done in earlier Sections and no other impacts are expected.
117. In many environmental assessments there are certain effects that, although they will occur during either the construction or operation stage, should be considered as impacts primarily of the location or design of the project, as they would not occur if an alternative location or design was chosen. For example, if a STP produces an effluent that does not meet legally established standards, then this is an impact of the design as it would not occur if a more rigorous treatment technology had been adopted.
118. In the case of this subproject there are few impacts that can clearly be said to result from either the design or location. This is mainly because:
 - The project is relatively small in scale and involves straightforward construction and low-maintenance operation, so it is unlikely that there will be major impacts;
 - Most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other ground disturbance. However the routine nature of the impacts means that most can be easily mitigated;

- The STP site is located ideally away from the town, and is selected according to the Hapur Master Plan 2005
- There is no development in the vicinity of the of the site
- Ideally located in the south of Hapur with respect to the predominant wind direction of north, northwest followed by west
- A minimum distance of 300 m is maintained between the nearest dwellings of Chatauli Village; a temple and a school which are away from the village are located at about 300 m from the boundary of the site. Further the layout plan of the STP is devised such that there is a maximum distance between these places and the potential odour generating units (anaerobic ponds). With this the minimum distance to the nearest dwelling is over 500 m
- A thick green buffer zone around the facility is provided
- Development control over future development around the site
- STP process is designed to meet the CPCB specified standards for disposal on land for irrigation, and utilization of water for irrigation purpose and avoiding disposal into drain.

Table 5-2: Effluent Disposal Standards

Parameter	Standards for Disposal in	
	Inland Surface Water	On Land for Irrigation
Suspended solids mg/l, max.	100	200
Particle size of suspended solids	shall pass 850 micron IS Sieve	-
pH value	5.5 to 9.0	5.5 to 9.0
Temperature	shall not exceed 5°C above the receiving water temperature	
Oil and grease, mg/l max,	10	10
Total residual chlorine, mg/l max	1.0	-
Ammonical nitrogen (as N),mg/l, max.	50	-
Total kjeldahl nitrogen (as N);mg/l, max. mg/l, max.	100	-
Free ammonia (as NH ₃), mg/l,max.	5.0	-
Biochemical oxygen demand (3 days at 27°C), mg/l, max.	30	100
Chemical oxygen demand, mg/l, max.	250	-
Arsenic(as As).	0.2	0.2
Mercury (As Hg), mg/l, max.	0.01	-
Lead (as Pb) mg/l, max	0.1	-
Cadmium (as Cd) mg/l, max	2.0	-
Hexavalent chro-mium (as Cr + 6),mg/l, max.	0.1	-
Total chromium (as Cr) mg/l, max.	2.0	-
Copper (as Cu)mg/l, max.	3.0	-
Zinc (as Zn) mg/l, max.	5.0	-

Selenium (as Se)	0.05	-
Nickel (as Ni) mg/l, max.	3.0	-
Cyanide (as CN) mg/l, max.	0.2	0.2
Fluoride (as F) mg/l, max.	2.0	-
Dissolved phosphates (as P),mg/l, max.	5.0	-
Sulphide (as S) mg/l, max.	2.0	-
Phenolic compounds (as C ₆ H ₅ OH)mg/l, max.	1.0	-
Radioactive materials: (a) Alpha emitters micro curie mg/l, max.	10 ⁻⁷	10 ⁻⁸
(b) Beta emitters micro curie mg/l	10 ⁻⁶	10 ⁻⁷
Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
Manganese	2 mg/l	-
Iron (as Fe)	3mg/l	-
Vanadium (as V)	0.2mg/l	-
Nitrate Nitrogen	10 mg/l	-

Source: CPCB

119. There are small-scale industries present in Hapur. Industrial users of a sewerage system can discharge industrial wastewaters to the sewer system. Some industrial wastes can cause hazards in the sewerage system and treatment facility, disrupt biological and other processes at the STP or affect worker health and safety; some waste components may not be effectively treated, and may be stripped to the atmosphere, discharged with treated effluent or partition into treatment plant residuals rendering it potentially hazardous.

