

NAGPUR MUNICIPAL CORPORATION



AUGMENTATION TO NAGPUR CITY WATER SUPPLY SCHEME – PENCH - IV

DRAFT PROJECT REPORT – PART 4

UPGRADATION & PROPOSED DISTRIBUTION NETWORK IN EXISTING & PROPOSED ESR COMMAND AREA

VOLUME – 1



Submitted to :
The Executive Engineer
Pench Project Cell
Nagpur Municipal Corporation
Ground Floor North Wing
Mahanagarpalika Marg
Nagpur 440 001

Prepared by



SHAH TECHNICAL CONSULTANTS PVT. LTD.

WITH

DINESH RATHI & ASSOCIATES



Augmentation to Nagpur City Water Supply Scheme

Pench-IV

Draft Project Report (Part-4)

**Up-gradation & Proposed
Distribution Network**

Volume-1

(Design Concept Report)

Augmentation to Nagpur City Water Supply Scheme (Pench-4)**Draft Project Report (Part-4)
Up-Gradation & Proposed Distribution System****I N D E X****Volume -1: Design Concept Report (Distribution System)**

Sr. No.	Particulars	Page	
		From	To
	Preamble	01	01
Chapter-1	Brief History of Existing Water Supply Scheme	02	09
1.0	Background	02	02
1.1	Existing Water Supply Schemes	02	06
1.2	Treated Water from Various WTP (Rated Capacity)	06	06
1.3	Trunk Distribution System	07	07
1.4	Present Water Distribution Zones	08	08
1.5	Existing Service Reservoir	08	09
Chapter-2	Water Demand for Nagpur City within NMC Limits	10	15
2.1	Population	10	12
2.2	Water Demand	13	14
2.3	Water Loss In Transmission and Distribution	15	15
Chapter-3	Design Concept	16	22
3.1	Design Data &	16	18
3.2	Network Design	19	20
3.3	Cost Estimates	20	22
Chapter-4	Up-gradation & Proposed Distribution System ESR Command Area	23	31
4.1	South East Zone	23	24
4.2	East Zone (Kanhana)	24	25
4.3	North Central Zone	25	26
4.4	Central Zone	27	27
4.5	North West Zone	28	29
4.6	South West Zone	29	30
4.7	List of Proposed ESR & Controlling Levels	31	31

Sr. No.		Particulars	Page	
			From	To
COST ABSTRACT (DPR Part-4)				
		Abstract of Cost	32	32
ANNEXURE				
		Statement of Ward Area & Population Distribution		
DRAWINGS				
		Water Distribution Zones (2011)		
		Nagpur City Map showing Existing & Proposed Transmission Main & ESR's		
		Ext. & Prop. ESR Command area with 129 ward		

Volume-2 : Design, Drawing & Estimates
(South East Zone)

Volume-3(A) : Design & Estimates (East Zone Kanhan)

Volume-3(B) : Drawings (East Zone Kanhan)

Volume-4(A) : Design & Estimates (North Central Zone)

Volume-4(B) : Drawings (North Central Zone)

Volume-5 : Design, Drawing & Estimates (Central Zone)

Volume-6 : Design, Drawing & Estimates
(North West Zone)

Volume-7 : Design, Drawing & Estimates
(South West Zone)

	<i>Preamble</i>

Preamble

The work for preparation of detailed project report of Augmentation to Nagpur water supply scheme (Pench-4) is entrusted to M/s Shah Technical Consultants (STC), Mumbai by Nagpur Municipal Corporation (NMC).

The submission of the detailed project report is divided in four parts as,-

- 1) Part -1: Lifting Water at Pench Reservoir and conveying it upto Mahadula.
- 2) Part - 2: Conveyance of Water from Mahadula to Proposed WTP at Godhani, Treatment and Further Conveyance upto MBR at Governor House
- 3) Part - 3: Transmission Of Water upto different (Existing & Proposed) ESR's from MBRs, including Proposed Elevated Service Reservoirs.
- 4) **Part - 4: Up gradation & Proposed Distribution System.**

Out of these four parts, Part-1, 2 & 3 are already submitted to NMC.

