FINAL REPORT

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 I-G : Initial Environmental Examination

Detailed Project Report for Water Supply System in Panipat

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)

FINAL REPORT

Volume I-G: Detailed Project Report for Panipat Water Supply
Initial Environmental Examination

July 2010

Abbreviations

ADB	:	Asian Development Bank
CC	:	Construction Contractor
CGWB	:	Central Ground Water Board
CI	:	Cast Iron
CPHEEO	:	Central Public Health & Environmental Engineering Organization
CWPS	:	Clear Water Pumping Station
CWR	:	Clear Water Reservoir
DCLC	:	Delhi Carrier Link Canal
DFR	:	Draft Final Report
DI	:	Ductile Iron
DPBC	:	Delhi Parallel Branch Canal
DPR	:	Detailed Project Report
EIA	:	Environmental Impact Assessment
ESMC	:	Environmental & Social Management Cell
ESP	:	Environmental & Social Policy
GoH	:	Government of Haryana
GoI	:	Government of India
GRC	:	Grievance Redressal Committee
ha	:	Hectare
HDPE	:	High Density Polyethylene
HH	:	Household
HP	:	Horse Power
HUDA	:	Haryana Urban Development Authority
IA	:	Implementing Agencies
IEE	:	Initial Environmental Examination
IS	:	Indian Standard
JLN Canal	:	Jawaharlal All Nehru Canal
km	:	Kilometer
KW	:	Kilo Watts
LPCD	:	Liters Per Capita per Day
m	:	Meter
m^3	:	Cubic meter
ML	:	Million Liters
MLD	:	Million Liters per day
mm	:	Millimeter
MW	:	Mega watt
NA	:	Not Available
NCR	:	National Capital Region
NCRPB	:	National Capital Region Planning Board
NCT	:	National Capital Territory
NGO	:	Non-governmental Organizations
NH	:	National Highway
O & M	:	Operation and Maintenance
OHSR	:	Overhead Service Reservoir
PHED	:	Public Health Engineering Department

PPP	:	Public Private Partnership
PSC	:	Pre-stressed Concrete
PWD WSSD	:	Public Works Department – Water Supply & Sanitation Department
RCC	:	Reinforced Cement Concrete
RWPH	:	Raw Water Pump House
SCADA	:	Supervisory Control and Data Acquisition
Sq. m	:	Square kilometer
TA	:	Technical Assistance
TW	:	Tube Well
UASB	:	Up flow Anaerobic Sludge Blanket
UFW	:	Unaccounted for Water
ULB	:	Urban Local Body
WJC	:	West Jamuna Canal
WTP	:	Water Treatment Plant

Contents

Appendix

List of Tables

List of Maps

1. INTRODUCTION

1. Panipat is located in the eastern part of Haryana State in north India. Geographically, Panipat District is located between 29^0 09' 15"and 29^o 27' 25" north latitudes and 76^o 38' 30"and 77^o 09' 15" east longitudes. Panipat is an historic town; it is the headquarter of Panipat District. it is located at about 165 km south of State Capital Chandigarh, and 85 km north of National Capital Delhi. The Town is well connected with other parts of the State and Country. National Highway 1 (NH 1/ Grand Trunk Road), connecting Delhi and Wagah Border in Punjab, and many important cities passes through the town. It is the point of convergence of various roads from Delhi, Uttar Pradesh and Haryana States. It is also a Railway Junction; the Delhi- Ambala Railway line, runs parallel to the G.T. Road. Location of Panipat is depicted in **Map 1-1**.

2. Groundwater is the main source of water supply in Panipat. Water is extracted through 195 tube wells drilled in various parts of the town. About 81 MLD of water supplied daily from these tube wells, in which about 56 MLD is supplied by PWD-WSSD (Public Works Department – Water Supply & Sanitation Division) and the remaining by HUDA (Haryana Urban Development Authority). PWD-WSSD has provided over 27,300 water connections in their service area serving approximately 166,800 population which is about 58 percent of total service area population as per 2006 records, and the remaining are mostly using the groundwater through individual hand pumps and tube wells. A number of consumers located on the outskirts of the PWD-WSSD service area have been reported to be using personal hand pumps as their main source because of low residual pressure in distribution system at those locations. Due to unequal distribution, the rate of water supply in some areas is very less. Groundwater in and around Panipat, as per the Central Ground Water Board (CGWB), is over exploited and the quality in some areas is not acceptable for drinking.

3. Master Plan for the Water Supply System in Panipat was formulated in 2009 under this TA. In continuation, this subproject for Water Supply System Improvement in Panipat has been formulated and the Detailed Project Report (DPR) is 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 Ghaziabad.

4. This Initial Environmental Examination (IEE) Report is prepared in accordance with NCRPB Environmental and Social Management System (ESMS) and Policy for project funding.

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

Project Location

Legend

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

Client:
Asian Development Bank
National Capital Region Planning Board

Consultant:
Wilbur Smith Associates

Drawn: Roopa	Checked: SKG
Date: April 2010	Approved: NSS
Scale: NTS	

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 water supply improvement project in Panipat does not falls under the ambit of the EIA Notification, and, therefore EC is thus not required.

C. Environmental and Social Management System of NCRPB

10. 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

11. *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.

12. 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

13. 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.

14. The proposed subproject of construction of flyover at Mohan Nagar Junction in Ghaziabad is unlikely to have significant impacts. The project site is also not located or near any eco-sensitive area. The subproject is however likely to have typical impacts associated with the construction activity in urban areas and therefore classified as Category E2.

15. 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

16. There are two water supply service providers in Panipat Town for non-industrial users: Public Works Department (Water Supply and Sanitation department) (PWD-WSSD) and the Haryana Urban Development Authority1 (HUDA). While PWD-WSSD provides service in the municipal area HUDA services the areas (called sectors) developed by it. Tube wells have traditionally been the main source of water in Panipat. At present there are 195 tube wells, from which 81 MLD of water is supplied. Water is supplied directly from the tube wells into the distribution network. The distribution system in PWD (WSSD) area is generally laid on ad hoc basis, with no defined zones. All tube wells are directly connected to distribution lines. Compared to this, in areas served by HUDA, distribution system has been laid on sectoral basis and water is first pumped to a clear water reservoir and then boosted to the distribution system. OHSRs have been constructed in some cases but are not being used. The total length of distribution system has been reported to be around 285 km and comprises of mainly AC pressure pipes and in some cases CI and PVC pipes. Disinfection of water is done on-line. Existing water supply system is presented in **Map 3-1** and existing Tube Wells are shown in **Map 3-2**

17. Available records and estimates implies that about 58 percent of the population is connected to water supply system although the actual figure may be higher as there appear some unauthorized connections. A number of consumers located on the outskirts of the PWD-WSSD service area have been reported to be using personal hand pumps as their main source because of low residual pressure in distribution system at those locations. Due to an unequal distribution, rate of water supply in some areas could be less as compared to the targeted per capita rate. Households not connected to the system are also depend on own sources like hand pumps. There are no public stand posts (PSP) and hand pumps provided by the service providers in the town. However, many unauthorized PSPs are reported to exist.

18. The existing tube wells are demonstrating a marked decrease in yield and deteriorating water quality according to PWD-WSSD and the Ground Water cell of the state Agriculture Department. At few places, the ground water quality has become un-potable. Accordingly, the existing water sources are unable to meet the peak summer season demand. Extensive ground water usage for domestic as well as commercial and Industrial use was observed to be a common phenomenon in the town. The level of the water table is reported to be sharply depleting during last 5 years, resulting in declining yield from existing tube wells. The CGWB in its report observed that although deeper groundwater is fit for drinking, groundwater is polluted and is not fit for drinking in some parts of the town. Also, ground water in and around Panipat is over exploited.

[1] HUDA is an autonomous government body and functions as the land developer in Haryana

19. The water supply system of Panipat Town has not been given any comprehensive look for improvement in the past. The approach seems to have been mostly ad-hoc. Construction of additional tube wells to meet increased demand or construction of new tube wells as replacement against failed tube wells has been the practice. Similarly extension of pipe lines in newly developed areas has been done. There is no defined zoning of distribution system. Whenever there is any complaint of low pressure, laying additional pipe line or a new pipe line of bigger size seems to be the practice. In addition to this, there has been a sharp growth of population in fringe areas.

20. The water supply system in Panipat is thus facing several problems at present. A low level of service in terms of coverage, unequal and low per capita water supply, short hours of supply and insufficient terminal pressure in the outlying areas are among these problems.

B. Description of the Subproject

21. According to the Water Supply Master Plan of Panipat, the town is divided into 32 water supply zones. The present subproject is proposed to augment the water supply in 18 of 32 zones, which has already developed and have contiguous development (**Map 5**). The remaining zones at present are mostly undeveloped.

22. The Water Supply Master Plan of Panipat has recommended to discontinue the the present groundwater based water supply system and develop a new canal based water supply system, with Carrier Link (CL) Canal and Parallel Delhi Branch (PDB) Canal, the two perennial canals passing through the town, as source. This recommendation was based on the following::

(i) Dependability of local ground water has greatly reduced and it has come under over exploited zone

(ii) The quality of ground water in Panipat is deteriorating continuously making it unfit for human consumption in parts of the town

(iii) Availability of raw water in the Link channel and in Delhi parallel canals and willingness of GoH to allocate water for Panipat water supply

(iv) The quality of raw water in the canal is good and treatable. This canal water is already a source for many towns and villages including NCT of Delhi

(v) The canals are passing through Panipat town only, thus pumping from long distance is not involved. The canals are located above the ground level, thereby facilitating lower pumping head and also reducing chances of any external pollution

(vi) This is an economical solution than bringing water from Yamuna River as it involves pumping

(vii) There is a strong public demand for providing drinking water from the canal. Honorable Chief Minister of Haryana has therefore announced in a public meeting his commitment to provide treated canal water to Panipat town on 20th January 2008

23. This subproject is designed with Parallel PDB Canal as main source and CL Canal as

supplemental source in emergencies. These two canals run parallel to each other in the north of the town. A water works campus will be developed on a selected site between two canals, where facilities for raw water collection, treatment, clear water storage and pumping facilities will be located.

24. An inlet channel will be constructed to tap water from both the canals. This channel will terminate into the raw water sump, rectangular in shape with pump house constructed on the top. Water shall be pumped into inlet chamber of the WTP. Treated (clear) water will be stored in underground reservoir (CWR) adequate for 2 hour storage. Layout Plan of water works campus is presented in **Map 3-5** and **Map 3-6**. The clear water pump house will be constructed on the top of the CWR. Alternatively, Pump House may be constructed adjacent to the sump with Horizontal centrifugal pumps with positive suction arrangement.

25. Treated water will be pumped to 18 Zonal Overhead Service Reservoirs (OHSR) through a ring pumping main pipeline. The alignment of ring main pipeline and location of zonal reservoirs is presented in **Map 3-7**. Water shall be distributed from these zonal reservoirs to the distribution networks of each zone which also will be improved/ extended as required according to design (**Map 3-8**).

26. In order to reduce UFW (Un accounted For Water), service lines of all existing consumers will be replaced with new saddle pieces, ferrules and MDPE pipes. All consumers will be provided with water meters. Bulk water meters will be provided for each OHSR and one at the delivery pipe of CWPS to record actual water produced, distributed and billed. The whole system of water production and storage up to OHSRs is proposed to be controlled through SCADA for economy and effective monitoring of water supply.

Table 3-1: Proposed Water Supply Infrastructure in Panipat

Infrastructure	Function	Description	Location
Canal intake and inlet channel	Drawing of water from main canal and feeding into raw water sump	The canal intake will consists of opening in the main canal at a suitable level to discharge design quantity. Design discharge is 100 MLD Inlet channel will be of rectangular RCC open channel of 40 m length, 2,000 mm wide and 800 mm deep	A parcel of land (area 4.25 ha) between the two canals – Delhi Carrier Link Channel and Delhi Parallel Branch Canal is selected as appropriate for setting up of water works campus for Panipat. All facilities (intake channel, raw and clear water sumps, raw and clear water pump houses and WTP) will be located within this site. Canal intakes will be constructed on both the adjoining channels. Water will mainly be drawn from DLC, while DPC will provide water supply during the maintenance

Infrastructure	Function	Description	Location
			or unscheduled closure of DLC. The parcel of land is selected is under private ownership and is presently under agricultural use.
Raw Water Sump	To store raw water	Underground sump Capacity of sump: 0.146 ML; Size: CA 73 m2 and 2 m deep	Within the water works campus
Raw Water Pump House (RWPH)	To pump raw water from raw water sump to WTP inlet	5 VT pumps of capacity 40 KW (3 working + 2 standby) installed in one room building constructed above the raw water sump	Within the water works campus
Water Treatment Plant (WTP)	Treat water to Indian drinking water standards	WTP capacity: 100 MLD Conventional treatment process with simple clarification or clarification through tube settlers. WTP shall include: pre-chlorination, alum dosing, flash mixing, flocculation, clarification, filtration, post-chlorination, wash water re-circulation and sludge disposal systems	Within the water works campus
Clear Water Sump (CWS)	Store treated water from WTP for supply	Underground sump Capacity of sump: 0.146 ML Size: CA 72 sq. m; and 2m deep	Within the water works campus
Clear Water Pump House (CWPH)	To pump clear (treated) water from clear water sump to OHSRs through the pumping main	3 VT pumps of capacity 400 KW (2 working + 1 standby) installed in one room building constructed above the CWR	Within the water works campus
Pumping Main /Ring Main Pipeline	Transport water under pressure from CWR to 18 zonal OHSRs	31.4 km of DI pipe of 300 to 900 mm diameter (300 mm - 7.41 km; 350 mm – 7.44 km; 400 mm – 5.11 km; 500 mm – 2.12 km; 600 mm – 0.27 km; 700 mm – 2.36 km; 800- 0.52 m; 900 – 1.2 km	Buried in a trench in the Right of Way (ROW) of Asand Road, Jatal Road and Sanauli Road.
Overhead	To store clear	18 service reservoirs – 17	Located on a selected parcel

Infrastructure	Function	Description	Location
Service Reservoirs (OHSRs)	water pumped from WTP at higher level for supply under gravity into the distribution system	no.s OHSRs and 1 GLSR.	of land in each zone. Area required is about 500-900 $m^{2.}$
Bulk Water Meters	To measure the quantity of water produced at WTP and supplied into the distribution network	19 no.s	One each at 18 OHSRs, and one at delivery pipe of CWS
Distribution network (rehabilitation & augmentation)	Supply of water from OHSRs to consumer connections	Replacement - 138 km of HDPE pipe of 110-450 mm diameter New - 264 km of HDPE pipe of 110-400 mm diameter	Distribution network will extend throughout many parts of the town, where pipes will be buried within or alongside road way with in the available ROW.
Consumer Connections with meters	Convey water from distribution system to the household; measurement of quantity of water supplied	30,000 number of connections; service pipe line of all existing consumers will be replaced with new saddle pieces, ferrules and MDPE pipes	at each house with existing service connection

27. The site selected for development of waterworks campus between the two canals is under the private ownership and is presently under cultivation. The site is selected based on techno-economic considerations. Private land acquisition is necessary as there is no suitable government vacant land in and around Panipat. Total area of the selected site is 4.25 ha. The site is accessible by an earthen kutcha road.

Photo 1 & 2: View of the Proposed Water Works Site

28. Pumping main (DI pipe of diameter 300 – 900 mm) of 31.4 km will be laid as a closed ring () From in between points, branch lines will take off to the 18 OHSRs. All pipelines will be buried along the road in the available ROW.

29. Overhead service reservoirs (OHSRs) will be constructed one in each Zone on identified land parcels owned by government. Each OHSR requires an area of ranging from 625 sq m to 1,000 sq m.

Table 3-2: Details of Proposed OHSRs

Zone	Capacity (ML)	Staging Height (m)	OHSR Location	Remarks
Zone 1	1.50	20 m	Virat Nagar	Government Land
Zone 2	1.25	20 m	Model Town	Government Land
Zone 3	1.00	20 m	Ali Park	Government Land
Zone 4	1.50	20 m	Canal Camp	Government Land
Zone 5	1.25	20 m	Satkartar Colony	Government Land
Zone 6	2.00	20 m	Kabri Road	Private land
Zone 7	1.00	20 m	Ram Nagar	Government Land
Zone 8	2.00	On ground	Geeta Colony	Government Land
Zone 9	2.00	20 m	Gandhi Park	Government Land
Zone 10	1.25	20 m	Chawla Colony	Government Land
Zone 11	1.50	20 m	Veterinary Hospital	Government Land
Zone 12	1.50	20 m	Housing Board	Government Land
Zone 13	1.50	20 m	Sanjay Park	Government Land
Zone 14	2.00	20 m	Khadi Ashram	Government Land
Zone 15	1.50	20 m	Housing Board	Government Land
Zone 16	1.75	20 m	Bharat Nagar	Government Land
Zone 17	1.75	20 m	Moti Colony	Government Land
Zone 18	1.50	20 m	Kabulbag Colony	Government Land

30. Existing distribution network will be rehabilitated/improved by replacing the old, damaged and undersized pipes as per the design. New network will be provided in the presently uncovered areas in 18 selected zones as per the design. Distribution network will be of HDPE pipes of diameter ranging from 110 mm to 450 mm. The total length is 302 km.