120. As per the government legislations industrial effluents are not allowed to dispose into the municipal sewer system untreated. However, pre-treated effluent meeting the following parameters can be allowed to dispose into the sewer system:

Table 5-3: Standards for Effluent Disposal into Public Sewers

Parameter	Disposal into Public Sewers
Suspended solids mg/l, max.	600
pH value	5.5 to 9.0
Oil and grease, mg/l max,	20
Ammonical nitrogen (as N),mg/l, max.	50
Biochemical oxygen demand (3 days at 27°C), mg/l, max.	350
Arsenic(as As).	0.2
Mercury (As Hg), mg/l, max.	0.01
Lead (as Pb) mg/l, max	1.0
Cadmium (as Cd) mg/l, max	1.0
Hexavalent chromium (as Cr + 6),mg/l, max.	2.0
Total chromium (as Cr) mg/l, max.	2.0
Copper (as Cu)mg/l, max.	3.0
Zinc (as Zn) mg/l, max.	15
Selenium (as Se)	0.05

Nickel (as Ni) mg/l, max.	3.0
Cyanide (as CN) mg/l, max.	2.0
Fluoride (as F) mg/l, max.	15
Phenolic compounds (as C6H5OH)mg/l, max.	5.0
Radioactive materials:	
(a) Alpha emitters micro curie mg/l, max.	10 -7
(b)Beta emittersmicro curie mg/l	10 -6
Bio-assay test	90% survival of fish after 96 hours in 100% effluen
Manganese	2 mg/l
Iron (as Fe)	3mg/l
Vanadium (as V)	0.2mg/l

121. Uttar Pradesh Pollution Control Board (UPPCB) is mandated with implementation of Water (Prevention & Control of Pollution) Act, 1974 in the state, and therefore enforce and implementation of pollution control norms is under its purview. However, the IA must collaborate with the UPPCB to ensure that no illegal and/or non-confirming wastewater enters into the sewer system. The following measures are recommended to prevent, minimize, and control industrial discharges to the sewerage system:

- As far as possible disallow entry of industrial wastewater including sewage into the sewer system
- Effluent discharged into the sewer system needs to be pre-treated to meet the standards specific by the CPCB (**Table 5-3**) or by the UPPCB, if any.
- Collaborate with UPPCB in the implementation of a source control program for industrial users to ensure that any wastewater discharged to the sewer system can be effectively treated;
- Collaborate with UPPCB in the regular inspection of industrial user facilities and collect samples of wastewater discharges to the sewerage system to ensure compliance with the source control program;
- Conduct surveillance monitoring at sewer maintenance and of the influent to the wastewater treatment facilities;
- Investigate upstream sources of pollutants causing STP upsets or interference; and
- Facilitate public reporting of illicit discharges and connections

122. The significant impact that is a result of location is acquisition of private agricultural land for the development of sewage treatment facility. This could not be avoided as:

- There is no suitable government land for development STP
- This site was earmarked in the Hapur Master Plan 2005 for development of sewage treatment facility considering the technical suitability.

123. All resettlement issues related to Involuntary Resettlement were assessed by a parallel process of resettlement planning and will be compensated by measures set out in detail in the Resettlement Framework. Resettlement Plan prepared for the subproject is implemented in full and all its recommendations are complied with during implementation.

124. The STP site and surroundings, it appears, have a good potential for development in future, and therefore the land use needs to be controlled. As the proposed STP site located considerably away from the present development, land use of this area was not notified in the Hapur Master Plan 2005. However it is located within the regulated jurisdictional area of the Hapur-Pilkua Development Authority (HPDA), and therefore development and land use is controlled by HPDA. HPDA's approval is necessary for any development in regulated areas. Following measures shall be implemented to avoid any impact:

- Provide a buffer around the facility within the site; develop this as thick green buffer with suitable plantation. This will increase the aesthetical appearance of the areas and will act as a visual barrier (this has already been taken into consideration in the design of STP layout)
- Immediate development around the site shall be controlled; residential and other sensitive uses like schools, hospitals, etc can not be located in about 250 m around the site. The immediate surroundings of the site may be developed as green belt or non-sensitive uses like industrial development.