The present report Part-4, Up-gradation & Proposed Distribution system Covers Detailed design, drawing & estimate of distribution network in in Existing & Proposed ESR Command area within NMC limits.

<i>Chapter-1</i> <i>Brief History of Existing System</i>

CHAPTER - ONE

Brief History of Existing Water Supply Scheme

1.0] BACKGROUND

Nagpur City gets water from three sources namely Gorewada tank, Kanhan River and Pench canal. Gorewada tank source was developed in the year 1911. As city grew and the need for water increased, Gorewada tank source became inadequate. As augmentation was not possible due to site conditions, surface water source from river Kanhan 14 km. Away from city was considered as perennial source. In 1976, the irrigation department, Govt. of Maharashtra executed a storage dam across river Pench for hydroelectric project at Totaladoh and pickup dam at Navegaon Khairi. In 1982 Pench I scheme was commissioned, in 1994 Pench II Scheme was commissioned and in 2003 Pench –III was commissioned.

1.1] EXISTING WATER SUPPLY SCHEMES

1.1.1] OLD GOREWADA SOURCE

This was developed in the year 1911. It consists of an earthen bund across river Pili at a distance of about 8 Km. towards North-East of Nagpur city having gross and live storage capacities 8.82 Mm³ and 7.92 Mm³ respectively. On the downstream of Gorewada tank, conventional Water Treatment Plant of 16.0 Mld capacity is constructed. Treated water is collected in pure water sump of capacity 18.16 lakh liters. and then pumped to Seminary Hills G.S.R. of capacity 4.54 ML by means of 210 BHP Centrifugal (C.F.) type pumps through 450 mm dia M.S. Rising Main. *The system is augmented & 450 mm dia pipe line is now connected to Gittikhadan GSR.*

1.1.2] KANHAN WATER SOURCE

The existing surface water intake which is located 300 m. downstream of the confluence of the Kolar River and the Kanhan River draws about 95.3 mld. In 1956 a barrage was constructed across Kanhan River about 0.5 km. upstream of Kanhan head works with a storage capacity of 7.82

Mm³. Kanhan Water Supply Scheme was commissioned in four phases during the years 1940 to 1970. The first phase capacity in 1940 was 27.3 Mld which was augmented to 63.6 Mld in 1954. The capacity was further augmented to 86.3 Mld in 1966 and finally to 109 Mld (up gradable to 120mld) in 1970.

In this scheme, two intake wells in Kanhan river bed and two dry wells on the right bank of Kanhan River are constructed. Raw water is pumped to conventional treatment plant of capacity 109 Mld (up gradable to 120mld) and pure water is pumped to G.S.R. of capacity 22.74 ML at Government House through 600 and 900 mm dia. M.S. parallel Rising Mains of length 15.24 Km. which are interconnected to each other. Considering the limitation of availability of water from the source, this source is now limited to cater the projected demand of East zone only.

1.1.3] PENCH SOURCE

Augmentation to Nagpur Water Supply Scheme, Pench Phase-I:-

In 1970, the Irrigation Department of Government of Maharashtra executed a storage dam across river Pench for hydro electric project at Totaladoh and pickup dam at Navegaon Khairi. The right bank canal from this pickup dam was proposed to supply water to the Koradi Thermal Power Station as also about 247 Mld for Nagpur city water supply. It was planned to implement the scheme in stages and accordingly Pench Phase-I scheme is commissioned 1982.

In this scheme 113.5 Mld water is drawn by gravity to the Mahadula pumping station. The canal water is pumped to the B.P.T. of capacity 5.7 lakhs liters through 1606 mm dia twin M.S. Rising Mains of length 5624 m. From B.P.T. water is taken to the Gorewada balancing tank through 700 mm dia duplicate C.I. gravity mains each of length 400 m. From Gorewada tank it is drawn to the conventional treatment plant of capacity 113.5 Mld through 1200 mm dia M.S. gravity main. The filtered and chlorinated water from the treatment plant is pumped to Seminary Hills

G.S.R. of capacity 20.43 ML. Sitabuldi G.S.R. is fed from Seminary Hills G.S.R. through 700 mm dia M.S. Feeder Main of length 4000 m.

Improvements to Distribution System for Nagpur City Stage-I:-

Under Pench Phase-I scheme; three G.S.Rs Seminary Hills, Gittikhadan and Sitabuldi Fort have been constructed.