Table 3-3: Distribution System

Diameter	Pipe	New Pipeline		Replacement		Total	
		Length (m)	*%*	*Length (m)*	*%*	*Length (m)*	*%*
110 mm	HDPE	205,864	78.0	71,606	51.72	277,470	68.97
125 mm	HDPE	17,588	6.7	24,004	17.34	41,592	10.34
140 mm	HDPE	12,409	4.7	11,036	7.97	23,445	5.83
160 mm	HDPE	9,462	3.6	11,699	8.45	21,161	5.26
180 mm	HDPE	5,976	2.3	6,145	4.44	12,121	3.01
200 mm	HDPE	6,179	2.3	6,035	4.36	12,214	3.04
225 mm	HDPE	736	0.3	1,978	1.43	2,714	0.67
250 mm	HDPE	2,698	1.0	3,224	2.33	5,922	1.47

Diameter	Pipe	New Pipeline		Replacement		Total	
280 mm	HDPE	255	0.1	1,198	0.87	1,453	0.36
315 mm	HDPE	1,768	0.7	822	0.59	2,590	0.64
355 mm	HDPE	546	0.2	564	0.41	1,109	0.28
400 mm	HDPE	368	0.1	66	0.05	434	0.11
450 mm	HDPE	-		65	0.05	65	0.02
Total		**263,847**		**138,440**		**402,287**	

31. The NRW reduction programme will include replacement of leaking house connections and non-functioning consumer meters, and installation of bulk meters to measure flow in the network. All existing house connections will be replaced with new saddle pieces, ferrules and MDPE pipes, buried in shallow trenches leading from existing distribution lines to individual houses. Consumer meters will be provided for all connections. New connection will also be provided with consumer meters. New bulk flow meters will be installed at each new reservoir and at clear water pumping station, comprising 19 units in total.

C. Energy Efficiency Measures

32. The water supply subproject has been designed with utmost consideration of energy efficiency in the whole system. In the first place, the system has been designed with the surface water based supply eliminating the current energy intensive groundwater based water supply system. Given almost the flat topography of the town, the design is optimized to the extent possible. Gravity flow is designed wherever possible (from source to raw water sump; within the WTP; and from overhead service reservoirs to households. The pumping main and network design is optimized for terminal pressure requirements using the WaterCAD software. In order to reduce UFW (Unaccounted For Water), service pipe line of all existing consumers will be replaced with new saddle pieces, ferrules and MDPE pipes. All consumers will be provided with water meters. Bulk water meters will be provided for each OHSR and one at the delivery pipe of CWPS to record actual water produced, distributed and billed. The whole system of water production and storage up to OHSRs is proposed to be controlled through SCADA for economy and effective monitoring of water supply.

33. The pumping equipment has been designed with the maximum efficiency to optimize the energy consumption. Various combinations of number of pumps, stages, motor speed have been considered to select the best pump with ideal specific speeds. Specific speeds of the pumps are proposed to achieve maximum efficiency of pumps. As per American Standard for DS Centrifugal Pumps issued by Hydraulic Institute, New Jersey, the specific speed for Pumps should be in the range of 2000 to 3000 for attaining optimum efficiency. The pumps are designed accordingly. Attainable efficiency for procuring the pumps and motors are considered as 88 to 92 percent for pumps and 94 percent for motors. It is proposed that during the procurement, the evaluation of bid shall also be in terms of efficiency. If any bidder offers lower efficiency then the evaluation and bid comparison should be made by loading additional capitalized power cost per point of lower efficiency quoted. Support estimations are provided in the DPR to guide the implementing agency to help in procurement. The pumps shall conform to IS 1710 – 1989 Specification for Vertical Turbine Pump and IS 5120–1992 Technical Requirements for Roto-dynamic

Special Purpose Pumps and tested to class 3 of IS: 9137-1978 Code for Acceptance Tests for Centrifugal, Mixed Flow and Axial Flow Pumps.

34. The total annual power consumption of raw and clear water pumping stations is estimated as 0.14 million KWH and 1.71 million KWH units respectively. The WTP power consumption is not estimated at this stage. It is suggested that pumping equipment shall be replaced after 15 years and that the efficiency needs to be ensured.

D. Occupational Health & Safety

35. Operation of Water Treatment Plant (WTP) involves various processes: pre-chlorination, alum dosing, flash mixing, flocculation, clarification, filtration, post-chlorination, wash water re-circulation and sludge disposal systems prechlorination, aeration, alum-mixing, flocculation, clarification, filtration, and disinfection. Chemicals such as Alum and chlorine will be used in the treatment processes.

36. There is invariably a safety risk when considerable quantities of chlorine are handled (chlorine cylinders will be brought by trucks to the site, installed and operated to disinfect the water supplies). Since facilities are located in the urban area, precautions will thus be needed to ensure the safety of both workers and citizens.

37. The average dose of chlorine for pre-chlorination will be about 4mg/l and that for post-chlorination will be about 2 mg/l. Initially about 354 kg of chlorine will be consumed daily (2011), which will increase to 682 kg at ultimate stage (2041). Chlorine cylinders (called tunners, with capacity about 900 kg) will be procured from nearest manufacturing unit and stored at the site. Tonners sufficient for 30 days will be stored in the storage; this will be about 15 tonners (12 tonners in storage, and 3 tonners in the chlorine room (2 working + 1 standby)) during initial stage and 25 tonners in the ultimate stage).

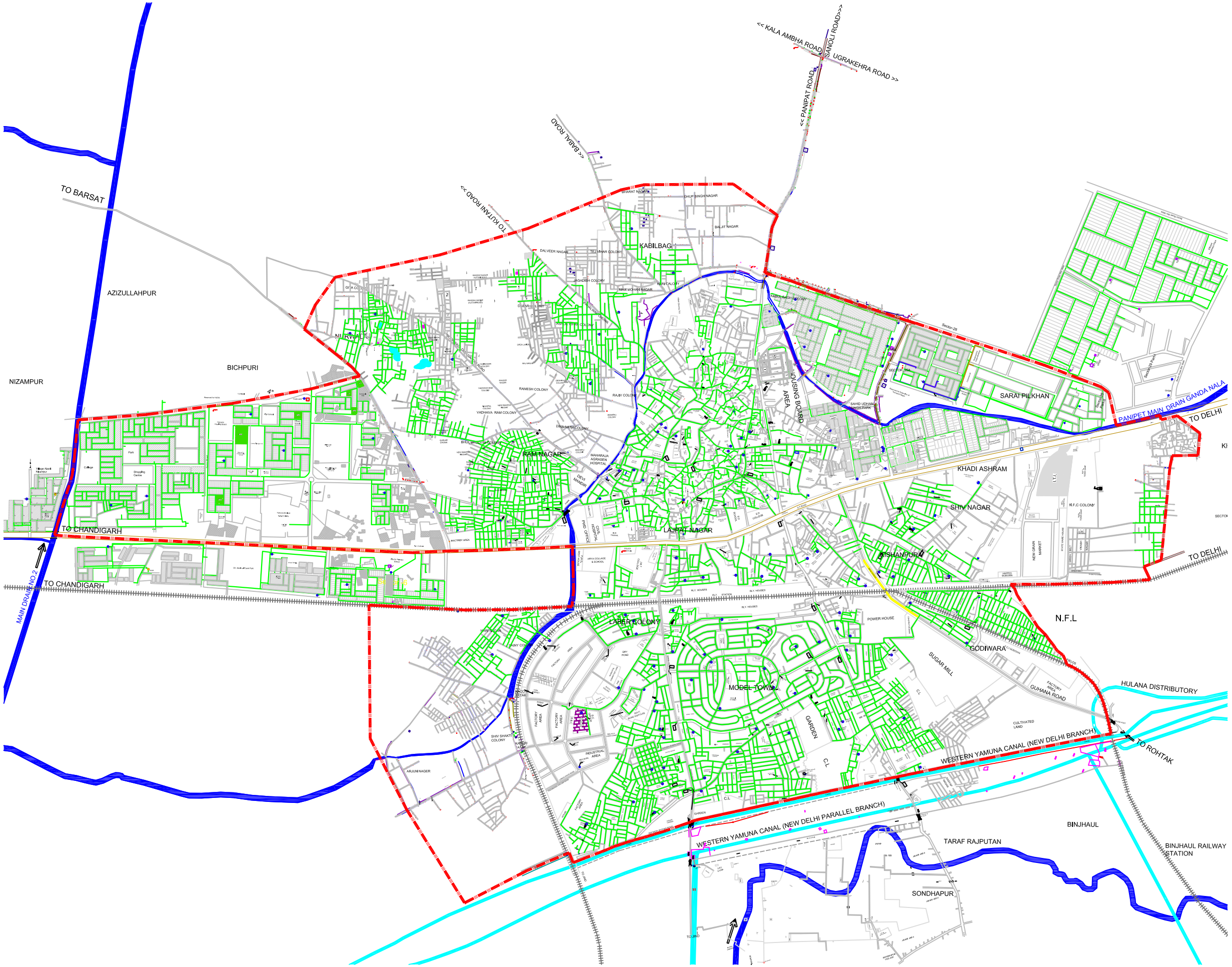
38. Chlorine equipment and storage will be provided in chlorination plant, which will be developed with all safety features and equipment to meet with any accidental eventuality. The chlorination plant will comprise a chlorinator, container store, vehicular access, mechanical container handling facility and a chlorine neutralization pit with a lime slurry feeder. The container store area and chlorinator room will be made in house and provided with continuous forced ventilation system as well as provided with facility for isolation in the event of major chlorine leakages. Safety equipment will be provided to the plant operators in the chemical house as well as in the chlorine house. Visible and audible alarm facilities also to be provided in the event of chlorine gas leak. A separate office building cum laboratory shall also be provided.

39. Training will be provided to the staff in safe handling and application of chlorine. This will be included as part of WTP turnkey contract. Each chlorinator will be provided with standard operating manuals for safe operation and as well as maintenance and repairs.

40. With all the safety features included in the design, the health and safety risk due to handling chlorine will be negligible.

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

Panipat
Existing Water Supply System



Legend

- DPR Project Boundary
- National Highway
- Other Roads
- Railway Line
- Canal
- Drain
- Hand Pump
- Culvert
- Manhole
- Transformer
- Electricpole
- Lamppost
- Telephonepole
- GPS
- TBM
- Tree
- OFC
- Ditch
- Building
- Tube Well

Overlay Legend

- Existing Pipe Line

Client
Asian Development Bank
National Capital Region Planning Board

Consultant
Wilbur Smith Associates

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

Scale: 0 400 800 1200 1600 Meters

Map 3-1

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

Panipat
Location of Tubewells in Municipal Area

Legend

- Municipal Boundary
- Ward Boundary
- 20 Ward Number
- Major Roads
- Other Roads
- Railway Line
- Cart Track
- House settlement
- Temple
- Water Course

Overlay Legend

- TW Tube Well
- 050 Tube Well Number for City Portion
- 050 Tube Well Number for Model Town

Source:
PHED Panipat, Haryana

Client

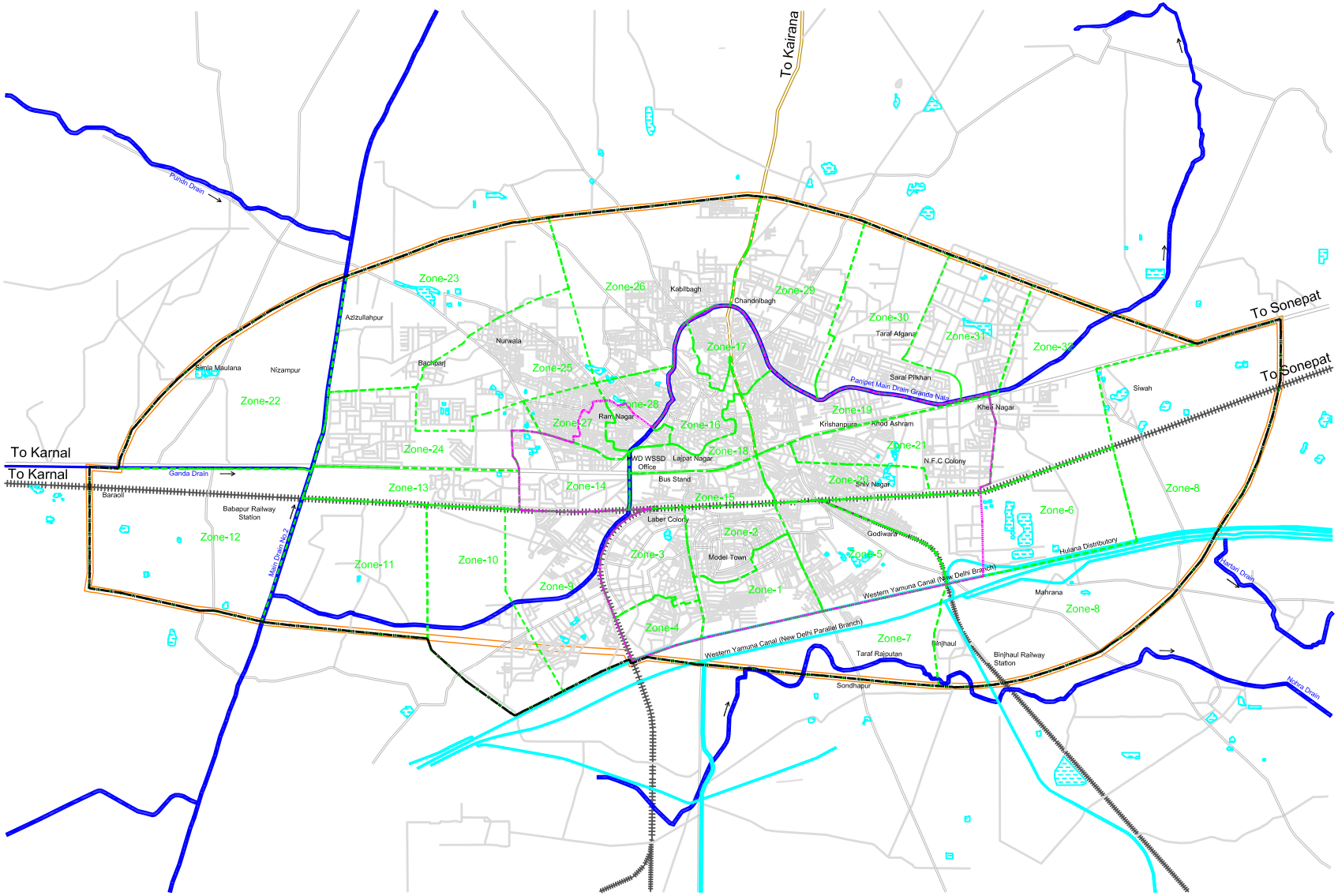
Asian Development Bank
National Capital Region Planning Board

Consultant

Wilbur Smith Associates

Drawn: SK	Checked: NSS
Date: April 2010	Approved: NSS
Scale: NTS	

Map. 3-2



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

Panipat
Water Supply Master Plan Zones

Legend

- Study Area Boundary
- Municpal Boundary
- Proposed Road
- National Highway
- State Highway
- Major Roads
- Other Roads
- Railway Line
- Canal
- Drain
- Ponds and Lakes

Overlay Legend

- Zone Boundary
- Zone-16 Zone Number

Client
Asian Development Bank
National Capital Region Planning Board

Consultant
Wilbur Smith Associates

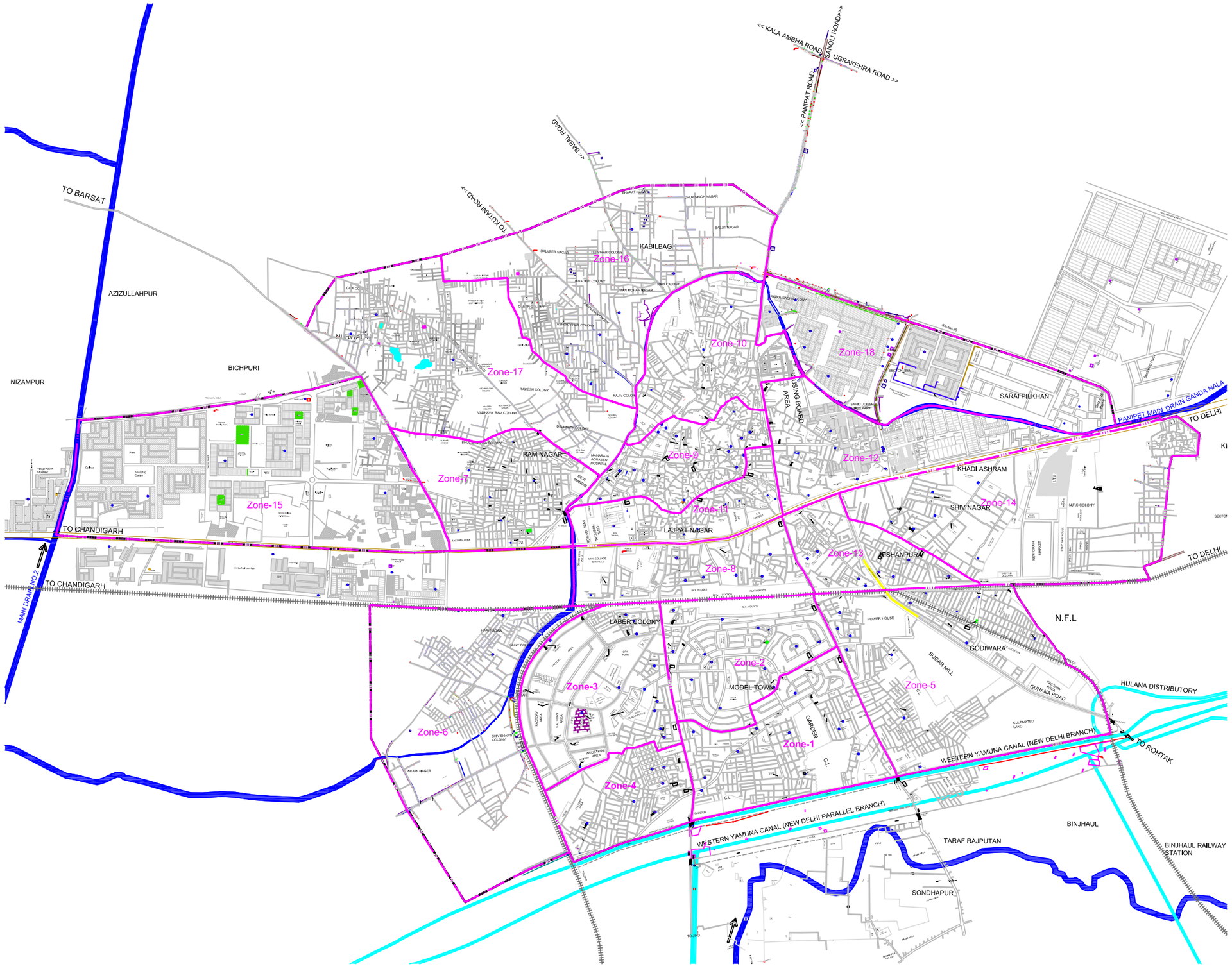
Drawn: SK	Checked: NSS
Date: April 2010	Approved: NSS