6. INSTITUTIONAL REQUIREMENTS

A. Institutional Arrangements

125. Following agencies will be involved in implementing this Sewerage System Improvement Subproject in Hapur:
- (i) NCRPB: National Capital Region Planning Board is the funding agency for the project.
 - (ii) Implementing Agency (IA): Implementing Agency of the Project will be Hapur Nagar Parishad (HNP). IA will be responsible for the project implementation. Operation & maintenance will also be the responsibility of the IA.
 - (iii) Design and Supervision Consultants: Implementing Agency will be assisted by Design and Supervision Consultants (DSC) in tendering, and reviewing and revising designs during the construction, if required, and supervising the construction to ensure quality.
 - (iv) Construction Contractors: IA will appoint Construction Contractors (CC) to build the infrastructure elements.
126. Implementing the project according to and in compliance with the policies the funding agency, NCRPB, will be the responsibility of the Implementing Agency (IA). The Environmental and Social Management Cell (ESMC) of NCRPB will deal with environmental and social safeguard issues. ESMC would guide and monitor IA in complying with its ESMS and Policy.
127. *ESMC*. The ESMC will be housed inside the appraisal function of NCRPB and will have two distinct sub-functions, i.e. managing environmental safeguards and social safeguards. ESMC will be provided with one full-time staff - safeguards officer, who will look after the day-to-day activities related to the safeguard compliance. Safeguard Officer will be responsible for both environmental and social safeguard functions. Based on the necessity, the Safeguards Officer will source expertise from outside/external consultants on a case-to-case basis.
99. ESMC will review and approve IEE, oversee disclosure and consultations, and will monitor the implementation of environmental monitoring plan and environmental management plan where required. The Construction Contractor (CC) will implement mitigation measures in construction. IA or DSC will monitor the implementation of mitigation measures by the CC. ESMC will oversee the implementation of EMP. Implementation of mitigation and monitoring measures during the operation and maintenance (O&M) stage will be the responsibility of the implementing agency.

7. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

128. Following **Table 7-1** shows the potential negative impacts of the Hapur Sewerage Subproject as identified and discussed earlier in this Section, and the mitigation measures proposed to reduce those impacts to acceptable levels. The table also shows mitigation activities, methods, its location and schedule of implementation, and project agencies responsible for implementation. An assessment of whether or not proposed mitigation measure will successfully mitigate the impact (shown as 0) or provide an additional benefit (shown as +), is also presented in **Table 7-1**.

B. Environmental Monitoring Plan

129. **Table 7-1** shows that most mitigation activities are the responsibility of the Construction Contractors (CC) employed to build the infrastructure during the construction stage. Responsibility for the relevant measures will be assigned to the Contractors via the contracts through which they are appointed, so they will be legally required to take the necessary action. There are also some actions that need to be taken by Implementing Agency in their role as project proponent, and some actions related to the design that will be implemented by the IA in assistance with the Design Consultants.
130. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular monitoring of implementation measures by construction contractors will be conducted by the Implementing Agency. Periodic monitoring and overseeing of implementation of mitigation measures will be conducted by the Environmental Specialist of the Executing Agency. Monitoring during operation stage will be conducted by the Operating Agency, and third party monitoring will be conducted by government regulatory agencies like UP Pollution Control Board.
131. Most of the mitigation measures are fairly standard methods of minimising disturbance from building in urban areas (maintaining access, planning work to minimize public inconvenience and traffic disruptions, finding uses for waste material, etc). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects.
132. **Table 7-2** shows the proposed Environmental Monitoring Plan (EMP) for this Project, which specifies the various monitoring activities to be conducted during different phases of the project. The EMP describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

Table 7-1: Environmental Management Plan

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	
Preconstruction						
Land acquisition and involuntary relocation: acquisition of 25 ha of land for STP at Chatauli Village	M	P	<ul style="list-style-type: none"> Implement compensatory measures as recommended by the Resettlement Plan prepared in compliance with Government and ADB legislations 	HNP	STP Site	0
Pollution and health risk due to disposal of untreated or partially treated wastewater, and sludge disposal, and odour nuisance	L	P	<ul style="list-style-type: none"> Treated water shall be utilized for irrigation use, especially in winter months (December – February) there shall be no disposal into Choyya Nala Provide required infrastructure as part of the project to facilitate the supply of water to irrigation purpose Obtain Consent for Operation (CFE) from Uttar Pradesh Pollution Control Board prior to STP construction Provide green buffer zone around the facility, which will act as visual screen and barrier, which will improve aesthetic appearance 	DC & HNP	STP	0
Construction						
Excavation will produce large quantity of waste soil	M	P	<ul style="list-style-type: none"> Utilize soil for raising the level of low lying areas and in construction Limit use for non-productive area reclamation purposes, and shall not be used in areas near wetlands or protected bodies of water Include clauses on the contractor’s contract such as: <ul style="list-style-type: none"> Plan the work to ensure that all earthworks are conducted during the dry season, Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather; and Use tarpaulins to cover spoils and other loose material when transported by truck. 	CC	Network sites	+
Accumulation of water in trenches during rains			<ul style="list-style-type: none"> Avoid scheduling of excavation work place during the monsoon months Complete sewer laying work in excavated stretches and refill before onset of monsoon In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil and ensure that drains are not blocked with excavated soil 			
Excavation for sewer construction and waste soil could create dust	M	T	<ul style="list-style-type: none"> Damp down soil (by water sprinkling) to reduce dust due to winds Ensure speedy completion of work and remove the surplus soil as soon as possible Bring the construction material (aggregate and sand) as and when 	CC	Network Sites	0