For proper distribution of water in all parts of city after execution of Augmentation to Nagpur water supply scheme Pench Phase-I, improvements to Distribution system for Nagpur City, Stage-I has been executed.

Under this scheme seven E.S.Rs have been constructed at Laxminagar (1 No.), Wanjarinagar (1 No.), Minimatanagar (1 No.), Sakardara (2 Nos.), Lakadganj (2 Nos.) each having capacity of 2.27 ML. For proper distribution of water from these seven E.S.R.s distributions net work in seven zones has been provided.

Augmentation to Nagpur Water Supply Scheme Pench, Phase-II:-

After executing Phase-I scheme; Nagpur city was to receive 256 Mld of water from all sources. However, due to the losses due to leakages and other factors in the pipe lines, the actual supply to the city was to the tune of 130 Mld. Thus for 1991 census population of 16.57 lakhs, the actual supply from all sources worked out to only 77 LPCD against an anticipated supply of 180 LPCD and hence Augmentation to Nagpur Water Supply Scheme Pench Phase-II was implemented.

Accordingly, Augmentation to Nagpur Water Supply Scheme Pench-II with Pench right bank canal as a source was sanctioned in the year 1989 and commissioned in year 1994.

In this scheme 136 Mld water is drawn by gravity to the Mahadula pumping station. The scheme envisages baby canal from Pench Right Bank Canal, canal head regulator, raw water sump of capacity 4.65 ML at Mahadula. The raw water is pumped to the existing B.P.T. of capacity

5.70 lakh ltrs. through 1626 mm dia M.S. Rising Main of length 5.60 km. From B.P.T. water is conveyed to Gorewada tank through 1500 mm dia P.S.C. 8 Kg.cm² gravity main of length 400 m. From Gorewada tank water is taken to conventional water treatment plant of capacity 145 Mld through 1100 mm and 1000 mm dia P.S.C. 4 Kg./Sq.cm. gravity mains of length 650 m and 325 m respectively. Pure water is pumped to Seminary Hills G.S.R. of capacity 20.43 ML through 1321 mm dia M.S. Rising Main of length @ 3760 m. In this scheme two E.S.R.s at Jaripatka and Sharda Rolling Mill each of capacity 22.7 lakhs liters are constructed.

Augmentation of Nagpur Water Supply Scheme, Pench Phase-II is handed over to Nagpur Municipal Corporation, Nagpur for day to day maintenance on 31/07/1994.

Improvements to Distribution System for Nagpur City, Stage-II:-

In order to distribute the additional quantity of water from Pench Phase-II scheme, equitably, it was necessary to strengthen the existing distribution and transmission system.

Accordingly, based on the recommendations of the Tripathi committee and considering future development of City, Maharashtra Jeevan Pradhikaran also carried out detailed survey and prepared plans and estimates for the complaint pockets based on the computerized design prepared by V.R.C.E., Nagpur. Accordingly, 'Improvements to Distribution system for Nagpur City, Stage-II' scheme was administratively approved by Government vide G.R. No. WSS-1092/620/C.R. No. 117/92/UD-30, dated 19-11-1992 for Rs. 54.14 Crores.

The scheme envisages construction of 22.70 lakhs liters capacity R.C.C. E.S.R.s (Seven Nos.) at Ramnagar, Khamla, Jaripatka, Onkarnagar, Nandanvan, Subhannagar and Takliseem (Jaitala), feeder mains to feed all these reservoirs and distribution network.

Pench-III, Stage-I:-

Tata consulting Engineers (TCE) has prepared Master plan for Water supply & sewerage for Nagpur city upto year 2031. The digital base map for Nagpur City by aerial photography & complete piping network is imposed during Pench –III project. After execution of Pench-III, Stage-I, Nagpur City has received 100 – 120 Mld of water. The scheme envisages additional Raw Water Pumping Machinery at Mahadula Pumping Station, Raw water gravity main from Gorewada Tank to New state of art Technology 120 Mld water treatment plant including pumping station at Gorewada. 1200 mm dia. M.S. treated water pumping main from WTP to Seminary Hill MBR.