Scale: -400 0 400 800 1200 1600 Metres

Map 3-3

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

Panipat
Subproject Area Base Map
(18 zones covered)



Legend

- DPR Project Boundary
- National Highway
- Other Roads
- Railway Line
- Canal
- Drain
- Hand Pump
- Culvert
- Manhole
- Transformer
- Electricpole
- Lamppost
- Telephonepole
- GPS
- TBM
- Tree
- OFC
- Ditch
- Building
- Tube Well

Overlay Legend

- Zone Boundary
- Zone-14 — Zone Number

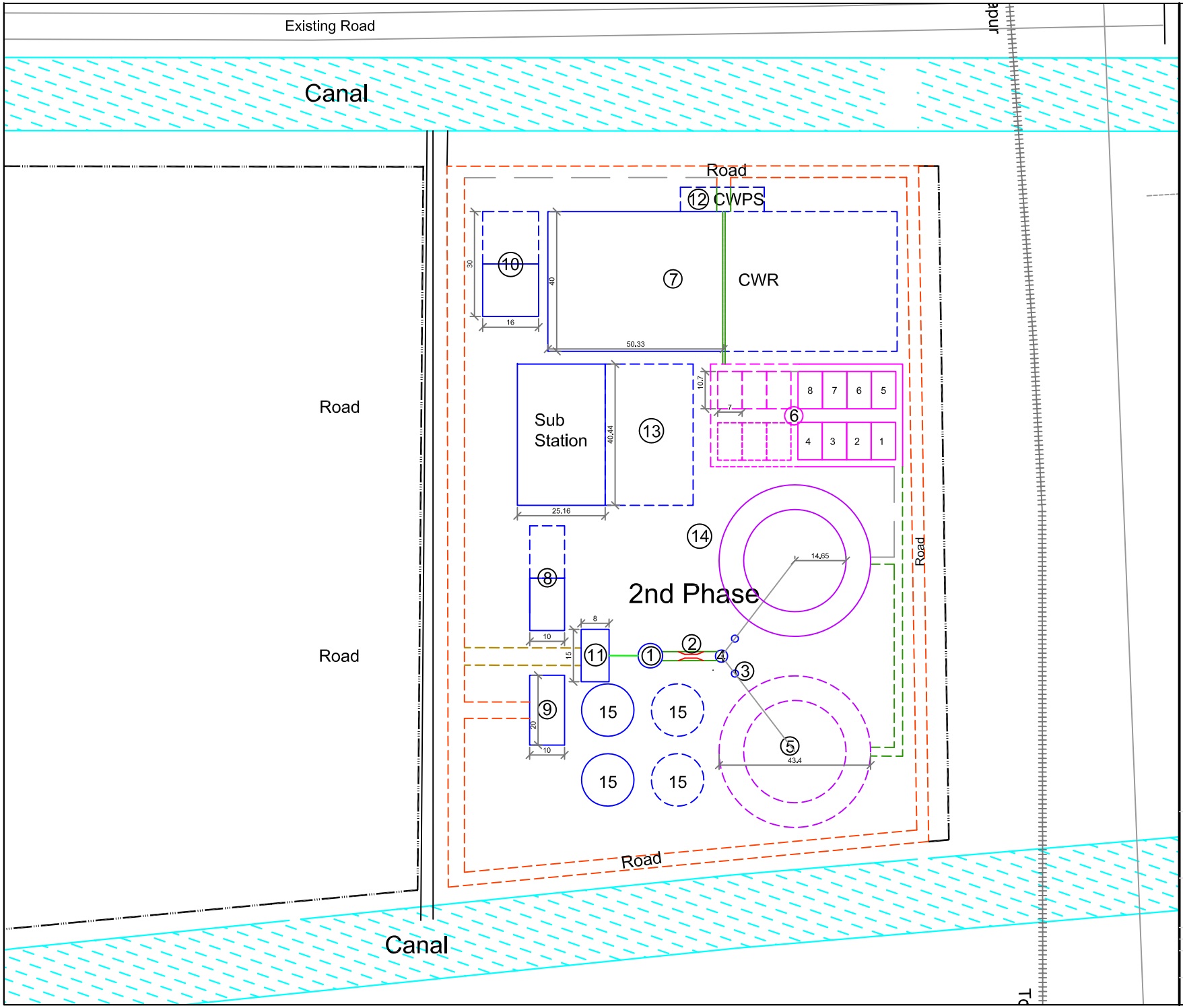
Client
Asian Development Bank
National Capital Region Planning Board

Consultant
Wilbur Smith Associates

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

Scale: 0 400 800 1200 1600 Meters

Map 3-4



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

Panipat
Layout Plan of Water Teatment Plant

Legend

- Existing Canal
- Existing Road
- Railway Line
- WTP Boundary
- Proposed Channel
- Proposed Road
- Future Plant

S. No	Description	Size
1	Inlet Chamber - 1 No.	3.5m Ø
2	Pharshall Flume - 1 No.	1 No.
3	Flash Mixer - 1 Nos.	3.15m Ø
4	Distribution Chamber - 1 No	3.5m Ø
5	Clarifiers - 1 Nos	43.4m Ø
6	Filters - 8 Nos	10.0mx6.5m
7	Clear Water Reservoir - 1 No	50mx40m
8	Cholination Building	15.0mx10.0m
9	Office Building Cum Laboratory - 1 No	10.0mx20.0m
10	Alum Storage	15.0mx16.0m
11	Raw Water Pumping Station - 1 No.	-
12	Clear Water Pumping Station - 1 No	-
13	Electrical Substation - 1 No.	-
14	Back Wash Tank - 1 No.	-
15	Waste Back Wash Storage Tank - 1 No.	-
16	Area	4 Hectares

Client:
Asian Development Bank
National Capital Region Planning Board

Consultant:
Wilbur Smith Associates

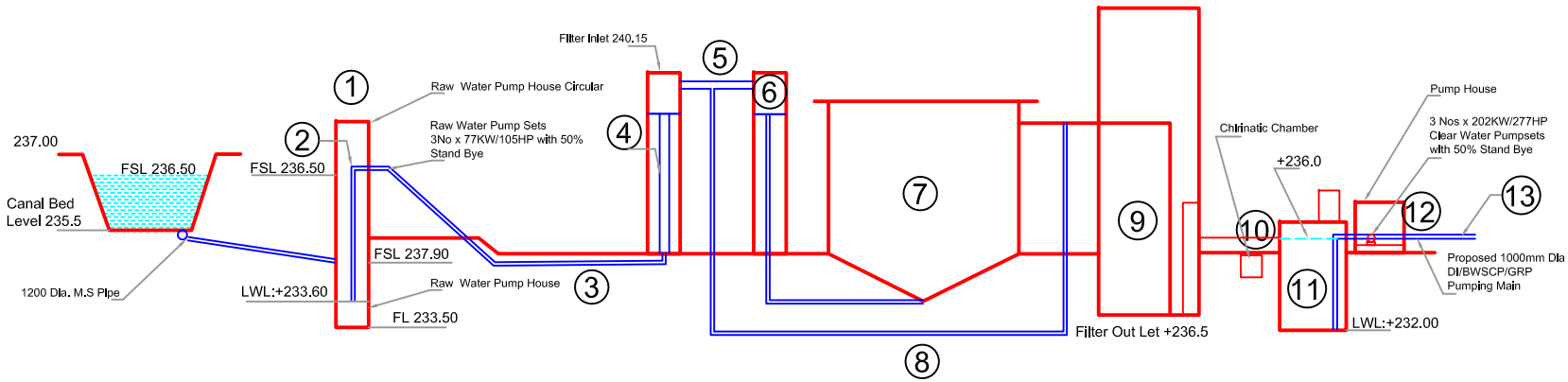
Drawn: SK | Checked: NSS
Date: July 2010 | Approved: NSS

Scale: 0 15 30 45 60 Meters

Map 3-5

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

Panipat
Hydraulic Flow Diagram of WTP



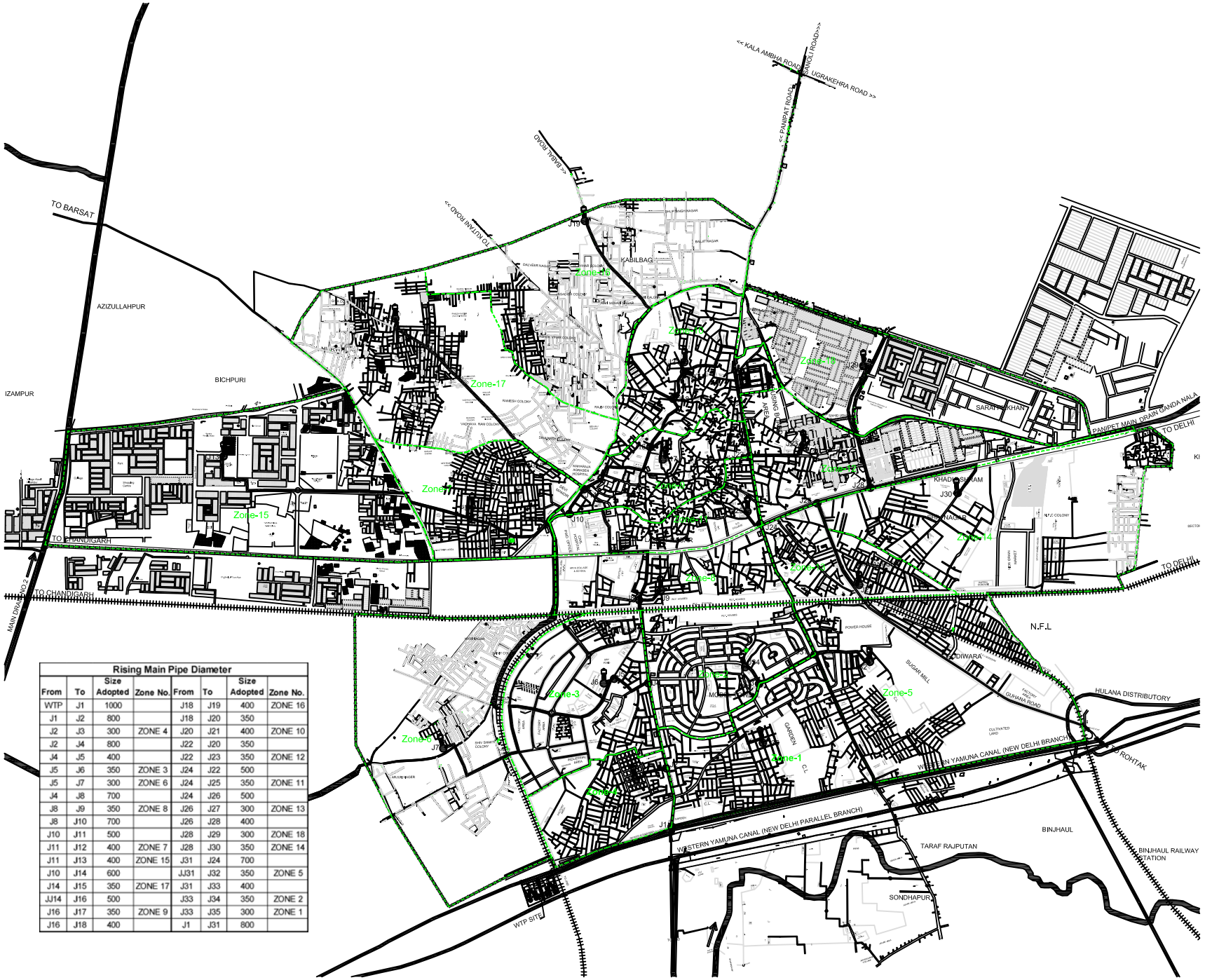
1. Intake Well Cum. Pump Houses
2. Raw Water Pumpsets 3 Nos.
3. Raw Water Pumping Main 800mm Dia 100m Pipe Line
4. Inlet Chamber
5. Parshalflume Channel
6. Flash Mixer 4 meters
7. Clariflocculator 4 Nos
8. Bypass Channel
9. Filter House, Chemical House, Wash Water Tank
10. Clear Water Channel with Chlorine Contaor Chamber
11. Clear Water Reservoir
12. Clear Water Pump Station with Pumpsets 3 Nos
13. Clear Water Pumping Main 1000 Dia MS/DI/BWSCP/GRP

Client:
Asian Development Bank
National Capital Region Planning Board

Consultant:
Wilbur Smith Associates

Drawn: SK	Checked: NSS
Date: April 2010	Approved: NSS
Scale: NTS	

Map 3-6



Rising Main Pipe Diameter

From	To	Size Adopted	Zone No.	From	To	Size Adopted	Zone No.
WTP	J1	1000		J18	J19	400	ZONE 16
J1	J2	800		J18	J20	350	
J2	J3	300	ZONE 4	J20	J21	400	ZONE 10
J2	J4	800		J22	J20	350	
J4	J5	400		J22	J23	350	ZONE 12
J5	J6	350	ZONE 3	J24	J22	500	
J5	J7	300	ZONE 6	J24	J25	350	ZONE 11
J4	J8	700		J24	J26	500	
J8	J9	350	ZONE 8	J26	J27	300	ZONE 13
J8	J10	700		J26	J28	400	
J10	J11	500		J28	J29	300	ZONE 18
J11	J12	400	ZONE 7	J28	J30	350	ZONE 14
J11	J13	400	ZONE 15	J31	J24	700	
J10	J14	600		JJ31	J32	350	ZONE 5
J14	J15	350	ZONE 17	J31	J33	400	
JJ14	J16	500		J33	J34	350	ZONE 2
J16	J17	350	ZONE 9	J33	J35	300	ZONE 1
J16	J18	400		J1	J31	800	

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

Panipat
Rising Main Alignment and OHSRs

Legend

- DPR Project Boundary
- National Highway
- Other Roads
- Railway Line
- Canal
- Drain
- Hand Pump
- Culvert
- Manhole
- Transformer
- Electricpole
- Lamppost
- Telephonepole
- GPS
- TBM
- Tree
- OFC
- Ditch
- Building
- TW Tube Well

Overlay Legend

- Overhead Service Reservoir (OHSR)
- Zone Boundary
- Zone-14 Zone Number
- Node
- J35 Node Number
- 1000 mm Dia Pipe
- 800 mm Dia Pipe
- 700 mm Dia Pipe
- 600 mm Dia Pipe
- 500 mm Dia Pipe
- 400 mm Dia Pipe
- 350 mm Dia Pipe
- 300 mm Dia Pipe