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	
			<ul style="list-style-type: none"> required to the site; avoid temporary storage Cover soil with tarpaulins when carried on trucks 			
Generation of noise and vibrations from excavation – in areas where sewer construction requires excavation of cement concrete roads	L	T	<ul style="list-style-type: none"> Provide prior information to the local public about the work schedule Do not conduct noise generating activities in the night Ensure that there are no old and sensitive buildings that may be in risk due to use pneumatic drills Employ manual methods, where required 	CC	Sewer network site in cement concrete roads	0
Dust generation due to excavation for other facilities	L	T	<ul style="list-style-type: none"> Remove waste soil as soon as it is excavated Damp down soil to reduce dust due to winds Use tarpaulins to cover waste soil in transport Bring the construction material (aggregate and sand) as and when required to the site; avoid temporary storage 	CC	STP and Pumping Station sites	0
Road side trees may be removed along roads for laying of sewers	L	P	<ul style="list-style-type: none"> Only remove trees if it can not be avoided Plant and maintain two trees for every one removed 	CC	Network and STP sites	0
Impacts due to improper mining for construction materials	L	P	<ul style="list-style-type: none"> Obtain construction materials such as sand, aggregate and gravel only from quarries licensed and approved by GoUP (Directorate of Geology and Mining) 	CC	NA	
Shops and other business may loose income if customer's access is impeded	L	T	<ul style="list-style-type: none"> Leave spaces for access between mounds of soil Provide walkways and metal sheets to maintain access across trenches for people and vehicles where required Increase workforce in these areas to finish work quickly Consult local people: inform them of work in advance 	CC	Network sites	0
Excavation could damage existing infrastructure	L	P	<ul style="list-style-type: none"> Identify the services to be affected in each zone Coordinate with respective agencies (BSNL, UPSEB) in shifting those infrastructure Provide prior public information about the likely disruption of services Provide alternate arrangements for services like water supply in the event of disruption beyond reasonable time, for instance, through tankers 	IA & CC	Network sites	0
Traffic, people and activities could be disturbed sewer construction work	M	T	<ul style="list-style-type: none"> Conduct work during light traffic Plan work such that trench excavation, sewer laying, and refilling including compacting, at a stretch is completed in a minimum possible time Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line In unavoidable circumstances of road closure, provide alternative 	CC	Network sites	0

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	
			<ul style="list-style-type: none"> routes, and ensure that public is informed about such traffic diversions In case of closure of important roads, provide information to the public through media – daily news papers and local cable television (TV) services, about the need and schedule of road closure, and alternative routes At all works sites public information/caution boards shall be provided (name of the project, cost, schedule, contractor name, implementing & executing agency, schedule of work at that locality, details of traffic diversion, responsible officer for implementation and receiving complaints) 			
Increase in traffic due to trucks carrying construction material & waste	L	T	<ul style="list-style-type: none"> Plan routes to avoid narrow streets, congested roads, and places of religious importance Plan work to avoid peak traffic hours 	HNP & CC	All sites	0
Site of social/cultural importance (schools, hospitals and religious places) may be distributed by noise, dust, and impeded access	L	T	<ul style="list-style-type: none"> avoid work at sensitive times, such as religious and cultural festivals As above: remove waste quickly, cover/spray stockpiles, cover soil/sand on trucks As above: increase workforce to finish work quickly As above: use wooded planks and metal sheets to allow access (people/vehicles) Use modern vehicles/machinery & maintain as specified to reduce noise and exhaust emissions 	CC	Network sites	0
Workers and public at risk from accidents on site			<p>Ensure that health and safety measures are in place as part of the contract. These shall include:</p> <ul style="list-style-type: none"> Follow standard and safe procedures for all activities, like provision of shoring in trenches Exclude the public from all construction sites; barricade the site; provide caution & sign boards Ensure that workers use Personal Protective Equipment Provide On/off-site Health & Safety Training to workers; Maintain accident reports and records. 	CC	All sites	0
Economic benefits for people employed in workforce	M	T	<ul style="list-style-type: none"> Ensure that most of the workforce is from local communities 	CC	All sites	+
Operation and Maintenance						
Pollution and health risk due to disposal of untreated or partially treated wastewater, and sludge disposal			<ul style="list-style-type: none"> Obtain Consent for Operation (CFO) from UPPCB before start of STP operation Maximize utilization of treated effluent for irrigation purpose 	Operating Agency	STP	0