Construction of R.C.C. elevated service reservoirs 2.27 MI each at following 14 locations.

- 1) Nara, 2) Mahalginagar, 3) Wanjari, 4) Dhaba, 5) Dhantoli,
- 6) Reshimbag, 7) Boriyapura, 8) Gayatrinagar, 9) Chinchbhuvan,
- 10) Killa Mahal, 11) Bezanbag, 12) Kalamna, 13) Bharatwadi,
- 14) Dighori.

There are 43 service reservoirs in the city at 31 locations. Details of the existing reservoirs are given in Table. The existing storage capacity is 150.79 MI which @ 32 % of the total supply.

1.2] TREATED WATER FROM VARIOUS WTP :- (Rated Capacity)

Kanhan Water Works	108.00 Mld
Pench Phase – I	113.00 Mld
Pench Phase – II	133.00 Mld
Pench Phase – III, Stage – I	100.00 Mld
Old Gorewada	16.00 Mld
Total	470.00 Mld

1.3] TRUNK DISTRIBUTION SYSTEM

Old Gorewada Scheme

Clear water is pumped to Seminary Hills old reservoir through 450 mm. MS rising main. A direct tapping of 400 mm dia MS pipeline was taken to the Gittikadhan Ground Service Reservoir (GSR).

Kanhan Scheme

Clear water of 109 Mld is pumped through two rising mains of 900 mm and 600 mm dia MS pipelines to Govt. House and to various elevated service reservoirs such as Jaripatka, Binaki, Minimata nagar, Subhan nagar, Lakadganj, Nandanvan, Sakardara and Dighori in the East Nagpur. These rising mains are interconnected at three locations one near pumping station, near Aakashwani station and near Sharda Rolling Mills. 900 mm rising main is tapped to supply water to reservoirs at Binaki, Wanjari, Minimata Nagar, Kalamna, Lakhadganj, Nandanvan, Sakardara Bharatwadi and Subhan nagar. 600 mm pumping main is tapped to supply water to Jaripatka/Nari & Nara reservoir.

Pench Schemes

Clear water is pumped to master balancing reservoirs located at Seminary Hills. Govt. House reservoir is connected to Seminary Hills reservoir by 1200 mm dia and 450 mm dia MS pipe lines. Seminary Hills reservoirs supply water to West Nagpur and Govt. House reservoir supplies water to East Nagpur. Clear water from Pench I, Pench II & Pench III and Old Gorewada is pumped to Seminary Hill Reservoirs. Clear water pumping main of old Gorewada is tapped on the way by 400 mm which goes to Gittakhadan reservoir. Seminary Hill reservoir distributes water to Ramnagar, Laxminagar, Sitabuldi fort and Govt. House Reservoirs. There is a direct tapping to Pench II pumping main which supply water to new Ramnagar, new Laxminagar, Khamla, Dhantoli, Chinchbhuwan, Gayatrinagar, Takliseem reservoirs & University sump for Dabha ESR. From Seminary Hill Reservoir, water is directly supplied to High land drive, Phutala Area and High Court road.

1.4] PRESENT WATER DISTRIBUTION ZONES

Prior to Pench-III scheme, there were 28 service reservoirs in the city. After commissioning of Pench III, Ph.I City is served by 43 reservoirs. These 43 reservoirs get water from two main sources i.e. Pench and Kanhan. From easy operation and maintenance point of view, the total area has been divided into Ten water supply zones. Details of existing ten water distribution zones are as follows,

EXISTING TEN WATER DISTRIBUTION ZONES

Zone No.	Name Of Zone	Population (Yr. 2001)
I	DHARAMPETH	2,50,000
II	LAXMI NAGAR	2,50,000
III	HANUMAN NAGAR	2,00,000
IV	DHANTOLI	2,00,000
V	NEHARU NAGAR	1,45,000
VI	GANDHIBAG	2,60,000
VII	SATARANGI PURA	3,20,000
VIII	LAKADGANJ	1,60,000
IX	ASHINAGAR	1,80,000
X	MANGALWARI	2,05,000

Water is supplied to the city by Master Balancing Reservoirs at Seminary Hills & Govt. House. Seminary hills and Govt. house are the two master balancing reservoirs from which the water is supplied to other reservoirs. These two MBR's also supply water to its command area. The reservoirs which get water from Kanhan are directly connected to pumping main.