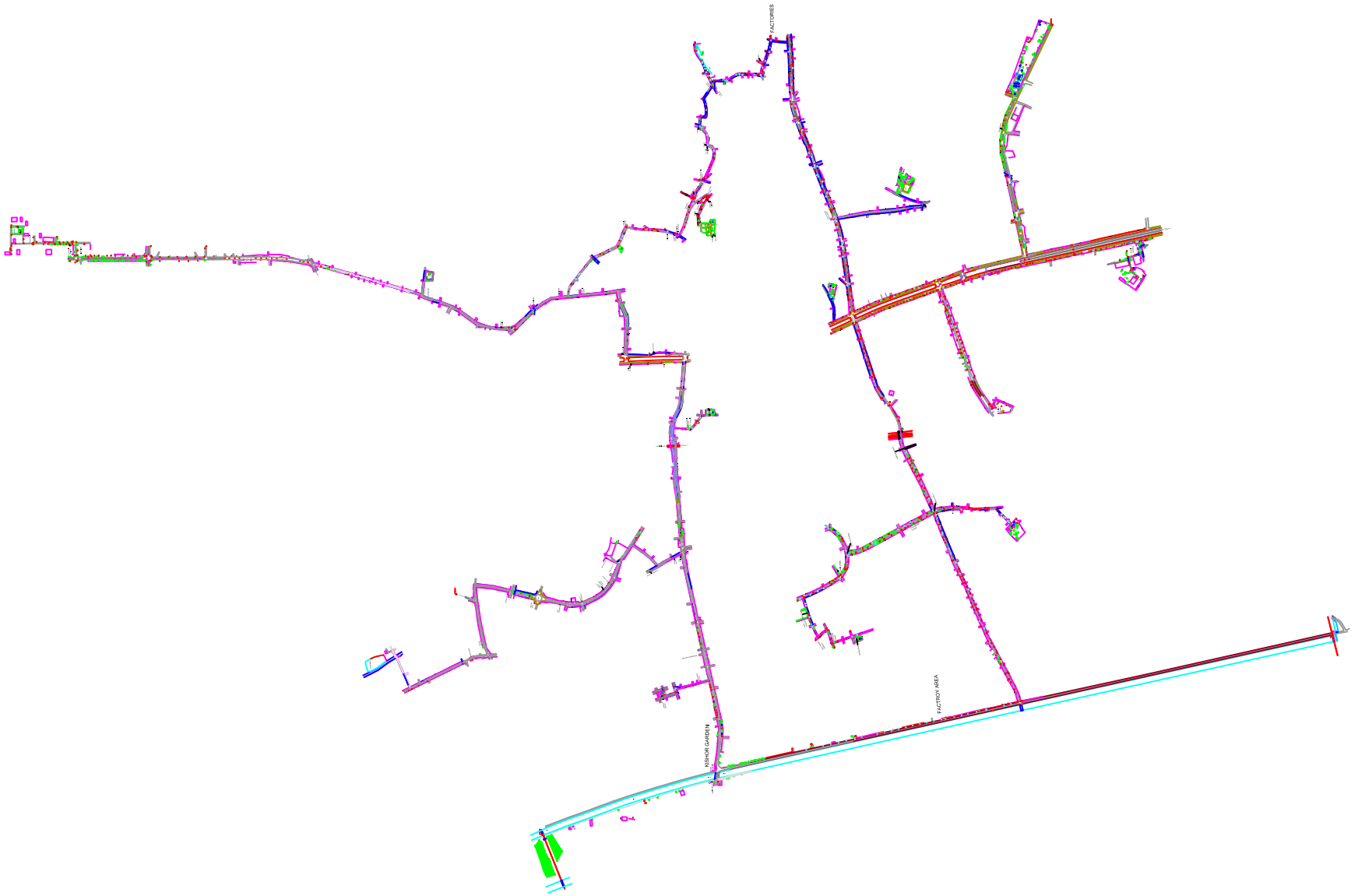
Client:
Asian Development Bank
National Capital Region Planning Board

Consultant:
Wilbur Smith Associates

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

Scale: 0 400 800 1200 1600 Meters

Map 3-7



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

Panipat
Proposed Distribution Network.

Legend

- Road
- Drain
- Railway Track
- DMder
- Footpath
- Fencing
- Building
- Boundary
- Habitation
- Shops
- Gate
- Park
- Pump
- House
- Water Pipe
- Canal
- Bore
- Hand Pump
- Culvert
- Manhole
- Transformer
- Electricpole
- Lamppost
- Telephonepole
- Gps
- Tbm
- Tree
- Ofc
- Pond
- Water Tank
- Water Walv
- Box
- Retaining Wall
- Well
- Sign Post

Client:
Aslan Development Bank
National Capital Region Planning Board

Consultant:
Wilbur Smith Associates

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

Scale: 0 250 500 750 1000 Meters

Map 3-8

4. DESCRIPTION OF ENVIRONMENT

A. Physical Resources

1. Location

41. Panipat is located in the eastern part of Haryana State in north India. Geographically, Panipat District is located between 29^0 09' 15"and 29^o 27' 25" north latitudes and 76^o 38' 30"and 77^o 09' 15" east longitudes. The historic Town of Panipat, headquarter of the Panipat District, is located in north central part of the district, and is located at about 165 km south of State Capital Chandigarh, and about 85 km north of National Capital Delhi. Town is well connected with other parts of the State and Country. National Highway 1 (NH 1/ Grand Trunk Road) connecting Delhi and Wagah Border in Punjab, connecting many important cities passes through the town. The town is the point of convergence of various roads from Delhi, Uttar Pradesh and Haryana States. It is also a Railway Junction; the Delhi- Ambala Railway line, runs parallel to the G.T. Road.

42. The railway line divides the town into two parts; the old town of Panipat lies on the eastern side of the railway line, while the recent development, the industrial area and the Model Town, is on the western side. Till 1989 Panipat was part of Karnal District. Thereafter the Panipat passed through various changes in its administrative jurisdiction, and finally in 1992 it is formed as a separate district.

2. Topography, soil and geology

43. Panipat district forms part of Indo gangetic plain and lies in Yamuna Sub basin of the Ganges basin. Physio-graphically, the district is characterized by two distinct features - vast upland plains and Yamuna flood plains. The district is mainly drained by River Yamuna and its tributaries. Topography of Panipat Town is almost flat with gentle slope in the northwest to southeast direction towards Yamuna River. Panipat Main Drain originating in the northwestern side passes through the town towards Yamuna in southeast direction.

44. Panipat District is occupied by geological formations of Quaternary Age comprising of recent alluvial deposits belonging to the vast Gangetic alluvial plains. The district has two types of soils – tropical arid brown and arid brown soils. The arid brown soils are found in major parts of the district whereas tropical arid brown soils are found in north eastern part of the district, especially in Panipat and Bapoli blocks.

3. *Climate*

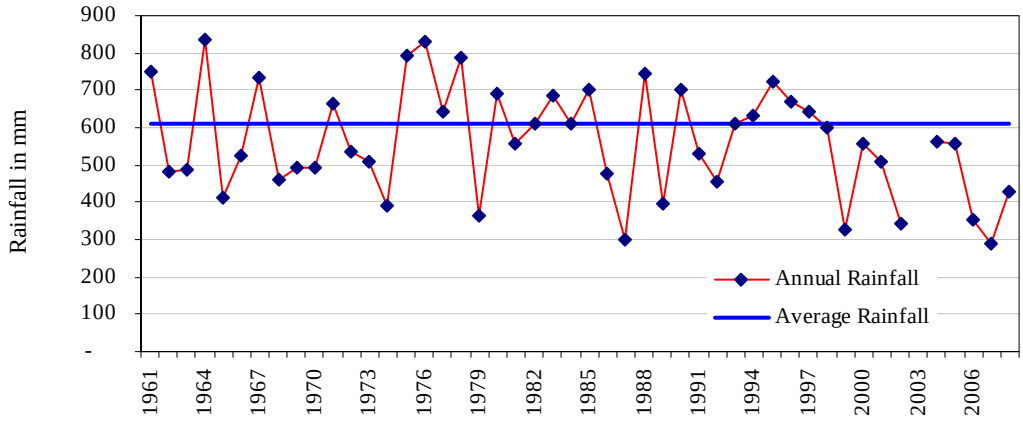
45. Panipat is located in the northwest part of the country where the climate is mostly sub tropical and semi arid. There are three distinct seasons – first of which is the monsoon season - hot and humid season from mid-June to September. Second season, winter, is the cool and dry season from October to March. The third season, summer, is characterized by hot and dry weather which prevails from April to mid-June.

46. Panipat experiences unreliable rainfalls which are mainly concentrated in monsoon seasons. The region receives rainfall mainly under the influence of southwest monsoon from July to September. Around 70 percent rainfall is received during this season and the remaining rainfall is received during December to February. The annual average rainfall is about 610 mm , which is spread over 31 rainy days. As presented in the following Table the rainfall data of last five years indicate that the annual rainfall was much less than the long term annual average – departure from normal rainfall being as high as -52.4 percent in the year 2007.

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

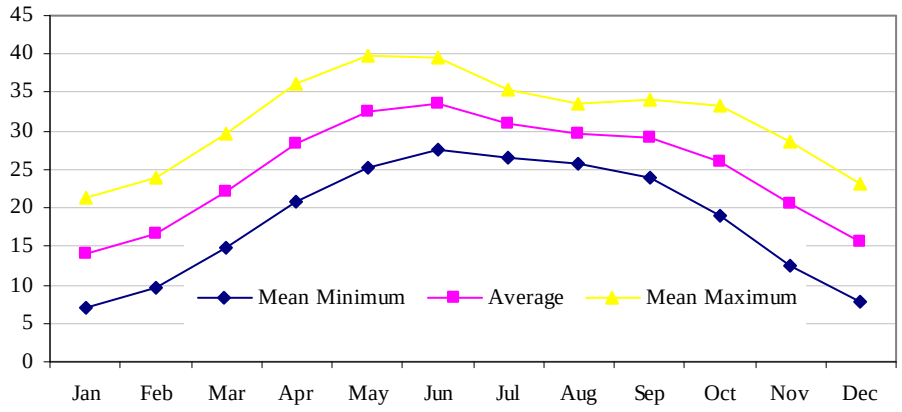
Month	**Rainfall (mm)**					
	Normal	**2004**	**2005**	**2006**	**2007**	**2008**
January	21.6	49.0	17.0	3.0	-	-
February	10.4	-	13.0	-	51.8	2.2
March	13.2	-	40.0	9.0	15.0	-
April	9.3	10.0	-	-	-	2.0
May	8.7	26.0	-	4.0	7.0	37.0
June	47.9	37.0	16.0	96.0	61.0	50.5
July	184.6	18.0	108.5	172.5	44.5	137.0
August	194.1	317.3	71.0	24.0	41.5	110.5
September	92	71.0	290.0	44.5	69.5	91.3
October	18.3	31.0	-	-	-	-
November	3.9	-	-	-	-	-
December	6.1	1.0	-	-	-	-
Total	**610.1**	**560.3**	**555.5**	**353.0**	**290.3**	**430.5**

Figure 1: Long-term Rainfall Pattern of Panipat



47. Owing to its sub-tropical continental monsoon climate with hot summers and cold winters, Panipat 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: Average Monthly Temperature



4. Air Quality

48. Haryana State Pollution Control Board (HSPCB) conducts ambient air quality monitoring in Panipat. It also takes assistance of large scale public sector units located in Panipat (like National Fertilizer Limited and Panipat Refinery) to conduct ambient air quality monitoring using mobile monitoring units. Data shows that particulate matter is high because of the dry atmosphere, dusty roads and surrounding land, and Suspended Particulate Matter (SPM) exceeds National Ambient Air Quality Standards (NAAQS) at most of the monitoring locations. Levels of chemical pollutants (oxides of sulphur and nitrogen) are below national standards except at one location..

Table 4-2: Ambient Air Quality in Panipat

Location	Land Use	Monitoring Date	SOx	NOx	SPM
SD Senior Secondary School	Sensitive	16-Mar-09	12.4	41.1	312.9
ESI Hospital	Sensitive	18-Mar-09	15.7	14.6	195.8
HUDA Sector 17	Residential	10-Apr-09	8.0	33.0	139.8
HUDA Sector 13	Residential	10-Apr-09	14.0	27.0	362.0
STP, Jatal Road	Residential/Rural	21-Mar-09	13.0	8.0	119.9
Near Gohana Railway Crossing	Mixed/Residential	10-Mar-09	6.1	33.2	335.2
HP Petrol Pump, Jatal Road	Mixed/Residential	21-Mar-09	6.1	23.3	325.6
GT Road (near Wooden Mill)	Mixed/Residential	06-May-09	12.0	30.0	652.0
GT Road (near Ansal City)	Mixed/Residential	06-May-09	7.0	33.0	298.6

All values are in $\mu g/m^3$; all values are presented in 24 hours average

Table 4-3: National Ambient Air Quality Standards

Land Use	Average	SPM	NOx	SOx
Industrial Areas	Annual Average	360	80	80
	24 hours Average	500	120	120
Residential, Rural & other Areas	Annual Average	140	60	60
	24 hours Average	200	80	80
Sensitive Area	Annual Average	70	15	15
	24 hours Average	100	30	30

All values are in $\mu g/m^3$

Source: Central Pollution Control Board

5. Surface Water

49. River Yamuna is an important Indian river. The River flows at about 20 km east of Panipat Town in north-south direction. This is the only river which is passes through Haryana State. Within or nearby the Panipat Town, there are no notable water bodies in the town. A drain of 4-6 m wide – known as Panipat Drain (*Gandha Nalla*), flows across the town from north-west to south-east. Rainfall in the town is erratic and the water flow is limited only to wastewater received from residential and industrial areas. Since there is no proper sewerage system in the town, domestic wastewater is disposed into open open drains, which finally discharges into Panipat Drain.

50. There a number of small and medium scale textile/dying industries in the old town area. Due to lack of proper treatment facilities, most of the units dispose untreated and partially treated wastewater into the open drains and ultimately into Panipat Drain. It was observed during the field visit that open drains are filled with coloured water, a typical characteristic of wastewater from textile/dying units. (Photo 1).

51. This drain flow down further towards southeast and combines with other small drains and ultimately reaches Yamuna River, about 40 km southeast of Panipat. However, due to low flow, the drain water does not generally reach the river, except during heavy rains. Indiscriminate disposal of untreated/partially treated wastewater is the main reason for groundwater contamination in Panipat.

52. There is a dry pond in the central part of the town. Local people indicated that due to erratic and low rainfall, and also due to encroachment of inflow channels, this pond remains dry throughout the year (Photo 2).

Photo 1: Open Drains Carrying Wastewater in Old Town

Photo 2: Panipat Jheel (Pond)

53. Two canals of the West Jamuna Canal (WJC) system –Parallel Delhi Branch (PDB) Canal and Carrier Link Canal (\CLC), flow through western part of the town in north-south direction. Both the canals originate from Main Branch Canal of WJC at Munakh head regulator, about 125 km upstream of Panipat. WJC originates from Tajewala Barrage. The proposed water supply system for Panipat is based on these two canals. Capacity of CLC is reported to be 2,823 cusecs and that of PDB is 5,545 cusecs. These two canals again meet at Khubdu head regulator, on downstream of Panipat. From this regulator two canals take-off namely 'PDB' and JLN Canal.

54. PDB is a dedicated canal to supply raw water to NCT of Delhi, while CLC provides for the requirement of JLN Canal and also requirement of raw water of NCT of Delhi during maintenance of 'PDB. As presented in the following Table, quality of water is good, but however requires treatment (filtration and disinfection) for use as potable water.

Table 4-4: Canal Water Quality

Parameter	Unit	Value	Value	IS 10500-1991
		12-Feb-2009	22-Feb-2009	Standard
Colour	-	Turbid	Turbid	Unobjectionable
Odour	-	Earthy	Earthy	Unobjectionable
Turbidity	NTU	55	35	5
pH	-	8	8	6.5-8.5
Electrical Conductivity	µmhos/cm	258	242	
Temperature	Degree-centigrade	16	26	
Nitrates	mg/l	0.16	0.20	45
Fluorides	mg/l	0.18	0.18	1.0
Iron	mg/l	0.20	0.24	0.3
Chromium	mg/l	Absent	Absent	0.1
Sulphates	mg/l	22	25	200
Chlorides	mg/l	7	7	250
Total Alkalinity	mg/l	92	88	200
Total Hardness	mg/l	124	120	300
Free Ammonia	mg/l	0.02	0.03	
Nitrites	mg/l	0.003	0.003	Nil
Dissolved Oxygen	mg/l	9.4	8.8	

Source: HSPCB

µmhos/cm - micro mhos per centimeter; mg/l – milligram per litre NTU – Neflo Turbidity Units

6. Groundwater

55. Panipat District is occupied by geological formations of Quaternary age comprising of recent alluvial deposits belonging to the vast Gangetic alluvial plains. The ground water exploration undertaken by CGWB has revealed the existence of 8 – 23 granular zones down to a maximum depth of 460 m. These zones mainly comprise of various grades of sand and gravel. The first granular zone forms the water table aquifer and occurs down to 50 - 150 m below ground level. The second aquifer occurs between 130 and 250 m depth, the third one exists between 286 and 366 m depth. The discharges range from 605 to 3258 lpm for 6 – 20 m of draw down (Source: Ground Water Information Booklet, Panipat District Haryana, Central Ground Water Board, 2007)

56. The depth to water level is shallow in northern part and deeper in southern parts of the district. In Panipat town and surroundings the water level ranges from 20 - 40 m. The long-term net change of water levels indicates a general decline in the large part of the district and it is up to 15m. The maximum fall is observed around Panipat Town in Panipat block. The overall flow of ground water is towards south- west direction. The ground water development has exceeded the available recharge (about 137 percent in Panipat) and categorized as over exploited (Source: Ground Water Information Booklet, Panipat District Haryana, Central Ground Water Board, 2007)

57. As per the CGWB Report, concentration of by nitrate and fluoride in groundwater is higher than permissible limits, and in some areas heavy metals like Mn, Pb and Fe are also present beyond limits. Heavy metals like Cd, Ni, Zn, Cu, Co and Sr are also present but in low concentrations. Ground Water is hard in a large area. Ground Water in some parts of

the city is unsuitable for drinking. Deeper ground water is by and large safe.

58. Presently groundwater is the prime and only source of water supply in Panipat City. For most of the small and medium scale industries, groundwater is the main source.

B. Ecological Resources

59. Haryana, an intensively cultivated state, is deficient in natural forests. Forests are mainly distributed in the Northern and South-Eastern districts of the state; forestry activities are mainly dispersed over the rugged Shivalik Hills in the north, Aravalli Hills in the south, sand dunes in the southwest, other wastelands and water-logged, saline and alkaline soils in the central part of the State. Only 3.52 percent of the total geographical area in the State has been notified as forest area. There are no forests in and around Panipat.