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	
			<ul style="list-style-type: none"> Use dried sludge for agriculture Conduct regular monitoring to ensure quality of treated effluent and sludge 			
Odour nuisance	M	T	<ul style="list-style-type: none"> Plant and maintain trees as specified in design during construction 	CC	STP and sewage pumping station	0
			<ul style="list-style-type: none"> Operate the STP in compliance with standard operating procedures Maintain trees as buffer zone around the facilities Regulate land use around STP 	HNP HPDA		+
Illegal disposal of industrial effluent into the sewer can affect the system	M	P	<ul style="list-style-type: none"> As far as possible disallow entry of industrial wastewater including sewage into the sewer system Effluent discharged into the sewer system needs to be pre-treated to meet the standards specific by the CPCB (Table 4 2) or by the UPPCB, if any. Collaborate with UPPCB in the implementation of a source control program for industrial users to ensure that any wastewater discharged to the sewer system can be effectively treated; Collaborate with UPPCB in the regular inspection of industrial user facilities and collect samples of wastewater discharges to the sewerage system to ensure compliance with the source control program; Conduct surveillance monitoring at sewer maintenance and of the influent to the wastewater treatment facilities; Investigate upstream sources of pollutants causing STP upsets or interference; and Facilitate public reporting of illicit discharges and connections 	HNP	NA	0
Leaks and overflows from sewerage system can cause contamination of soil and water	L	T	<ul style="list-style-type: none"> Limit the sewer depth where possible. For shallower sewers, use small inspection chambers in lieu of manholes; Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replace if broken to minimize silt/garbage entry Ensure sufficient hydraulic capacity to accommodate peak flows & adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas Establish routine maintenance program, including: <ul style="list-style-type: none"> Development of an inventory of system components, with 			

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	
			<p>information including age, construction materials, drainage areas served, elevations, etc.;</p> <ul style="list-style-type: none"> ○ Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. ○ Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and ○ Monitoring of sewer flow to identify potential inflows and outflows <ul style="list-style-type: none"> ● Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages); ● Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed; ● When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system. 			
Disturbance to people, traffic and activities due to repair & replacement of sewers especially near schools, hospitals, temples, etc.	NS	T	<ul style="list-style-type: none"> ● Consult people – inform about work nature and schedule ● Provide walkways and metal sheets to maintain access across trenches for people and vehicles where required 	HNP	Network repair sites	0

Sig - Significance of impact (L-low; M-medium; High; NS – not significant); Dur – Duration (T-temporary; P-permanent)

0 – impact mitigated to acceptable level; + positive benefit

BOD – Biochemical Oxygen Demand; BSNL – Bharat Sanchar Nigam Limited; CC – Construction Contractor; DC – Design Consultant; HNP – Hapur Nagar Palika; HPDA – Hapur-Pilkhua Development Authority; STP – Sewage Treatment Plant; UPSEB – Uttar Pradesh State Electricity Board