1.5] SERVICE RESERVOIR

Details of the existing service reservoirs are as follows.

Details of Existing OF M.B.R. , E.S.R. & G.S.R.

Sr. No.	Name of ESR	Nos	Capacity (ml)	G.L. (m)	F.S.L. (m)	L.S.L. (m)	St. Ht. (m)	Re-mark
1	Semi Hill. Old GSR	1	4.54	349.700	356.180	348.180		
2	Governor House GSR	3	22.74	344.000	345.950	339.850		
3	Ramnagar GSR	1	0.91	329.175	331.975	327.975		\$\$
4	Wanjarinagar(old)	1	2.27	305.860	326.220	321.650	15.790	
5	Laxminagar (old)	1	2.27	311.700	335.280	330.700	19.000	
6	Seminary Hills M.B.R	2	20.43	349.700	356.180	348.180		
7	Gittikhadan GSR	1	5.94	338.345	343.065	336.920		\$\$
8	Sitabuldi Fort GSR	2	22.74	334.300	338.400	332.400		
9	Laxminagar (New)	1	2.27	311.790	335.280	330.710	18.920	
10	Wanjarinagar (New)	1	2.27	305.860	326.220	321.650	15.790	
11	Minimatanagar	1	2.27	290.830	317.980	310.330	19.500	\$\$
12	Sakkardara	2	4.54	303.760	326.000	321.000	17.240	
13	Lakadganj	2	4.54	301.250	327.250	322.250	21.000	\$\$
14	Jaripatka	1	2.27	295.760	321.760	316.760	21.000	
15	Binaki	1	2.27	292.675	318.675	313.675	21.000	
16	Ramnagar ESR	1	2.27	329.430	345.930	340.930	11.500	\$\$
17	Khamla (Pande Layout)	1	2.27	309.460	329.460	324.460	15.000	
18	Jaripatka (Nari)	1	2.27	295.760	321.760	316.760	21.000	
19	OnkarNagar	1	2.27	299.580	325.580	320.580	21.000	\$\$
20	Nandanvan	1	2.27	296.000	322.000	317.000	21.000	\$\$
21	Subhan nagar	1	2.27	286.030	312.030	307.030	21.000	
22	Takali seem	1	2.27	322.220	341.220	337.220	15.000	\$\$
	Total	28	118.16	ml				
23	Nara	1	2.27	296.000	322.000	317.000	21.000	
24	Mahalginagar	1	2.27	298.000	324.000	319.000	21.000	
25	Wanjari	1	2.27	287.325	313.325	308.325	21.000	\$\$
26	Dhaba	1	2.27	346.735	372.735	367.735	21.000	\$\$
27	Dhantoli	1	2.27	307.495	330.495	325.495	18.000	\$\$
28	Reshimbag	1	2.27	299.500	325.500	320.500	21.000	
29	Boripura	1	2.27	308.000	334.000	329.000	21.000	
30	Gayatrinagar	1	2.27	314.860	338.860	333.860	19.000	\$\$
31	Chinchbhuvan	1	2.27	295.140	321.140	316.140	21.000	\$\$
32	Killa Mahal	1	2.27	298.495	324.495	319.495	21.000	\$\$
33	Bezanbag	1	2.27	312.435	336.435	331.435	19.000	\$\$
34	Kalamna	1	2.27	291.680	317.680	312.680	21.000	\$\$
35	Bharatwada	1	2.27	286.175	312.175	307.175	21.000	\$\$
36	Dighori	1	2.27	297.875	323.875	318.875	21.000	\$\$
	Total	14	31.78					
	Under execution							
	Wadi Tekadi	1	0.85	359.480	385.48	380.48	21.000	
	Grand Total	43	150.79					

Note : \$\$ Corrected levels as per survey carried out by consultants.

<i>Chapter-2</i> <i>Water Demand of Nagpur City</i>

CHAPTER – TWO**Water Demand for Nagpur City within NMC Limits****2.1] POPULATION:-**

NMC has prepared the Master Plan for Water Supply & Sewerage upto the target year 2031 and hence total population projections has been considered same as Master Plan, prepared by TATA Consulting Engineers Ltd. in the year 2000. In the Master plan population projection were calculated by various methods as given in Table X.1 (Refer Table-IV-9.) TCE Report.