60. Haryana Forest Department has taken a massive afforestation programme of community, panchayat and farm lands to increase the forest and tree cover of the state to 6.6 percent. Department has set a goal to bring 10% of area under forest and tree cover by 2010. In Panipat District, afforestation is mainly undertaken along the roads and canals.

61. Panipat 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

62. Located close to the national capital Delhi, and c along the National Highway 1 (NH 1), Panipat is traditionally a commercial and industrial centre. NH 1 and the railway line running parallel the NH, divides the town into two parts. On the western side across the railway line are the industrial area and the model town. The older, historical part of the town is on the eastern side. Total area of the town is 19.86 sq. km comprising 31 municipal wards, inhibiting 261,740 population (2001 Census). As shown in the following Table, of the total area about 50 percent is in residential use followed by industrial land use of about 21 percent.

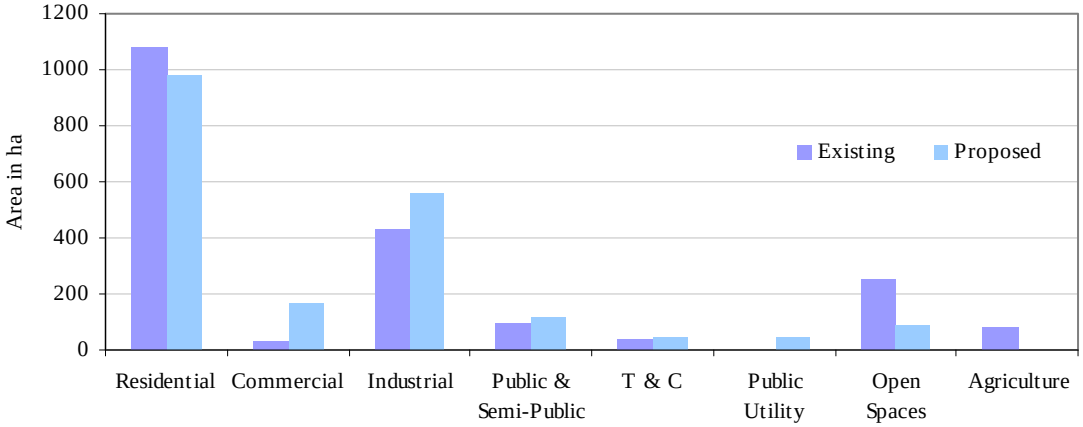
Table 4-5: Existing & Proposed Land Use in Panipat Municipal Limits

Land Use Classification	**Existing Land Use**		**Proposed Land Use**	
	Area	**% of total area**	**Area**	**% of total Area**
	ha	*%*	*ha*	*%*
Residential	1,075	52.3	980	49.3
Commercial	28	1.4	165	8.3
Industrial	427	21.5	555	27.9

Land Use Classification	Existing Land Use		Proposed Land Use	
	Area	% of total area	Area	% of total Area
Public & Semi-Public	95	4.8	113	5.7
Transport & Communication	33	1.7	42	2.1
Public Utility			44	2.2
Open Spaces	252	12.7	88	4.4
Special Zone	-	-	-	-
Agricultural Zone	77	3.9	-	-
Total	**1,987**	**100.0**	**1,987**	**100.0**

Source: Development Plan 2001

Figure 3: Land Use as per 2001 and 2011 Master Plans



2. Industry & Agriculture

63. Owning to its all-round economic development fuelled by intense agricultural development subsided by industrial development, Haryana is one of the prosperous states in India. The state has recorded one of the highest per capita income INR 50,488 (at 2006-07 current prices), much higher than the national average of INR 29,642.

64. Agriculture constitutes the main economy, a major factor being the irrigation system. Wheat, paddy, sugarcane are the major crops while pulses, oilseeds, vegetables etc, are also grown. Irrigation of the district is through WJC System and tube wells. In Panipat Town, as shown in the land use in last section, nearly 4 percent of land is still under agricultural use. Beside agriculture, animal husbandry and fishery also play a subsidiary role in the economy of the district.

65. Panipat is one of the important industrial centres in the State of Haryana. Panipat Town, known for handlooms at national and international markets, is an export hub for cotton durries, mats, carpets, floor coverings, etc. For its exquisite hand tufted woolen carpets and other handloom products, it has earned the name of "Weavers City of India". About 40 percent of the total handloom exports of the country are said to be from Panipat District alone. Panipat houses important large industries like National Fertilizer Limited, Pepsico, Panipat Thermal Power Station, and Panipat Refinery of Indian Oil Corporation. Besides, Panipat district is also known for its pickles industry. Various food products and pickles are being exported to Middle East and European Countries. There are five industrial

estates developed by the State Government in Panipat. Of the 1,706 industrial plots developed in these five estates, 1,652 have been allotted to enterprisers and industries have been established.

66. There are 24 large and medium scale industries in operation in Panipat. As stated above, main industry in Panipat is textile – 14 out of 24 units are textile units are remaining are various types – steel, sugar mills, foods, distillery, fertilizers, petroleum refinery etc. In overall district, as of march 2008, there are 3,085 small scale industrial units, of which over 60 percent are in Panipat Town. Most of these are textile and dying units.

3. Infrastructure

67. *Water Supply and Sewerage*. There are two water and wastewater service providers in Panipat Town - PWD-WSSD and HUDA. These agencies provide all the basic services pertaining to water supply and sewerage facilities in Panipat Town. PWD-WSSD is a line department responsible for providing water supply and sewerage services. HUDA is an autonomous government body and functions as the land developer in the state. HUDA is responsible for providing services only to the areas developed by it, which are called as HUDA "Sectors".

68. Groundwater is the main source of water supply in Panipat. Groundwater is extracted through 115 tube wells drilled by PWD-WSSD and 80 by HUDA in various parts of the town. About 81 MLD of water supplied daily from these tube wells, in which about 56 MLD is supplied by PWD-WSSD and the remaining by HUDA. PWD-WSSD has provided over 27,300 water connections in their service area serving approximately 166,800 population which is about 58 percent of total service area population as per 2006 records, and the remaining are mostly using the groundwater through individual hand pumps and tube wells. A number of consumers located on the outskirts of the PWD-WSSD service area have been reported to be using personal hand pumps as their main source because of low residual pressure in distribution system at those locations. Due to an unequal distribution of water, per capita water supply in some areas is very less. HUDA has provided 4,818 water connections in the HUDA service area.

69. Underground sewerage system in Panipat was developed under GoI sponsored Yamuna Action Plan I. About 200 km of sewers were laid (150-1,800 mm diameter) with 3,729 house connection, serving less than 10 percent of the total population. There are two STPs of 10 MLD and 35 MLD capacities. In addition to this, sewerage system has been provided by HUDA in its sectors. Wastewater from HUDA sewers is disposed into the town sewerage system for treatment and disposal. The effluent from the treatment plants is discharged into Panipat drain, which ultimately meats River Yamuna.

70. *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 road side drains is connected at several places to Panipat Main Drain running across the town. Since there is no proper sewerage system in the town, the open drains mostly carry wastewater. There are several small and medium scale industries - mainly textile/dying units, in Wards 1 to 3, which discharge untreated and partially treated industrial effluent

into the open drain system. Due to short rainy season with scanty rains, storm water system mainly carries wastewater throughout the year. Throwing of solid waste into the open drain is prevalent; most of the drains, including the Panipat Main Drain, are choked and blocked with indiscriminate solid waste disposal. (Photos 3 & 4).

Photo 3: View of Open Drains in Panipat

Photo 4: Panipat Main Drain filled with Wastewater & Solid Waste

4. Transportation

71. Panipat is located advantageously – proximity to national capital Delhi (90 km north of Delhi) and its location along a very important national road corridor – NH 1. Panipat is well connected with other parts of the State and Country. NH 1 - from Delhi to Wagah Border (with Pakistan) in Punjab, connects all important cities and hinterland in Haryana and as well in Punjab State. Besides, Panipat is the point of convergence of various roads from Uttar Pradesh and Haryana States. The town is also well connected by national rail network. The Delhi-Ambala railway line passes through the town. There are regular and frequent train services from Panipat Railway Junction connecting various parts of the country. Nearest Airport is at Delhi, about 100 km south of Panipat.

72. Panipat is provided with a relatively good road network, particularly in the model town area of the town, where streets are wide and not heavily utilized by traffic. The situation however is different in the old town where roads are narrower and more congested (with both traffic and pedestrians), and the roads are not well maintained.

73. 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. Within 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

74. According to the census, population of Panipat was 191,000 in 1991 and 261,740 in 2001 (decadal growth rate of 37 percent). The preceding decade of 1981-91 also experienced a higher growth (38.5 percent). Gross average density has increased from 96 persons per hectare in 1991 to 132 in 2001. The total population of Panipat Urban Agglomeration with a total area of 8,065 ha (80.65 sq. km) is 354,148. Following Table shows the population growth of Panipat in the municipal limits.

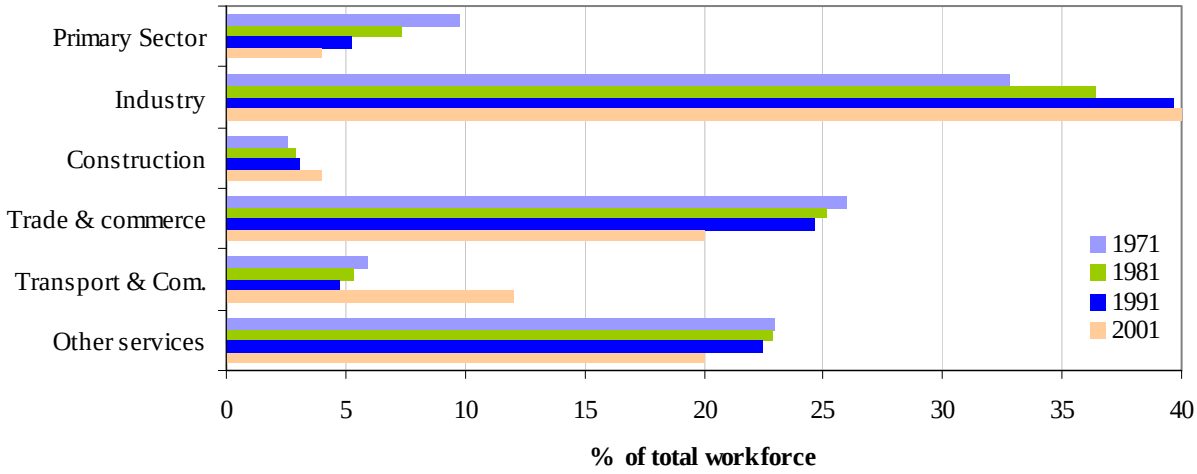
Table 4-6: Population Growth of Panipat

Year	Population	Decadal Growth Rate (%)
1941	38,000	-
1951	54,981	44.73
1961	67,026	21.81
1971	87,981	31.34
1981	137,927	56.82
1991	191,000	38.41
2001	261,740	27.00

Source: Census of India

75. According to the 2001 Census, the workforce participation rate (WPR) in Panipat was 32 percent. As shown in the following figure, 40 percent of the total workforce was engaged in industrial sector, followed by trade & commerce sector and other service sectors. Although declined, primary sector still provides employment to about 4 percent of the total workforce.

Figure 4: Occupational Structure



76. Majority of people in Panipat District (90 %) are Hindus and the remainder are mainly Muslims (6%), Sikhs (3%), Jains, Christians and Bhudhists. Over 90 percent of people speak Hindi, followed by Punjabi (~8 percent) and Urdu (~1 percent) and the reminder speak other languages. Locally, people prefer to converse in Hariyanvi – a dialect of Hindi language. A few also speak English.

2. History Culture and Tourism

77. Panipat has a rich historical background. According to Indian epic, the Mahabharata, Panipat was one of the five patas or prasthas (villages) which Pandavas demanded from Kauravas in the peace deal. Owing to its strategic location and favorable terrain with vast expanse of plain lands, Panipat was used as a Gateway to India by foreign invaders during the medieval period. Panipat was the great-battle field for three most important and decisive battles of Indian political history in 16th and 18th Centuries.

78. The First Battle of Panipat, was fought between Sultan of Delhi, Ibrahim Lodhi and Mughal invader, Zaheeruddin Babur in April 1526 AD. Babur won this decisive battle, Delhi and Agra passed into his hands laying the foundation for Mughal rule in India. The Second Battle of Panipat was fought in November 1556 AD between King Hemu and Akbar, who just succeeded Humayun to the throne of Delhi. Akbar won this battle that gave the final verdict in favour of the Mughals stabilizing its power in the region. The Third Battle of Panipat in January 1761 AD was fought between the Afghan invader Ahmed Shah Abdali and the Marathas, friends of the Mughal Emperor Shah Alam II. Due to various reasons, the Marathas lost the battle, which proved to be disastrous and the event marked the beginning of the downfall of the Mughals, and on the other hand there

was confrontation among the other Muslim rulers, which ultimately paved the way for the rise of British Raj in India.

79. The following are the monuments of national importance in Panipat and are under the protection of Archeological Survey of India.

(i) Kabuli Bagh Mosque: This mosque was built by Babur in 1528-29 AD after the first battle of Panipat to commemorate the Victory over Ibrahim Lodhi

(ii) Ibrahim Lodhi Tomb: This marks the final resting place of the last Sultan of Delhi, Ibrahim Lodhi, killed in first battle.

(iii) Obelisk Commemorating the Third Battle of Panipat (Kala Amb): This pillar marks the site of Black Mango Tree near which the third battle of Panipat was fought..

(iv) Baba-i-Faiz Gate: This gateway was built by Nawab Sadiq in 1733 AD is the main entrance to the Panipat Town.

(v) Kos Minars: In 1619 AD, Mughal Emperor Jahangir erected these Minars (tall brick structures stand on low square plotform and covered with plaster) at every Kos – (a running length of about 4.5 km) along the ancient imperial route from Agra to Lahore. There are two Kos Minars in Panipat.

80. Owing to its historical importance, Panipat attracts large number of tourists, throughout the year. In 2007, according to available estimates, a total of 444,663 tourists, including 590 foreign tourists, visited Panipat District. This is nearly 8 percent of total tourist inflow into Haryana State.

5. ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

A. Overview

81. As a general practice, 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 water supply system in Panipat.

B. Construction Impacts

82. Proposed water supply subproject involves the following:

(i) Construction of intake and intake canal
(ii) Construction of raw water sump
(iii) Construction of raw water pump house
(iv) Construction of Water Treatment Plant of 100 MLD capacity
(v) Construction of clear water sump
(vi) Construction of clear water pump house
(vii) Laying of ring pumping main (31.4 km of DI of diameter 300-900 mm)
(viii) Construction of 18 overhead service reservoirs
(ix) Rehabilitation of existing distribution network and expansion to new areas (replacement - 138 km of HDPE pipe of 110-450 mm diameter; new - 264 km of HDPE pipe of 110-400 mm diameter)
(x) Provision of 19 no.s bulk meters
(xi) Provision of consumer connections with meters

1. Construction Method

83. The intake canal, raw and clear water sump, raw and clear water pump houses and water treatment plant will be constructed on a selected site between the two canals. All these facilities will be constructed with in this site.

84. Canal intake will be developed by creating an opening in the existing canal, and installing a discharge gate. As the canal is owned and maintained by Irrigation Department of Government of Haryana, as per the procedure it will be constructed/installed by Irrigation Department and the cost will be borne the PWD - WSSD. Work will be carried out as per

the standard construction practices of Irrigation Department. Construction will be undertaken by isolating the construction area by constructing a coffer dam into one side of the canal, while the water can flow uninterrupted through the remaining section. This practice will avoid the closure of canal. Construction work will be completed in about a week.

85. An open intake channel of 2,000 mm wide and 800 mm deep will be constructed from the canal to raw water sump. Design and construction will be such that the water from canal will flow by gravity into the sump. A trench of size 1,000 mm deep and 2,500 mm wide will be created in ground using backhoe digger, and the base will be leveled and a Plain Cement Concrete bed of 150 mm thickness will be developed. Reinforcement bars will be arranged over the bed and in the wooden case for walls, and the concrete, mixed on the site using the mixers, will be poured into to form bed and walls of the canal. Subsequently, bottom and inside walls will be smoothened by applying cement mortar by hand.

86. Two rectangular underground sumps (raw and clear water) will be constructed in the premises. Construction would involve creation of large cavity using back hoe diggers. Reinforcing rods would be placed in wooden casing and the concrete will be poured into to form bottom, walls and top of the sump. Necessary opening on the top of the sumps will be left for operational purposes.

87. Raw and Clear Water Pump Houses (RWPH and CWPH) will be constructed over the respective sumps. This will involve construction of a room with brick masonry walls and RCC roof slab. Pumps, brought to the site on a truck, will be installed using cranes or manually.