Table 7-2: Environmental Monitoring Plan

Mitigation measures	Location	Responsible for mitigation	Monitoring method	Monitoring frequency	Responsible for monitoring
Pre-construction					
<ul style="list-style-type: none"> Implement compensatory measures as recommended by the Resettlement Plan prepared in compliance with Government and ADB legislations 	STP Site	IA	As suggested in the RP	As suggested in the RP	EA
<ul style="list-style-type: none"> Provide green buffer zone around the facility, which will act as visual screen and barrier, which will also improve aesthetic appearance Provide required infrastructure as part of the project to facilitate the supply of water to irrigation purpose 	STP	DC	DPR Check	One-off - before approval of the project	EA
<ul style="list-style-type: none"> Obtain Consent for Operation (CFE) from Uttar Pradesh Pollution Control Board prior to STP construction 	NA	IA	Records Check	One-off – before start of the construction	EA
Construction					
<ul style="list-style-type: none"> Utilize soil for raising the level of low lying areas and in construction Limit use for non-productive area reclamation purposes, and shall not be used in areas near wetlands or protected bodies of water Damp down soil (by water sprinkling) to reduce dust due to winds Ensure speedy completion of work and remove the surplus soil as soon as possible Bring the construction material (aggregate and sand) as and when required to the site; avoid temporary storage Cover soil with tarpaulins when carried on trucks Avoid scheduling of excavation work place during the monsoon months Complete sewer laying work in excavated stretches and refill before onset of monsoon In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil and ensure that drains are not blocked with excavated soil 	All work sites, with focus on sewer network sites	CC	Site observations/CC records/ informal discussion with workers and people residing near the work sites	Weekly Random site inspections	IA EA
<ul style="list-style-type: none"> Only remove trees if it cannot be avoided Plant and maintain two trees for every one removed 	All sites	CC	Site Observations/CC Records	As required	IA EA
<ul style="list-style-type: none"> Obtain construction materials such as sand, aggregate and gravel only from quarries licensed and approved by GoUP (Directorate of Geology and Mining) 	NA	CC	Records Check	Before start of construction, & periodic during construction	IA

Mitigation measures	Location	Responsible for mitigation	Monitoring method	Monitoring frequency	Responsible for monitoring
<ul style="list-style-type: none"> • Leave spaces for access between mounds of soil • Provide walkways and metal sheets to maintain access across trenches for people and vehicles where required • Increase workforce in these areas to finish work quickly • Consult local people: inform them of work in advance • Identify the services to be affected in each zone • Coordinate with respective agencies in shifting those infrastructure • Provide prior public information about the likely disruption of services • Provide alternate arrangements for services like water supply in the event of disruption beyond reasonable time, for instance, through tankers 	Network sites	CC	Site observations/CC records/ informal discussion with workers and people residing near the work sites	Weekly Random site inspections	IA EA
<ul style="list-style-type: none"> • Conduct work during light traffic • Plan work such that trench excavation, sewer laying, and refilling including compacting, at a stretch is completed in a minimum possible time • Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line • In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions • In case of closure of important roads, provide information to the public through media – daily news papers and local cable television (TV) services, about the need and schedule of road closure, and alternative routes • At all works sites public information/caution boards shall be provided (name of the project, cost, schedule, contractor name, implementing & executing agency, schedule of work at that locality, details of traffic diversion, responsible officer for implementation and receiving complaints) 	Network sites	CC	Check construction schedule/ Site observations/CC records/ informal discussion with workers and people residing near the work sites	Weekly Random site inspections	IA EA
<ul style="list-style-type: none"> • Plan routes to avoid narrow streets, congested roads, and places of religious importance • Plan work to avoid peak traffic hours 	Routes for transporting construction material and waste	CC in coordination with the Traffic Police	Site observations	Weekly Random site inspections	IA EA

Mitigation measures	Location	Responsible for mitigation	Monitoring method	Monitoring frequency	Responsible for monitoring
<ul style="list-style-type: none"> Use modern vehicles/machinery & maintain as specified to reduce noise and exhaust emissions 	Network sites near sensitive locations like schools				
<p>Ensure that health and safety measures are in place as part of the contract. These shall include:</p> <ul style="list-style-type: none"> Follow standard and safe procedures for all activities, like provision of shoring in trenches Exclude the public from all construction sites; barricade the site; provide caution & sign boards Ensure that workers use Personal Protective Equipment Provide On/off-site Health & Safety Training to workers; Maintain accident reports and records. 	All sites	CC	Site observations/ informal discussion with workers and people residing near the work sites	Weekly Random site inspections	IA EA
<ul style="list-style-type: none"> Ensure that most of the workforce is from local communities 	All sites	CC	Site observations/ informal discussion with workers	Randomly	IA
Operation & Maintenance Phase					
<ul style="list-style-type: none"> Obtain Consent for Operation (CFO) from UPPCB before start of STP operation Maximize utilization of treated effluent for irrigation purpose Use dried sludge for agriculture Conduct regular monitoring to ensure quality of treated effluent and sludge 	STP	IA	Records check	Randomly	UPPCB
<ul style="list-style-type: none"> Maintain trees as buffer zone around the facilities Operate the STP in compliance with standard operating procedures 	STP	IA			
<ul style="list-style-type: none"> Regulate land use around STP 	STP	HPDA			
<ul style="list-style-type: none"> Monitoring of effluent quality (raw and treated effluent) 	Inlet and outlet of STP	Operating Agency	Parameters as specified by UPPCB	Weekly	Operating Agency
	Inlet and outlet of STP	Operating Agency	Laboratory tests as required	Monthly	Accredited lab/ UPPCB
<ul style="list-style-type: none"> Treated sludge 	STP ponds	Operating Agency	Laboratory tests as required	One-off before clearing from ponds for disposal	Accredited lab and UPPCB