Population Projection by Various Methods

Sr. No.	Method	Years			
		2001	2011	2021	2031
01.	Arithmetic Increase Method	18,36,145	20,47,538	22,58,931	24,70,325
02.	Geometric Increase Method	22,90,196	32,28,184	45,50,340	64,14,007
03.	Incremental Increase Method	18,92,434	21,60,122	24,27,808	26,95,493
04.	Migration-Birth/death Rate Method	19,97,387	24,90,808	32,05,884	42,08,420
05.	Graphical Trend Method	21,50,000	28,30,000	36,90,000	47,50,000

Master plan has adapted Graphical Trend method as it gives the least percentage error when compared with actual census figures.

Hence, total population projection for calculation of total water demand for Pench-IV, water supply project has been adapted as it is from master plan.

2.1.1] Deviation from Master plan

Projection of population in outer ward for year 2001 as per master plan is much less than actual Census population of these wards in year 2001. Similarly Projection of population in inner ward for year 2001 as per master plan is much more than actual Census population of these wards in year 2001. Hence projected population for design year 2011, 2021 & 2031 is worked out based on Census population of ward in year 2001. Trend of Growth of respective ward in decade 1991 to 2001 taken as guidelines (base) and modified growth rate is assumed with following few considerations, (Pl. Ref. Comparative statement, attached herewith as Annexure -1.) Census map along with abstract of ward wise & Prabhag wise total population is also attached for reference.

- Trend of migration of population from inner to outer wards.
- Developments of new layouts in South East, East & North side of City and availability of space for future growth.
- Saturation of wards in inner core of city.
- Residential plots/ building converted into commercial complex.

Total projected decadal population of the city hence worked out as per modified growth rate matches nearly the projected population considered in the Master plan. Population Densities of the ward are worked out based on modified growth rate for the respective decade as stated above. (Pl. Ref. Statement of ward area & population distribution, attached herewith as Annexure -2.)

Description	Years			
	2004	2011	2021	2031
As per Master Plan	23,50,000	28,30,000	36,90,000	47,50,000
Total Population (Modified)	23,67,000	28,73,000	36,83,000	47,65,000

2.1.2]Total Slum Population:-

Total slum population given below is a part of total population. Population of slum is taken from the data of “Integrated Slum Improvement Project in Nagpur with GTZ” (German Development Corporation) with base year as 2001. Growth rate for Slum is taken same as that of ward growth rate.

Description	Years			
	2004	2011	2021	2031
As per Master Plan	8,23,900	9,90,500	12,91,500	16,62,500
As per GTZ	8,47,500	10,03,300	12,42,100	15,41,300

2.1.3]Slum Population with House Connection for Water Supply:-

Slum population based on sample survey carried out the total slum with house connection for water supply (legal or illegal) has been appx. 60% and remaining 40% gets the water from public stand post.

NMC intends to encourage the individual house connections in slums and reduce the water supply from stand post. Hence for future projections, 10% decadal reduction i.e. from 40% present to 30%, 20% & 10% in water supply from stand post in the year 2011, 2021 & 2031 respectively.

Description	Years			
	2004	2011	2021	2031
Slum Population (House Connection)	5,08,500	7,02,310	9,93,680	13,87,170
Slum Population (Stand Post).	3,39,000	3,00,990	2,48,420	1,54,130
Total	8,47,500	10,03,300	12,42,100	15,41,300

2.2] WATER DEMAND:-

2.2.1] Domestic and Non-domestic Need Demand:-

As per CPHEEO manual on Water Supply and Treatment – Third edition (May, 1999) revised and updated the recommended 'Maximum' water supply in liter / capita / day (LPCD) is as follows:

Metropolitan & Mega Cities	Recommendation
Provided with piped water supply where sewerage system is existing / contemplated.	150 LPCD

Note :-

- (i) In urban areas, where water is provided through public stand posts, 40 lpcd should be considered;
- (ii) Figures exclude "Unaccounted for Water (UFW)" which should be limited to 15%.
- (iii) Figures include requirements of water for commercial, institutional and minor industries. However, the bulk supply to such establishments should be assessed separately with proper justification.