88. Water Treatment Plant will involve construction of Following components.

Table 5-1: Components of Water Treatment Plant

S. No	WTP Component	Dimension Details
1	Cascade Aerator	8 m dia, 5 No. of Steps, 0.3 m rise of each Step
2	Collecting Launder	1 m (B) x 0.55 m (H)
3	Raw Water Outlet Channel	6 m (L) x 1 m x 1 m (D)
4	Parshall Flume	5.1 m (L) x 0.3 m (B) of Throat x 0.3 m (D)
5	Flash Mixer	2.3 m dia & 3.9 m (H)
6	Inlet & Outlet Chamber for Flash Mixer	1 m x 1 m each
7	Dia of Impeller & Size of Blades	0.9 m dia & 0.2 m x 0.50 m, 4 No.s.
8	Flocculator	15.5 m dia
9	Clariflocculator	35.4 m dia
10	Size of Launder	0.8m (D)x 0.8 m(D)
11	Sludge Well	1.7m dia & 6.2 m (D)
12	Clarified water channel to Filter House	5.0 m (L) x 1.2 m (B) x 0.8 m (D)
13	Size of each Filter Bed (12 No.s)	5 m (L) x 4.8 m (B) x 3.35 m (D)
14	Wash Water Channel	0.7 m x 0.5 m
15	Filtered Water Channel	1 m x 0.7 m

16	Size of each Trough (6 No.s.)	0.35 m (B) x 0.45 (D)
17	Size of Main Gutter	0.8 m (B) x 0.6 m (D)
18	Wash Water Storage Tank	1.4 LL
19	Chemical Solution for Alum (2 No.s.)	1.3 m x 1.3 m x 1.3 m each
20	Chemical Solution for Soda (2 No.s.)	1.9 m x 1.5 m x 1.3 m each
21	Chemical Solution for Lime (2 No.s.)	1.0 m x 0.8 m x 1.0 m each
22	Chemical House	12.5 m x 10 m
23	Filter House	20 m (L) x 15 m (B)

89. The pumping (ring main) from CWR to OHSRS and distribution mains from OHSRs will be buried in trenches adjacent to roads, in the un-used area within the ROW, at the edge of the road carriage way. The ring main will run along the main roads (Asandh Road, Jatal Road and Sanauli Road), where there is enough space for the pipeline. However the distribution mains will be located in roads and streets in the town, where in some places this area is occupied by drains or the edges of shops and houses etc, so to avoid damage to property some trenches may be dug into the edge of the road.

90. Trenches will be dug using a backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed alongside, and the pipes (brought to site on trucks and stored on unused land nearby) will be placed in the trench by hand or using a small rig for the larger diameter pipes. Pipes will be joined by hand, after which excavated soil will then be replaced manually on beneath, sides and top of the pipe and compacted by a vibrating compressor. Where trenches are dug into an existing roadway, the bitumen or concrete surface will be broken by hand-held pneumatic drills, after which the trench will be excavated by backhoe, and the appropriate surface will be reapplied on completion.

91. Pipes are normally covered by 1.2 m of soil, and a clearance of 150 mm is left between the pipe and each side of the trench to allow backfilling. The maximum and minimum trench sizes for pumping main will be 2 m deep and 1.2 m wide (for 900 mm dia pipe) and 1.5 m deep 0.6 m wide (300 mm dia pipe). Similarly for distribution network, the maximum and minimum trench sizes will be 1.6 m deep and 1.1 m wide (for 500 mm dia pipe) and 1.4 m deep and 0.6 m wide (110 mm dia pipe).

92. New pipes and connections to the distribution lines will be provided to repair faulty house connections, and these will run to individual dwellings in small hand-dug trenches, or on the surface. New or replacement consumer meters will be located outside houses, attached to a wall or set onto the ground.

93. The seventeen overhead reservoirs and a surface reservoir will be built on small plots of government land at various locations in the town. The cavity for the foundations for the overhead service reservoirs (OHSR) will be excavated by backhoe, with soil being loaded onto trucks for disposal. Aggregate and concrete will be tipped into each void to create the foundations and floor, after which metal reinforcing rods will be added to create the outline of the walls of the GR and the vertical supporting pillars. Sections of reinforcing will then be encased in wooden shuttering and concrete will be poured in, and this process will be repeated to gradually create each structure from RCC, including the tank of the reservoirs. Surfaces will be smoothed and finished where necessary by hand.

2. Impacts on Physical Resources

a. Generation of surplus soil and its disposal

94. The proposed waterworks campus comprising of intake canal, raw water and clear water sumps with pumping stations and water treatment plan, will be developed on a selected site of 4.25 ha on the western side of the town. Works require excavation for underground sumps and foundations for the water treatment plant. Excavation for the sumps is expected to generate about 12,700 m^3 of soil. Since the WTP is proposed to be constructed on Turnkey basis, the detailed component specifications and as well as earthwork quantities are not available at this stage. Based on rough estimates with concept design, earthwork work excavation will be in the range of 1,000 – 1,500 m^3.

95. Thus the total earthwork excavation will in the quantum of 13,700 – 14,200 m^3 in development waterworks campus. 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 site is located between two canals and is comparatively low lying, and therefore this quantity of soil will be utilized beneficially for raising the level of the campus, avoiding the need for disposal elsewhere.

96. Water pumping main and distribution pipeline 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 water supply lines will generate around 260,000 m3 of soil. After construction, a part of the trench will be occupied by the pipe and in the remaining portion excavated soil will be backfilled on beneath, top and sides of the pipes. This means that most of the soil will be retained for refilling the trench, and an estimated about 9,500 m3 of waste material will be left over. 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. Due to comparatively high road level than the adjacent areas, especially in newly developing areas, water accumulation is common during rains. Raising the ground-level during the construction is very common, and therefore the demand for soil high. Surplus soil shall be utilized for the following beneficial activities in order priority:

- Utilize for raising the ground-level of OHSR and waterworks sites
- Utilize in other construction activities implemented by government departments within Panipat
- Provide waste soil to local people for filling up low laying areas.

b. Interference with surface drains and groundwater table

97. The other physical impact commonly associated with large-scale excavation (effects on surface and groundwater drainage) should again be minimal by the fact that this work will be conducted in the dry season. As the depth of water table in the city is deep (about 25 m) the trench excavation may not interfere with the groundwater drainage. Rainfall in Panipat 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 pipelines. The contractor therefore shall implement the following:

- Avoid scheduling of excavation work during the monsoon months
- Complete pipe 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

c. Dust and noise generation from excavation & construction works

98. 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, and leveling on the ground. 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;
- Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process;
- Bring the material (aggregate) 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.
- In case of surplus soil is provided for other departments or private persons, it will be the responsibility of contractor to ensure that it proper handling, transport & utilization
- Use tarpaulins to cover loose material/soil that is transported to and from the site by truck
- Control dust generation while unloading the loose material (particularly aggregate) at the site by sprinkling water and unloading inside the barricaded area
- Clean wheels and undercarriage of haul trucks prior to leaving construction site

- Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition where loaders, support equipment and vehicles will operate
- Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing

99. In the town many of inner roads are of cement concrete. As most of these roads are narrow and there is no earthen shoulder available on the edge of the road to lay the pipeline, it is necessary that the pipes are laid into the road requiring cutting/breaking open of road surface. 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 come under risk due to the use of pneumatic drills
- Employ manual methods, where required

c. Loss of fertile top soil

100. Development of waterworks campus on agriculturally fertile land will lead to loss precious fertile top soil. Total area of the site is 4.25 ha. The top soil of about 1 ft depth (0.3 m) may removed and preserved separately for use within the site for plantations and the surplus soil may be given to surrounding farmers.

d. Mining for construction materials

101. Large quantities of construction material like sand and aggregate will be required for WTP and reservoir constructions. As the excavated soil will be used for refilling trenches, pipeline construction will require minor quantities. Normally material for Panipat is procured from mines - sand from Panchkula (Yamuna River), and aggregate from Panchkula and Bhiwani District. To avoid any impacts related to mining of material, the contractor will be required to obtain sand and other mining material required for construction only from quarries licensed by the Directorate of Geology and Mining, Government of Haryana.

3. Impact on Ecological Resources

102. There are no significant ecological resources in the town (protected areas or rare or important species or habitats), so the construction should have no ecological impacts. Tree cover in the town is very limited. Roadside trees should not be removed unnecessarily to lay pipelines, and to mitigate any such losses the Contractor should be required to plant and maintain two trees (of the same species) for each one that is removed.

4. Impact on Economic Development

a. Land acquisition & resettlement

103. The Waterworks Campus will be constructed over a private land of 4.25 ha, which is presently under agricultural use. The acquisition of private land is necessitated due to non-availability of vacant government land in and around Panipat. The site is located ideally adjacent to the canal for development of canal based waterworks. The PWD - WSSD identified this site subsequent to the announcement of Canal-based water supply scheme to Panipat by the Honorable Chief Minister of Haryana in January 2008. The Town Planning Department is in the process of amending the Development Plan to change the land use of identified site to public use for construction of WTP.

104. The 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.

105. Pipeline will be laid 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.

b. Impeded access and loss of business

106. During the laying of pumping main and distribution lines, particularly in narrow streets and streets with on street commercial activities, there may be temporary disruption or relocation of hawkers and vendors.

107. 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 each 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 necessary preparations;
- Requiring contractors employed to conduct these works to provide wooden planks across trenches for pedestrians and metal sheets where vehicle access is required;
- Increasing workforce to complete the work in a minimum possible time

c. Disruption to other infrastructure services

108. During the laying of water supply lines along the roads, various infrastructure 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 (electricity, telephone, etc) about the construction work and if there is any need for shifting
- Coordinate with respective agencies and 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
- During construction, the water supply service will be affected. In case of water supply being affected for more than a day, alternative water supply may be provided through mobile tankers.

109. Transport is another type of infrastructure that will be affected by the pipeline laying 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 pipes alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. Following measures can potentially avoid traffic disruptions:

- Conduct work during light traffic; explore night working schedule ensuring workers and public safety
- Plan work such that trench excavation, pipe 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 minimise 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 work 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.

110. 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

111. 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

a. Damage/disturbance to historical sites

112. There are few protected historical monuments in Panipat, and in general Panipat is an historic place. So there may be a risk that any work involving ground disturbance could uncover and damage archaeological and historical remains. There are monuments within the subproject area (Kabuli Bagh Mosque, Ibrahim Lodhi Tomb, Baba-i-Faiz Gate and Kos Minars). Works will not disturb these sites. these are located in the old city area, and where habitations are developed all-around long ago. Excavations for laying of pipelines within 300 m of sites requires permission from ASI. However, no impacts on these sites are anticipated considering the present development around the sites. However, it will be necessary to adopt a series of measures, to both avoid sensitive sites and recognize and protect any chance discoveries. These include:

- No infrastructure, except unavoidable water supply pipe lines, shall be constructed within the 300 m of sites.
- Obtain permission from ASI for laying of pipelines within 300 m of sites.
- Ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.
- If any chance finds are recognized, the Contractor should:
    - Stop work immediately to allow further investigation if any finds are suspected;
    - Inform PWD - WSSD; call in the ASI if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

113. The water pipeline work 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 earlier, 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.

b. Public & worker safety

114. 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);
- Maintaining accidents reports and records

115. There is a risk of contact with carcinogenic material when working with AC pipes. Most of the existing distribution lines of AC, and therefore the replacement works of which may cause risk of contact. Under the subproject, it is designed that where there is a need to replace the existing pipes, the AC pipes will left as it is in the ground and the new pipes will be laid adjacent. There are no new AC pipes proposed.

d. Economic benefit

116. 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 & Maintenance Impacts

117. Regular operation of water supply system involves water abstraction, water treatment including chlorine injection into water supplies, pumping to OHSRs, and water distribution to consumers.

118. With the proposed canal based (surface water) water supply system, the existing groundwater based system will be discontinued. The water supply will increase from present 51 MLD to 80 MLD and ultimately to 114 MLD.

1. Impacts on Physical Resources

119. One of the main risks of the water supply system improvement through increased abstraction is that the source will be used unsustainably, at a rate that is above the level of natural replenishment, and that the source becomes depleted as a result. The water will be sourced from DCLC, a major branch canal of West Jamuna Canal (WJC) system. The total extraction is about 2.2 % of total flow, and this will be within the limits of water allocated[2] to Panipat Water supply. Therefore no impacts on source sustainability envisaged. . It should also be noted that water conservation measures included in the subproject (in particular the replacement of leaking distribution mains and faulty house connections) should significantly reduce system losses, and thus limit the volume needed.

120. A main requirement for O&M will be regular operation of Water Treatment Plant (WTP) which involves various processes: pre-chlorination, alum dosing, flash mixing, flocculation, clarification, filtration, post-chlorination, wash water re-circulation and sludge disposal systems prechlorination, aeration, alum-mixing, flocculation, clarification, filtration, and disinfection. Water will flow in gravity from canal to raw water sump from where it is pumped to inlet chamber of the WTP. Water will flow in gravity from the inlet chamber through all components of WTP and finally the treated water flows into the clear water sump in the premises. Chemicals such as Alum and chlorine will be used in the treatment processes.

121. Water treatment process will generate waste, which will comprise of the following: (i) sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc; and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton.

122. In the project design, it is proposed to provide recirculation system for wash water. For this purpose, wash water will be collected in two open tanks for alternative use, with a storage capacity of one day wash water in each tank. The settled water will be pumped

[2] This canal based water supply system was initiated based on the announcement of the Chief Minister of Haryana State that sufficient water to meet the demand of Panipat will be provided from the Delhi Carrier Link Canal of West Jamuna Canal (WJC). PWD - WSSD has requested the Irrigation Department for allocation of water (200 MLD to meet the ultimate demand of 2041 design year) for municipal water supply in Panipat. This is presently under the consideration of the Department.

back into the Inlet chamber and re-circulated with the raw water. Sludge from these tanks and also from the clarifier will be collected in a sludge tank. Sludge from the tanks will be sent to sludge drying beds, and the dried sludge will be sent either for land filling or used as soil conditioner.

123. Another main requirement for maintenance of the water supply infrastructure will be for the detection and repair of leaks. The usage of good quality new pipes should mean that pipeline breaks are very rare, and that leaks will be minimal. The repair of household connections and the provision of new connections to increase the number of people supplied should greatly reduce the incidence of illegal connections, which are often a major source of leaks. Leaks will be detected and rectified during operation phase. Repairs will be conducted in essentially the same way that the pipes were laid. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary.

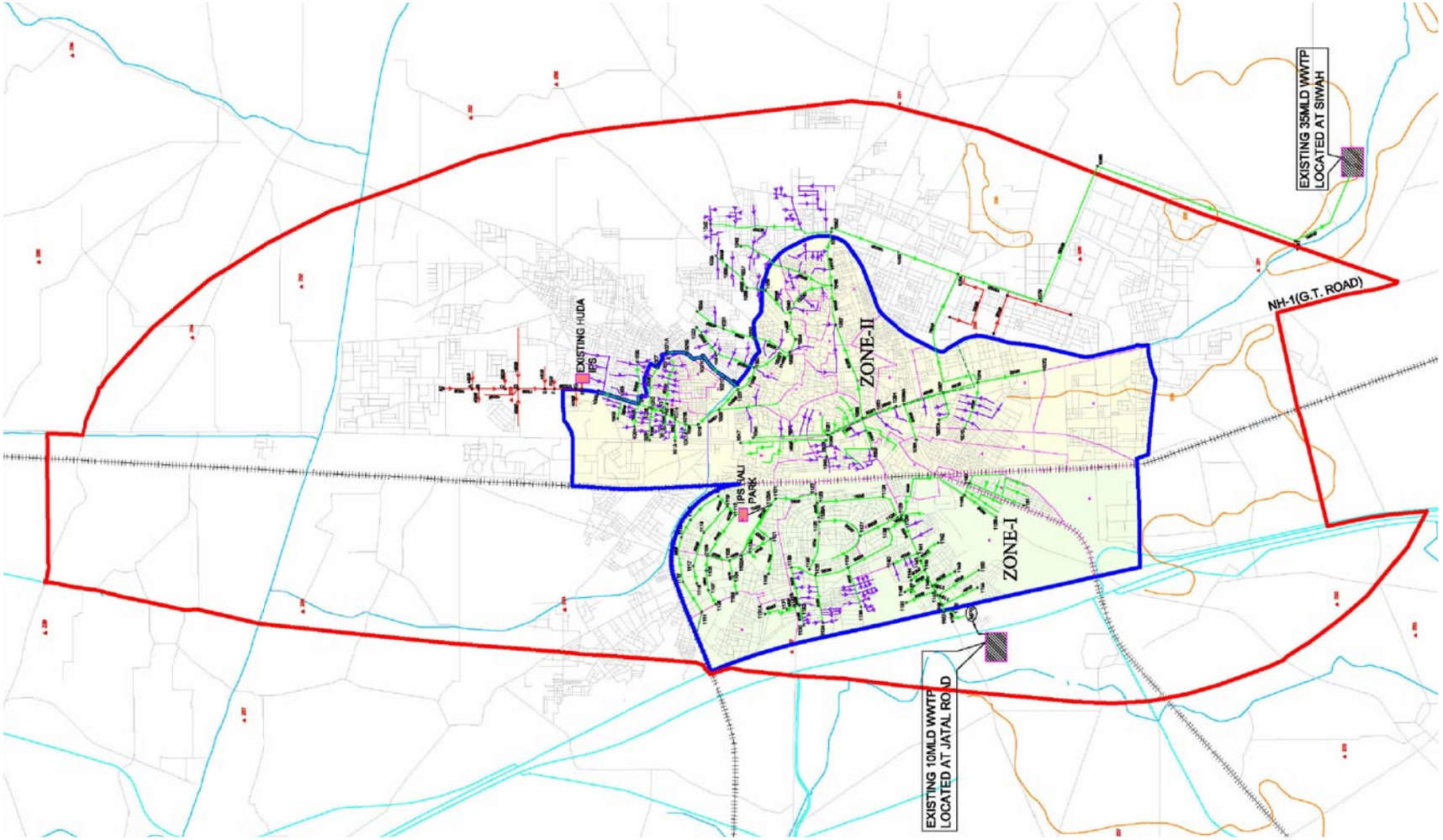
124. An important aspect of increased water supply is that of increased sewage generation, which needs to be treated and disposed properly without causing any impacts. With the current rate of water supply, without the project the gross water supply to the sub-project area is 51.6 MLD. With the project this will increase to 80 MLD and ultimately to 114 MLD. The sewage generation (85 percent of net water supply at consumer end) with the current situation will be 31.4 MLD, while with the project implementation same will increase to 57 MLD and ultimately to 81.5 MLD.