C. Environmental Management and Monitoring Costs

133. Most of the mitigation measures require the Contractors to adopt good site practices, which are part of their normal procedures, so there are unlikely to be major costs associated with compliance. These costs of mitigation by the contractors are included in the budgets for the civil works. Mitigation and monitoring provided by the IA/EA or its DSC will be part of incremental administration costs, which are already included in the project. Monitoring that is the responsibility of other agencies (UPPCB) will be provided as part of their day-to-day operations.
134. The main costs of environmental management and monitoring include the following items indicated in the following **Table 7-3**.

Table 7-3: Environmental Management and Monitoring Costs

Item	Quantity/Details	Total Cost
I. Project Implementation Phase		
		INR
Green belt around the site	8 ha (80,000 sq m)	Included in the project cost
Cost of obtaining CFE for STP from UPPCB	1 STP	40,000
Monitoring of implementation of mitigation measures	Regular monitoring by IA	Part of supervision costs
	Periodic monitoring/overseeing by EA	Part of operational costs of ESMC of NCRPB
II Operation & Maintenance Phase		
Regular influent and effluent quality monitoring at STPs	Daily monitoring – samples as require	Part of laboratory O&M costs
Periodic treated effluent quality monitoring (monthly)	Monthly / 12-samples/year	60,000
Cost of obtaining CFO for STP from UPPCB	1 STP	20,000

8. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project Stakeholders

135. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders are:

- Residents, shopkeepers and businesspeople near the work sites;
- Public representatives and prominent citizens
- Hapur Municipality;
- Public Health Engineering Department

136. Secondary stakeholders are:

- UDD as the Executing Agency;
- Other concerned government institutions (utilities, regulators, etc)
- NGOs and CBOs working in the affected communities;
- Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- The beneficiary community in general; and
- The ADB.

B. Consultation and Disclosure

137. A series of public consultation meeting were conducted during project preparation. Two forms of public consultations (consultation through household surveys and as well as ad hoc discussions on site) have been used to discuss the project and involve the community in planning the project and mitigation measures.

138. Photographs of consultation meeting are appended at **Appendix 1**. All the stakeholders were supportive of the project and indicated that the sewerage system in Hapur needs immediate improvement. Stakeholders were of the view that the project will bring enormous benefits to the inhabitants; some raised concerns about the proposed land acquisition for the STP and opined that the compensation shall be provided as per the current market rates.

9. FINDINGS AND RECOMMENDATIONS

A. Findings

139. The process described in this document has assessed the environmental impacts of all elements of the infrastructure of the Hapur Sewerage Rehabilitation & Augmentation Sub-project. Potential negative impacts were identified in relation to design, location, construction and operation of the improved infrastructure. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and measures have been included in the designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design. These include:

- Locating trunk, main and lateral sewers within the ROW of existing roads, to avoid the need to acquire land or relocate people;
- Locating sewers on unused land adjacent to roads wherever possible, to avoid damaging roads and disrupting traffic and other activities;
- Developing a thick green buffer zone around sewage treatment plant;
- Utilization of treated water for irrigation
- Design of STP layout such that there is maximum buffer distance between the odour generating potential unit (i.e. anaerobic ponds) and nearest habitation

140. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of the invasive nature of trenching work; because the sewer network is located in an urban area, some parts of which are very densely populated.

141. During the construction phase, impacts mainly arise from generation of dust from soil excavation and refilling; and from the disturbance of residents, businesses, and traffic by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. Among these, traffic disturbance during construction is considered to be significant due to narrow roads. Measures such as following have been suggested:

- Conducting work during light traffic;
- Avoiding the need to close road completely due to construction work by employing better methods;
- Providing alternative routes in case of unavoidable situation of road closure, and informing public about such traffic diversions;
- Avoid scheduling of excavation work place during the monsoon months
- Providing at all works sites public information/caution boards with information about the project, construction schedule, traffic diversion if any; entry restriction

information; competent official's name and contact for public complaints.