With the above recommendation, treated water demand has been considered with 150 lpcd for water supply through house service connection and 40 lpcd for the population, where water is provided through stand post.

Description	Years			
	2004		2004	
	Demand For Population As per Master plan			
Domestic demand (House Connection)	303.07	379.90	514.76	687.56
Domestic demand (Stand post)	13.18	11.89	10.33	6.65
Total	316.25	391.79	525.09	694.21

Description	Years			
	2004	2011	2021	2031
	Demand for Modified Projected Population			
Domestic demand (House Connection)	304.20	385.80	515.19	691.63
Domestic demand (Stand post)	13.56	12.04	9.94	6.17
Total	317.76	397.84	525.13	697.80

2.2.2] Non-domestic (Bulk) Demand:-

Nagpur has many large institutions and organizations like NEERI, RAILWAY, MES, VNIT, Govt. Medical College & Hospital, Air Force maintenance command etc. which requires bulk water supply, hence institutions / establishment with 100 mm and above size service connections are treated as bulk consumer and its water demand based on NMC billing for 2004 has been considered separately and worked out as 37.95 Mld and further projected proportionate to population growth.

Description	Years			
	2004	2011	2021	2031
Non-domestic Bulk Demand in Mld	37.95	45.70	59.59	76.71

2.3.3] Fire Demand:-

As per CPHEEO recommendation fire demand is calculated in kiloliters/day on formula $100\sqrt{p}$ where, p = population in thousands. The $\frac{1}{3}$ of the fire fighting requirements form the part of the service storage.

Description	Years			
	2004	2011	2021	2031
Fire Demand (ml)	4.85	5.32	6.07	6.89

2.3] WATER LOSS IN TRANSMISSION AND DISTRIBUTION:-

Water loss in transmission and distribution contributes to large extent for assessment of water demand at various stages. Recent study on water audit in Nagpur city conducted by STC suggests that out of appx. 50% UFW or NRW (Non Revenue Water) in Nagpur half of the NRW is real losses (physical losses) hence 25% of distribution losses is considered in 2004 water demand calculation. NMC has undertaken the leak detection program and has commitment to bring the NRW under control, hence for calculation purpose total NRW for 2011 onwards is reduced to 15% from 25%.

2.3.1] Losses in Transmission Main:-

Losses in raw water & pure water transmission are taken as 2% each as per MJP circular Feb. '92.

2.3.2] Losses in Water Treatment Plant:-

The water requirement for the back wash of filters in WTP works out to appx. 5% of WTP capacity, which is normally drained out. NMC contemplates to recycle the back wash water to reduce water losses; from 2011 onwards WTP losses are considered as 1% only.

Hence % of losses considered for demand assessment is as follows:

Component	2004	2011	2021	2031
1. R.W.T.M.	2	2	2	2
2. W.T.P.	5	1	1	1
3. P.W.T.M.	2	2	2	2
4. D. / SYS.	25	15	15	15

Chapter-3: Design Concept

(Up-gradation & Proposed D/System)

CHAPTER – THREE**Design Concept**

(Up gradation & Proposed Distribution System)

3.1] DESIGN DATA:-**3.1.1] Design Period:-**

The Existing & Proposed distribution network (150mm Dia. & above) in the ESR command area are analyzed for the year 2011 & 2021.

3.1.2] Population:- (Deviation from Master plan)

Please refer para No.1.1 of Chapter-Two,” Water Demand for Nagpur city within NMC limits”.

3.1.3] LPCD Rate & Water demand in command area of service reservoir:-

Water demand on distribution nodes in demarcated node area in command of service reservoir is worked out with following LPCD rates with 15 % losses in distribution system.

Design Year	Area Excluding Slum area	Slum area (Weighted average)
2011	$(150/0.85)=176.47\text{Lpcd}$	$[(150 \times 0.7) + (40 \times 0.3)/0.85] = 137.65$
2021	$(150/0.85)=176.47\text{Lpcd}$	$[(150 \times 0.8) + (40 \times 0.2)/0.85] = 150.59$
2031	$(150/0.85)=176.47\text{Lpcd}$	$[(150 \times 0.9) + (40 \times 0.1)/0.85] = 163.53$

Water demand @ 150 lpcd is inclusive of Commercial & Institutional water else other wise identified as major bulk consumer.