125. Underground sewerage system in Panipat was mostly developed under Yamuna Action Plan I, a GoI sponsored program to abate the pollution of River Yamuna. At present, in the subproject area (18 zones), the underground sewerage system is available in 16 zones (coverage10 to 100 %). The sewerage system in Zones 1,2,9, 10 and 11 covers entire zone areas. While the zones 3,5,6,7,8,12,13,14,15,16,17 and 18 have partial sewerage system (10 to 75 % coverage), Zone 4 and Zone 6 are not provided with sewerage system (**Map 5-1**). Overall, about 46 percent of the subproject area is covered with sewerage system. In the uncovered areas , septic tanks and open drains serve the purpose. At present there are two STPs of total capacity 45 MLD to treat and dispose the sewage to acceptable standards. Due to lack of proper industrial wastewater collection and treatment system, most of the untreated or partially treated wastewater is let off illegally into open drains as well as into underground sewerage system, due to which the STPs are often overloaded and the treatment efficiency declines considerably.

126. It is therefore necessary that (i) the sewerage system is extended to uncovered areas; (ii) the illegal entry of untreated/partially treated industrial wastewater into open drains and sewers is controlled, and (iii) sewage treatment capacity is gradually increased to meet the demand. Considering these issues, under Yamuna Action Plan II, Sewerage Master Plan of Panipat was prepared in 2006 The PWD - WSSD shall implement the Sewerage Master Plan along with the Water Supply Master Plan.

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

Panipat
Existing Sewerage Zone



Client

Asian Development Bank
National Capital Region Planning Board

Consultant

WIlbur Smlth Associates

Drawn:SK	Checked: NSS
Date: April 2010	Approved: NSS
Scale: NTS	

Map 5-1

127. In the consultation meeting conducted in Panipat as part of this IEE preparation, the stakeholders were concerned about the sewerage system in the town, and requested the implementing agency to implement the sewerage system master plan along with water supply master plan. The implementing agency replied that it will be implemented under the Yamuna Action Plan of Government of India.

2. Impacts on Ecological Resources

128. As there are no significant ecological resources in or around the town, any repairs or maintenance work and regular operation of WTP can be conducted without ecological impacts. The WTP design includes necessary facilities for safe disposal of back wash water (recirculation) and sludge (sludge drying beds), and therefore no impacts are anticipated.

129. The sewerage system needs immediate expansion and improvement not only to cater the present situation but also for the increased sewage generation resulting from implementation of this subproject. The current sewerage system facing problems in terms of coverage and entry of untreated/partially treated industrial effluent, etc. In uncovered areas, domestic and industrial wastewater illegally enters into the open drains and flows into Panipat Drain, which joins River Yamuna. It is therefore important to improve the sewerage system and control the entry of industrial wastewater into sewers and open drains to protect the environment.

130. A major ecological benefit of this project will be on groundwater regime. As presented in the baseline section, groundwater in and around Panipat is over exploited and in some areas the quality has become poor. This subproject is designed with surface water (an artificial canal) as source, eliminating the dependence on groundwater.

3. Impacts on Economical Development

131. Although network repairs could result in shops losing some business if the work means that access is difficult for customers, any losses will be small and short-lived and will probably be at the level of normal business fluctuations. Nevertheless, 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;
- Consulting the Traffic 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.

4. Impacts on Social and Cultural Resources

132. The operation & maintenance work will confine to within the facilities footprint, and no new areas will be disturbed or excavated. Therefore there are no likely impacts or risks.

133. The citizens of the town will be the major beneficiaries of the improved water supply, as they will be provided with a constant supply of better quality water, piped into their homes. This should improve the social capital of the city, and individual and community health and well-being. Diseases of poor sanitation, such as diarrhea 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.

6. INSTITUTIONAL ARRANGEMENTS

A. Institutional Arrangements

134. Following agencies will be involved in implementing this Water Supply Subproject in Panipat:

(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 Public Works Department – Water Supply & Sanitation Division (PWD-WSSD). 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.

135. Implementing the project according to and incompliance 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.

136. *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

137. The proposed subproject and its components, the baseline environmental profile of the subproject area, the anticipated environmental impacts and appropriate mitigation measures to avoid/ reduce/ mitigate/compensate for the identified impacts have been discussed in detailed in earlier sections.

138. An Environmental Management Plan is developed for implementation listing the impacts, appropriate mitigation measures, delegating the responsibility of implementation to concerned agencies. This is shown in the following **Table 7-1**.

139. 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 ESMC of NCRPB. Monitoring during operation stage will be conducted by the Operating Agency.

140. Most of the mitigation measures are fairly standard methods of minimizing 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.

106. **Table 12** 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	Cost
Preconstruction						
Land acquisition and involuntary relocation: *Description*: Acquisition of 4.25 ha of land for WTP, and 900 sq. m (0.09 ha) of land for construction of OHSR in zone 6.	M	P	• Implement compensatory measures as recommended by the Resettlement Plan prepared in compliance with NCRPB ESMS • Land acquisition and resettlement measures must be implemented before the signing of contract for civil works	PWD - WSSD	WTP Site	Part of RP Cost
Impacts due to increased water extraction and change in source. The subproject is designed with, Delhi Parallel Branch Canal, flowing through Panipat as source. The current source of groundwater, which is depleting & degrading fast, will be discontinued. *Description*: The estimated demand of Panipat is 113 MLD (2011), 130 MLD (2026) and 196 MLD (2041). This subproject will cater to 18 of 31 zones with a demand of 60 MLD (2011), 80 MLD (2026) and 114 MLD (2041). PWD - WSSD already initiated the process with Irrigation Department for allocating water (100 cusecs ~ 200 MLD to meet the ultimate demand of town) to Panipat. Considering the need, the canal-based water supply system for Panipat was announced by Honorable Chief Minister of Haryana, and therefore there will not be any problem in water allocation. There will not be any impacts as the water allocation	I	P	• Obtain State government's (Irrigation Department) allocation and approval for width drawl of 100 cusecs (~200 MLD) to meet the ultimate demand of 2041. This shall be obtained before acquisition of land for waterworks site • All existing tube wells of PWD - WSSD in 18 zones must be closed once the canal-based system is functional • All tube wells used by individual households must also be closed. Although PWD - WSSD has no control, it shall liaison with Groundwater & mines department and district administration to encourage users to close down.	PWD - WSSD	NA	-

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
will be from state's share and the proposed withdrawal is just 2.2 % of total flow in the canal.						
Risks of non-availability of water due closure of canal (scheduled or unscheduled); *Description*: This risk could have been avoided by providing raw water storage. But there are two parallel canals and there is no history of both the canals closing down at same time. Further Delhi is depends on these canals and there is no raw water storage. Therefore, there is no perceived risk of non-availability of water.	L	P	• Obtain permission to allow withdrawal from both the canals to account for emergencies • Primary allocation can be obtained from one canal (DPB) but provision of withdrawal from the other canal (DCLC) must be obtained from the Irrigation Department in case of emergencies.	PWD - WSSD	NA	-
Construction						
Excavation will produce large quantity of waste soil, which needs proper disposal. *Description*. Laying of pumping mains and distribution network is estimated to produce about 9,500 m3 of waste soil, which needs proper disposal. This soil however will not be produced at one location but spread over 18 zones in the City. Comparatively, construction of WTP, raw & clear water sumps, and 18 storage reservoirs will generate much lesser quantity, which will be utilized to raise the ground level at the respective sites. Due to flat terrain and comparatively high road level in newly developing areas, water accumulation is common during rains. Raising	L	P	Utilize surplus soil for following activities in order priority: • Utilize for raising the ground-level of OHSR and waterworks sites • Utilize in other construction activities implemented by government departments within Panipat • Provide waste soil to local people for filling up low laying areas.	CC	Pumping main & distribution network sites	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
the ground-level during the construction is very common, and therefore the demand for soil is high.						
Water accumulation in trenches during rains and related impacts	L	T	• Avoid scheduling of excavation work during the monsoon months • Complete pipe 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	CC	All construction sites	Part of standard contract
Dust nuisance due to construction *Description*. Earthwork excavation, refilling, handling and transportation of construction materials (like sand and aggregate), and handling, transportation and disposal of waste soil will produce dust if it is not done properly. Total quantity of earthwork involved in laying/replacing of distribution and rising main is about 260,000 m^3, including 9,500 m^3 of surplus soil for disposal.	M	T	• Cover or damp down by water spray on the excavated mounds of soil to control dust generation; • Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process; • Bring the material (aggregate) as and when required; • Ensure speedy completion of work – trench excavation, laying of pipe 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. • In case of surplus soil is provided for other departments or private persons, it will be the responsibility of contractor to ensure that it proper handling, transport & utilization • Use tarpaulins to cover loose material/soil that is transported to and from the site by truck	CC	All construction sites	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
			• Control dust generation while unloading the loose material (particularly aggregate) at the site by sprinkling water and unloading inside the barricaded area • Clean wheels and undercarriage of haul trucks prior to leaving construction site • Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition where loaders, support equipment and vehicles will operate • Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing			
Generation of noise and vibrations from excavation *Description*. High noise/vibration activities like rock blasting/pile construction are not anticipated. However, activities like breaking of CC/BT road surface using pneumatic drillers for laying pipelines may creates noise & vibration	L	T	• 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	Pumping main, distribution network & OHSR sites	Part of standard contract
Loss of fertile top soil *Description*. Development of waterworks campus on agriculturally fertile land (4 ha) will lead to loss precious fertile top soil.			• Remove the top soil for a depth of 0.3 m (1 feet) and stock separately • This may be used within the site or on demand it may be provided to local farmers	CC	WTP site	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
Cutting of trees *Description*. Road side trees are limited to few areas like model town. Pipelines will be laid avoiding trees; alignment will be altered slightly to save the trees, wherever possible during the work. There are no trees in reservoir sites. There are few trees in WTP site, which may need to cut.	L	P	• No trees shall be cut/pruned for laying pipeline • Only remove trees if it cannot be avoided at WTP site • Plant and maintain two trees for every one removed	CC	All construction sites	Part of standard contract
Impacts due to improper mining for construction materials *Description*. Large quantities of construction material like sand and aggregate will be required for WTP and reservoir constructions. As the excavated soil will be used for refilling trenches, pipeline construction will require minor quantities. Normally material for Panipat is procured from licensed mines - sand from Panchkula (Yamuna River), and aggregate from Panchkula and Bhiwani District.	L	P	• Ensure that construction materials (sand, aggregate and gravel) are obtained from quarries licensed by GoH (Directorate of Geology and Mining).	CC	NA	Part of standard contract
Shops and other business may loose income if costumer's access is impeded *Description*. Panipat is a commercial, trade & industrial town. There are a number of establishments in old city area (Zones 9, 10, 11, 12). Most of the old town area has narrow and congested roads.	L	T	• Consult local people: inform them of work in advance • 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	CC	Pumping main & distribution network sites	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
Excavation could damage existing infrastructure *Description*. Water supply lines will be laid along/within the road avoiding sewers, telephone/electricity infrastructure. As in most of the areas, water supply lines already exist, and therefore there is no major interference with the other infrastructure. But it cannot be altogether avoided.	L	P	• Identify the services to be affected in each zone • Coordinate with respective agencies (PWD - WSSD – sewerage section; telephone & electricity department) 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	PWD - WSSD & CC	Pumping main & distribution network sites	Part of standard contract
Traffic, people and activities could be disturbed due to laying of water supply lines *Description*. The roads in old city are very narrow. Commercial activity is very dominant, and roads congested with traffic and people. Construction work will affect the people, activities and business.	M	T	• Provide information to the public through media – daily news papers and local cable television (TV) services, about the work (nature & schedule) likely disturbances, and need and schedule of road closure if any, and alternative routes. This shall provide locality/zone-wise information (where &when the work will be taken up and when it will be completed) • Ensure that the work is completed as scheduled; ensure that well experienced contractors are engaged and discourage delays by suitable penalties built into the contracts • Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time • Avoid complete closure of road; ensure that work is conducted onto edge of the road; allow traffic to move on one line	CC	Pumping main & distribution network sites	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
			• Do not deploy heavy/large equipment, which will occupy & disturb traffic/people movement; if necessary use only during light traffic hours (6 AM – 10 AM) • In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions • 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	• Plan routes to avoid narrow streets, congested roads, and places of religious importance • Plan work to avoid peak traffic hours	PWD - WSSD & CC	All construction sites	Part of standard contract
Sites of archeological remains & monuments may be distributed *Description*. There are monuments within the subproject area (Kabuli Bagh Mosque, Ibrahim Lodhi Tomb, Baba-i-Faiz Gate and Kos Minars). Works will not disturb these sites. However, these are located in the old city area, and where habitations are developed all-around long ago. Excavations for laying of pipelines within 300 m of sites requires permission from ASI. However, no impacts on these sites are anticipated considering the present	L	T	• No infrastructure, except unavoidable water supply pipe lines, shall be constructed within the 300 m of sites. • Obtain permission from ASI for laying of pipelines within 300 m of sites. • Ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. • If any chance finds are recognized, the Contractor should: o Stop work immediately to allow further investigation if any finds are	PWD - WSSD & CC	Pumping main & distribution network sites	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
development around the sites.			suspected; o Inform PWD - WSSD; call in the ASI if a find is suspected, and taking any action they require to ensure its removal or protection in situ.			
Site of social/cultural importance (schools, hospitals and religious places) may be distributed by noise, dust, and impeded access during laying of pipelines. *Description*. In addition to ASI monuments listed above, there are a number of schools, religious places of local importance.	L	T	• avoid work at sensitive times, such as religious and cultural festivals • Remove waste quickly, cover/spray stockpiles, cover soil/sand on trucks • Increase workforce to finish work quickly • 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	
Workers and public at risk from accidents on site *Description*. Excavations for distribution lines will be mostly limited to 1.1 m except few which may 1.4 m deep. Rising main – 1.3 m to 2 m. Excavations for foundations (WTP and reservoirs) may go to a depth of 5-10 m. Public will be at risk as trenches for pipelines will be located along the roads.	M	T	• Follow standard and safe procedures for all activities – such as provision of shoring in trenches of 2 m or more • 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 – enclose the construction area, provide warning/sign boards • Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks etc); • Report accident and maintain records	CC	All construction sites	Part of standard contract
Economic benefits for people employed in workforce	L	T	• Ensure that most of the workforce is from local communities	CC	All sites	-

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
Operation and Maintenance						
Pollution and health risk due to indiscriminate disposal of backwash water & sludge. *Description*. It is designed to recirculate backwash water. Sludge is collected in sludge tanks (2 tanks for alternative use), and dried and disposed in sand drying beds in the site. Sludge can be used as soil conditioner. Operation manual will be provided for operation & maintenance of WTP including backwash & sludge handling & treatment.	L	P	• Operate WTP promptly with standard procedures as per the operating manual to be developed by the WTP contractor • Conduct periodic testing of sludge ensure that it is harmless and can be used as soil conditioner	PWD - WSSD	WTP site	
Pollution of water source & delivery of unsafe water to consumers due to WTP malfunction *Description*. This canal is a main branch of West Jamuna Canal System originating from Tejewala Barrage across Yamuna River. This is also a source of water to Delhi and is the major source of water supply for irrigation, industrial and irrigation purposes in several states. Yamuna River has a very large catchment. The water quality of canals is monitored by Pollution Control Board. Water quality of canals meet the criteria - "fit for drinking after conventional treatment." As part of the project design, a water quality testing laboratory will be set-up within the WTP to check the raw water quality and treated water quality daily at regular intervals.	L	P	• Ensure regular water quality monitoring • Liaison with Haryana State Pollution Control Board and obtain canal water quality data regularly • Ensure operation of WTP as per standard procedures • Conducting random monitoring of water quality at storage reservoirs and at consumer end	PWD - WSSD	NA	Part of project design

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
Increased sewage generation due to increased water supply *Description*. Currently average per capita water supply is 100 lpcd, which will increase to 135 lpcd with implementation of this subproject. Sewage generation in 18 zones will go up from present 25 MLD (2009) to 42 MLD (2011), 57 MLD (2026) and 82 MLD (2041). At present about 46 % of the project area (18 zones) is covered with sewerage system. Sewerage system however is not in good condition	M	P	• Provide sewerage system on priority to the entire project area • Implement sewerage master plan of Panipat prepared under Yamuna Action Plan	PWD - WSSD	Project area	-
Potential health & safety risk due to handing & application of chlorine in WTP *Description*. Large volumes of chlorine will be stored and used for disinfection of water in the WTP. Chlorination plant will be developed with all safety features and equipment to meet with any accidental eventuality. These include: mechanical container handling facility, chlorine neutralization pit with a lime slurry feeder, facility isolation plan, and alarm systems to detect chlorine gas leakage. Operation manual will be provided for chlorinators for O&M and repairs.	M	P	• Operate chlorinators promptly with standard procedures as per the operating manual of manufacturer • Provide necessary personal protection equipment to the staff • Provide training in operation & maintenance of WTP. The Turnkey contract for WTP shall include staff training.	PWD - WSSD	WTP site	Part of project design
Power consumption *Description*. The annual power consumption of raw & clear water pumping stations is estimated as 0.14 million KWH and 1.71 million KWH units respectively. No estimate	L	P	• Ensure operation and maintenance as per the standard procedures of the manufacturers • Replace pumps & motors for every 15 years	PWD - WSSD	WTP site	Part of project design