- Restoring the road surface to the normal condition as soon as possible

142. There were limited opportunities to provide environmental enhancements, but certain measures were included, as given below:

- Employing in the workforce people who live in the town to provide them with a short-term economic gain
- Providing surplus soil for people in low lying areas to raise the ground level of their premises
- Providing treated water for irrigation purposes near the STP site
- Providing treated sludge, with high nutrient values, to the farmers to improve the land fertility
- Preserving and providing top soil of the STP site for local farmers

143. Once the system is operating, most facilities will operate with routine maintenance, which should not affect the environment. Leaks in the sewer network will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be infrequent, affecting small areas only. The leaks and overflows from the system may have impacts such as contamination of soil and water, and appropriate measures are suggested to prevent, minimize and control the leaks and overflows. Similarly, measures are recommended to prevent, minimize, and control industrial discharges to the sewerage system.

144. During the operation phase the STP will use treated effluent for irrigation in the vicinity of STP. Following measures are suggested to ensure that the treated effluent meets the Indian wastewater disposal standards:

- Designing and operating of STP to treat the sewage to the Central Pollution Control Board (CPCB) standards for irrigation use
- Obtaining Consent for Operation (CFO) prior to start of operation, and during operation annually from UPPCB, and complying with all condition of CFO in STP operation
- Monitoring treated effluent quality regularly to ensure that it meets the stipulated standards

145. The main beneficiaries of the improved system will be the citizens of Hapur, who will be provided with a safe sewerage collection, treatment and disposal system, which serves all sections of the population, including urban poor. This will improve the quality of life of people as well as raising standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

146. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries. There will also be longer-term surveys to monitor the e quality of treated sewage and sludge
147. Finally, stakeholders were involved in developing the IEE, after which views expressed were incorporated into the IEE and the planning and development of the project. The IEE will be made available to the public. A town level stakeholder workshop for safeguard disclosure and consultation is scheduled for third week of September; the comments and feedback of this will be reflected in the next revision of this IEE.

B. Recommendations

148. There are two straightforward but essential recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated. These are that EA should ensure that:
 - Environmental Management Plan (EMP) proposed in this IEE report and all mitigation, compensation and enhancement measures proposed in the Resettlement Plan (RP) of the Project are implemented in full, as described in these two documents;
 - The Environmental Monitoring Plan proposed this report and the monitoring proposed in the Resettlement Plan are also implemented in full.

10. CONCLUSION

1. The environmental impacts of the proposed rehabilitation and augmentation of sewerage subproject t in Hapur have been assessed by the Initial Environmental Examination reported in this document, conducted according to ADB guidelines. Issues related to Involuntary Resettlement were assessed by a parallel process of resettlement planning and will be compensated by measures set out in detail in the Resettlement Framework for the subproject.
2. The overall conclusion of both processes is that providing the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject. There should in fact be some small benefits from recommended mitigation and enhancement measures, and major improvements in quality of life and individual and public health once the scheme is in operation.
3. There are no uncertainties in the analysis, and no additional work is required to comply with ADB procedure or national law. There is thus no need for further study or Environmental Assessment.

Appendix 1

Appendix 1

Photographs of Consultation:



Participants of Consultation meeting on 26-March-10

26/3/2010 को चितौली गांव के लिए भूमि का मूल
निश्चय के लिए किसानों एवं प्राप्यता नीतियों के
साक्ष- के चर्चा की गई।

चर्चा के मुख्य बिन्दु हैं :-

1. चर साल पहले वाईपस बनने के समय से 30 से 40 लाख
2. वाईपस बनने के बाद जमीन की कीमत रु 50 से 60 लाख
है।
3. हाईड फिल्लुअथ विकास गांव में दो साल पहले प्रीत विहार कालोनी
आवासीय तैयार नही। इसकी कीमत रु 600 से 800 प्रति मीटर
संकायत थी।
4. प्रीत विहार कालोनी के खातेदारों को एक-एक प्लॉट की
दीयागए।

- | | |
|----------------------------|---------------------|
| 1) विकास प्राप्यता सेवा - | <u>Subz</u> |
| 2) Janak Property Dealer - | <u>Ad</u> |
| 3) Bana Property Dealer - | <u>Sunder Baner</u> |
| 4) संजय | <u>Sanjay</u> |
| 5) राजेश्वर | <u>Rajeshwar</u> |
| 6) चेतन | <u>Chetan</u> |
| 7) इमेश | <u>Imesh</u> |

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