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
of WTP power is available at this stage. All pumps will be designed & procured for maximum efficiency. Regular and prompt maintenance and replacement after 15 years will be ensured. Entire bulk water supply system will be operated via SCADA to increase the efficiency and reduce the power consumption among others						
Disturbance to people, traffic and activities due to repair & replacement of sewers especially near schools, hospitals, temples, etc.	I	T	• Consult people – inform about work nature and schedule • Provide walkways and metal sheets to maintain access across trenches for people and vehicles where required	PWD - WSSD	Pumping main & distribution network sites	Routine O&M

ASI – Archeological Survey of India; CC – Construction Contractor; I - Insignificant; L- Low; M – Medium; PWD-WSSD –Public Works Department – Water Supply & Sanitation Division; O&M – Operation & Maintenance; P – Permenant; T – Temporary; SCADA – Supervisory Control & Data Acquisition

Table 7-2: Environmental Monitoring Plan

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost
• Implement compensatory measures as recommended by the RP • Implement LA and R&R measures before the signing of contract	WTP Site	PWD - WSSD	PWD - WSSD records; PAPs interview	As needed	NCRPB	Part of RP implementation cost
• Obtain water allocation from WJC canal 100 cusecs • All existing tube wells of PWD - WSSD in 18 zones must be closed once the canal-based system is functional • All tube wells used by individual households must also be closed.	NA	PWD - WSSD	PWD - WSSD records Household survey	As needed before LA As needed after start of new system After 1 year of operation	NCRPB	Part of project management costs
• Obtain permission to allow withdrawal from both the canals (primary allocation from one canal, and other for emergencies)	NA	PWD - WSSD	PWD - WSSD Records	As needed before start of civil works	NCRPB	Part of project management costs
Construction						
Utilize surplus soil for following activities in order priority: • Utilize for raising the ground-level of construction sites • Utilize in other construction works of other departments within Panipat • Provide to local people for filling up low laying areas.	Pumping main & distribution network sites	CC	Observations on-site/off-site; CC records;	Weekly	PWD - WSSD	Part of construction supervision costs

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost
• Avoid scheduling of excavation work during monsoon • Complete work in excavated stretches before monsoon • Regulate drainage by earthen bunds, if required • Cover or damp down soil mounds to control dust • Apply water prior to leveling/ any earth moving activity • Bring the material (aggregate) as and when required • Ensure speedy completion of work • Use tarpaulins to cover loose material in transport • In case of surplus soil is provided for other departments or private persons, it will be the responsibility of contractor to ensure that it proper handling, transport & utilization • Use tarpaulins to cover loose material/soil that is transported to and from the site by truck • Control dust generation while unloading the loose material (particularly aggregate) at the site by sprinkling water and unloading inside the barricaded area • Clean wheels and undercarriage of haul trucks prior to leaving construction site • Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition where loaders, support equipment and vehicles will operate • Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing	All construction sites	CC	Observations on-site/off-site; CC records;	Weekly	PWD - WSSD	Part of construction supervision costs
• Provide prior information to the local public about the work • Do not conduct noise generating activities in the night • Do not use pneumatic drills near old and sensitive	Pumping main, distribution network & OHSR sites	CC	Observations on-site/off-site; people interviews; CC records	Weekly	PWD - WSSD	Part of construction supervision costs

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost
buildings • Employ manual methods, where required						
• No trees shall be cut/pruned for laying pipeline • Only remove trees if it cannot be avoided at WTP site • Plant and maintain two trees for every one removed	All construction sites	CC	On-site observation; CC records	Weekly	PWD - WSSD	Part of construction supervision costs
• Procure construction material from licensed quarries	NA	PWD - WSSD	CC Records	Weekly	PWD - WSSD	Part of construction supervision costs
• Consult local people: inform them of work in advance • Leave spaces for access between mounds of soil • Provide walkways and metal sheets over trenches • Increase workforce in these areas to finish work quickly	Pumping main & distribution network sites	CC	Observations on-site/off-site; people interviews; CC records	Weekly	PWD - WSSD	
• Identify the services to be affected in each zone • Coordinate with respective agencies (PWD - WSSD – sewerage section; telephone & electricity department) • Provide prior public information • Provide alternate arrangements for disturbed services	Pumping main & distribution network sites	PWD - WSSD & CC	Observations on-site/off-site; people interviews; CC records	Weekly	PWD - WSSD	Part of construction supervision costs
• Provide information to the public • Ensure that the work is completed as scheduled; and discourage delays by suitable penalties built into the contracts • Plan to complete work in minimum time (excavation to refill) • Avoid complete closure of road; allow one-line traffic • Do not deploy heavy/large equipment in narrow streets,; if necessary use only during light traffic hours (6 AM – 10 AM)	Pumping main & distribution network sites	CC & PWD - WSSD	Observations on-site/off-site; people interviews; CC records	Weekly	PWD - WSSD	Part of construction supervision costs

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost
• Provide alternative routes in case of road closures • Provide public information/caution boards at all sites						
• Avoid narrow streets/ congested areas/sensitive areas for material transport • Plan work to avoid peak traffic hours	All construction sites	PWD - WSSD & CC	Observations on-site/off-site; CC records	Weekly	PWD - WSSD	Part of construction supervision costs
• Obtain ASI permission for laying of pipelines in regulated area • Ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. • If any chance finds are recognized, the contractor should stop work immediately; inform PWD - WSSD; call in the ASI.	Pumping main & distribution network sites	PWD - WSSD & CC	Observations on-site; CC records; interview with ASI staff	As needed	NCRPB	Part of construction supervision costs
• avoid work at sensitive times (religious/cultural festivals) • Remove waste quickly, cover soil/sand on trucks • Increase workforce to finish work quickly • Use wooded planks and metal sheets to allow access • Use modern vehicles/machinery & maintain as specified	Pumping main & distribution network sites	CC	Observations on-site/off-site; people interviews; CC records	Weekly	PWD - WSSD	Part of construction supervision costs
• Follow standard and safe procedures for all activities • Consulting the town authorities to identify any buildings at risk • Enclosing the construction area, provide warning/sign boards • Provided Personal Protective Equipment to workers • On/off-site Health and Safety Training for all site personnel; • Report accidental and maintain records	All construction sites	CC	Observations on-site; worker interviews; CC records	Weekly	PWD - WSSD	Part of construction supervision costs

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost
• Ensure that most of the workforce is from local communities	All sites	CC	Worker interviews; CC records	Randomly	PWD - WSSD	Part of construction supervision costs
• Water quality monitoring of DCLC and DPB	Monitoring point just downstream of WTP construction site	Contractor	pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, Total Alkalnity	Once before start of construction Quarterly during construction (4-times a year)	Contractor	Part of EMP costs
Operation Stage						
• Conduct periodic sludge testing	WTP	Operating Agency	Electric Conductivity, Moisture Content, % of organic carbon, Iron (Fe), Aluminum (Al)	Yearly Once	PWD - WSSD	Part of laboratory O&M Costs
• Conducting regular monitoring of water quality	WTP	Operating Agency	pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, Total Alkalnity	Daily	PWD - WSSD	
	All OHSRs	Operating Agency	pH, Cl, F, NO3, TC,	Monthly once	PWD - WSSD	Part of laboratory

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost
			FC, Hardness, Turbidity BOD, Total Alkalnity			O&M Costs
	Consumer end- random sampling in all zones	PWD - WSSD	pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, Total Alkalnity	Yearly once	-	Part of laboratory O&M Costs

ASI – Archeological Survey of India; CC – Construction Contractor; O&M – Operation & Maintenance; PWD-WSSD –Public Works Department – Water Supply & Sanitation Division

B. Environmental Management and Monitoring Costs

141. 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. Additional costs required for environmental quality monitoring is 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**
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
Canal water quality monitoring (two canals)	Quarterly monitoring 9x2 samples	45,000
II Operation & Maintenance Phase		
Regular water quality monitoring	Daily sampling	Part of laboratory O&M costs
Random quality testing at consumer end in all zones	Yearly once	Part of laboratory O&M costs

8. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project Stakeholders

142. 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
- Panipat Municipality;
- PWD - WSSD

143. Secondary stakeholders are:

- 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
- NCRPB as the funding agency

B. Consultation and Disclosure

144. A series of public consultation meetings were conducted during the project preparation. Various forms of public consultations (consultation through household surveys, ad hoc discussions on site and town-level consultation) have been used to discuss the project and involve the community in planning the project and mitigation measures. IEE is disclosed to public. Draft IEE will be placed in the NCRPB web-site to allow larger public consultation.

145. A town level safeguards disclosure and consultation meeting was organized in Panipat on August 31, 2009. Elected representatives of Panipat Municipality, prominent citizens, and officials of PWD - WSSD, Panipat and NCRPB attended the meeting. A total of 24 participants attended the meeting. Photos and the list of participants of consultation meeting are at Appendix 1. Following are the comments/suggestions of the participants:

- The TA Team briefed the participants about the proposed water supply project in Panipat and safeguard issues

- All the stakeholders were supportive of the project and indicated their willingness to participate to make it successful. They were of the view that the project will benefit all sections of people including the urban poor.
- Stakeholder were concerned about the groundwater depletion; the team indicated that present project is formulated with surface water source (WJC Branch), and therefore will avoid use of depleting ground water
- There were large scale concerns raised by stakeholders about the indiscriminate discharge of untreated industrial effluents into drains and degradation groundwater quality.
- A participant was of the view that along with water supply, sewerage system must be improved. Currently, although system is available in many parts, it is not functioning well. City has become unhealthy.
- For the above comment, PWD - WSSD indicated that the sewerage work is being taken up under the Government of India sponsored Yamuna Action Plan II. Currently this project is under preparation and therefore not included in the present project. TA Team indicated to the participants that this issue was discussed with the PWD - WSSD, and because it is being taken up under other project the same is not considered, and water supply is taken. TA Team also indicated that these concerns are included in the IEE Report.
- All participants are of the view that the project shall be taken up immediately.

9. RECOMMENDATION AND CONCLUSION

A. Recommendation

146. The process described in this document has assessed the environmental impacts of all elements of the infrastructure of the Panipat Water Supply 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:

- Design of surface water (canal) based water supply system replacing the existing unsustainable groundwater based system
- Decommissioning of existing tube wells as soon as the new system becomes operational
- Locating rising main pipeline, and main pipelines and branches of the distribution network within the ROW of existing roads, to avoid the need to acquire land or relocate people;
- •Locating pipelines on unused land adjacent to roads wherever possible, to avoid damaging roads and disrupting traffic and other activities
- Locating OHSRs on government lands to avoid the needs to acquire private land

147. 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 need to acquire land for building certain infrastructure, because of the invasive nature of trenching work; because the distribution network is located in an urban area, some parts of which are densely populated. Because of these factors there are impacts on the physical, social and human environment. Following are some of the important mitigation measures suggested:

- Implementation compensatory measures as recommended by the Resettlement Plan prepared in compliance with NCRPB ESMS
- Condition that the land acquisition and resettlement measures must be implemented before the signing of contract for civil works
- Obtaining permission for water withdrawal from both the canals (Delhi Carrier Link Canal and Delhi Parallel Brach Canal) to account for emergencies

148. During the construction phase, impacts mainly arise from generation of dust from soil excavation and refilling; and from the disturbance of residents, businesses, traffic and important buildings 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 main roads. Various appropriate measures are suggested:

- Damp down soil (by water sprinkling) to reduce dust
- Bringing the construction material as and when required to the site; avoid temporary storage, and covering soil with tarpaulins when carried on trucks
- Providing information to the public through media, about the work, likely disturbances, and need and schedule of road closure if any, and alternative routes.
- Providing public information/caution boards at all work sites
- Ensuring that the work is completed as scheduled; ensuring that well experienced contractors are engaged and delays discouraged
- Planning work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time
- Avoiding complete closure of road by conducting work onto edge of the road;
- Employing manual excavation methods, where required
- Leaving spaces for access between mounds of soil; providing walkways and metal sheets to maintain access across trenches for people and vehicles where required
- Careful planning of transportation routes with the Panipat Municipality and Traffic Police; scheduling the transportation of waste to avoid peak traffic periods
- Following standard and safe procedures for all construction activities

127. Once the system is operating, most facilities will operate with routine maintenance, which should not affect the environment. Measures required for safe handling chlorinators, collection, treatment and disposal of wash water and sludge, facilities for monitoring the quality of raw and treated water are already included in the WTP design.

128. The main beneficiaries of the improved system will be the citizens of Panipat, who will be provided with a constant supply of better quality water, which serves a greater proportion 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.

129. 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, and any requirements for remedial action will be reported to the NCRPB.

130. Stakeholders were involved in developing the IEE through both face-to-face discussions on site and a large public meeting held in the town, after which views expressed were incorporated into the IEE and the planning and development of the project.

131. There are two essential recommendations that need to be followed to ensure that the

environmental impacts of the project are successfully mitigated. The IA shall ensure that:

- All mitigation, compensation and enhancement measures proposed in this IEE report and in the Resettlement Plan (RP) of the subproject are implemented in full, as described in these two documents;
- The Environmental Monitoring Plan proposed this report and monitoring proposed in the Resettlement Plan are also implemented in full.

B. Conclusion

132. The environmental impacts of the proposed water supply subproject in Panipat have been assessed by the Initial Environmental Examination reported in this document, conducted according to NCRPB ESMS. 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.

133. 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.

134. There are no uncertainties in the analysis, and no additional work is required to comply with NCRPB procedure or national law. There is thus no need for further study or Environmental Assessment.

Appendix 1: Photos and List of Participants of Consultation Workshop at Panipat on 31-August-2009

Photo 1: TA Team explaining the project to the stakeholders

Photo 2: Participants in a sharing their views

Photo 3: Participants

(TA No. 7055-IND)-Capacity Development of the National Capital Region Planning Board (NCRPB) – Component B – Sub Project Water Supply System in Panipat City

Attendance for Public Consultations

Date: 31.08.09

Venue- R.H. Panipat

Sl. No	NAME	DESIGNATION	ORGANISATION	SIGNATURE
1	SUNIL KUMAR	M.C W.N4		
2				
3.	S.K Vats.	E.D.	M.C. Panipat	
4.	MUKESH Tiwari	Chairman I.T.P	Improvement TRUST PNP	
5.	Mohan Saluja	Social Worker		
6	Rajinder Sharma	M C.	M C PNP	
7		M. C.	ward 3	

2

(TA No. 7055-IND)-Capacity Development of the National Capital Region Planning Board (NCRPB) – Component B – Sub Project Water Supply System in Panipat City

Attendance for Public Consultations

Date: 31.08.09

Venue- R.H. Panipat

Sl. No	NAME	DESIGNATION	ORGANISATION	SIGNATURE
8	R. D. Sheela	A.E. I.T. Pnp	Imp. Trust	[signature]
9	D.K. Dhingra	J.E W/S Div. I Pnp	PHE Div I Pnp	[signature]
10	Sagar		40 M.T Pnp	[signature]
11	V. Chandrasekaran	Social Development Specialist, TA-7114, NCRPB, Delhi	TA-7114 NCRPB Delhi	[signature]
12	O P Goyal	Water Supply	T'	[signature]
13	Abhijeet Samanta	AD, NCRPB.		[signature]
14	P. Krishnan	Finance, ADB TA		[signature]

(3)

(TA No. 7055-IND)-Capacity Development of the National Capital Region Planning Board (NCRPB) – Component B – Sub Project Water Supply System in Panipat City

Attendance for Public Consultations

Date: 31.08.09

Venue- R.H. Panipat

Sl. No	NAME	DESIGNATION	ORGANISATION	SIGNATURE
15	ARUP K DAN	Social Specialist NCRPB/ADB	NCRPB/WSA/ADB	
16	ACHYUTHA RAO	Env. Specialist	NCRPB/ADB	
17	Rakesh Sharma President M.P. Panipat			
18.	Deep Parkash Malhotra PWD			
19	Shiv Nath Arora	MC		
20	Jai Bhagwan	N.G.O		
21	Ravinder Singh	Junior Engineer	PWD PHED Div-I PNP.	

(4)

(TA No. 7055-IND)-Capacity Development of the National Capital Region Planning Board (NCRPB) – Component B – Sub Project Water Supply System in Panipat City

Attendance for Public Consultations

Date: 31.08.09

Venue- R.H. Panipat (BBR)

Sl. No	NAME	DESIGNATION	ORGANISATION	SIGNATURE
22.	Rajesh Bhandari	M.C 15 ward	Panipat	Rajesh
23.	Ajeet Singh	MC ward 10	—	Ajeet
24.	Karnail Singh	J. E.	P.H.E.D	

www.WilburSmith.com

WilburSmith
ASSOCIATES
#8, Second Floor, 80 Feet Road,
RT Nagar Bangalore Karnataka - 560 032. India
w +91.80. 3918.7500 f +91.80. 2363.4097