Water demand at individual node is addition of usable area on each node of various wards included in command area with demand worked out as follows,

$$\text{Domestic water Demand} = [(A_{\text{Bal}} * D_{\text{Bal}} * L_{\text{pcd}}) + (P_s * L_{\text{pcd}} \text{ of Slum})]$$

Where,

Total population of ward = P_w

Usable Area of Ward = A

Average density of ward = $D_{\text{Ave}} = (P_w / A)$

Slum population in ward = P_s

Slum area in ward = A_s

Density of population in Slum = $D_s = (P_s / A_s)$

Population in Balance U-area in ward = P_{Bal}

Balance area excluding Slum = $A_{\text{Bal}} = (A - A_s)$

Density of balance Area = $D_{\text{Bal}} = (P_{\text{Bal}} / A_{\text{Bal}})$

Usable Area: Residential / Commercial Area

Non Usable: No population zone i.e. Reserved Forest, Agriculture Land,
Area No development zone as per DP, Institutional area, Lake,
Park, Play ground etc.

Bulk demand :

Consumers having tapping size 100 mm are identified as bulk consumers. Demand of most of the Consumers in North West & North Central Zone is feed from Seminary Hills & Govt. House MBR through separate trunk distribution main. Demand of Bulk consumer in South East, South West Zone (I.e. demand of Railway For Ajani Zone, Medical, Central Jail, VNIT, NEERI etc.) is considered either at node on transmission main or at ESR from where they are presently getting supply.

3.1.4] Losses:-

The loss of water through leakages & wastage in distribution system is taken as 15% on an average of the total demand.

3.1.5] Peak Factor:-

Pure water Distribution system is taken as - 3.0

3.1.6] Governing Levels:-

Lowest supply levels (L.S.L.) of respective ESR is considered as governing levels for Hydraulic calculations and residual head is measured above Ground level of node point.

3.1.6] Residual Head:-

Minimum residual head of 12 m is considered above the G.L. of design node point in the in the command area. (As per CPHEEO Norms). Distribution network is design / analyzed for residual head more than 12.0 to overcome the head loss in tertiary distribution network from design node onwards so that consumer shall received water at 12 m head. However in following exceptional case residual head at node is between 8 to 12 m.

- Restriction due to low Staging of Existing ESR.
- Higher level area in the command of fed through existing ESR with existing major trunk distribution system and laying of parallel distribution main is not economical as well as practicable.

3.1.8] Pipe Head Loss Formula:-

The design of the Distribution network is based on the Hazen William (H/W) head loss formula. The H/W co-efficient of roughness of pipe (C-value of pipe) is adopted as per Table No. 6.1 of CPHEEO manual

Pipe Type	New Pipe	Design purpose
Old Pipe lines (More than 5 years old)		
CI / DI		100
New Pipe lines (laid in last 3-5 years)		
CI	140	140
DI	140	140
Proposed Pipes (with internal lining)		
CI	140	140
DI	140	140
M.S.	130	110

Distribution Network is design such that rate of head loss (m/km) for respective type of pipe should not exceeds 5.00m/km for design peak flow.

3.1.9] Velocity through pipe line:-

Distribution network is design / analyzed such that velocity through pipe line should be less than 1.2 m/sec for design peak flow.

However in following unavoidable circumstance velocity in of pipe lines it is restricted to Max. of 1.50 m/sec.

- Existing pipe line is available and laying of parallel pipe is not practicable.
- In initial stretch of pipe lines near ESR, as water in command area is supplied in zoning pattern in different hours, total cumulative peak flow in this stretch of pipe line will always be less than as estimated.

3.1.10] Pipe Materials:-

The existing network of Distribution main is consists of CI / DI pipes upto 700 mm dia & MS pipes for higher diameter. DI pipes are now generally preferred over CI pipes due to their high tensile & bending strengths, high impact resistance, good ductility and corrosion resistance. Further more, they are virtually maintenance free and have longer life.

Hence Centrifugally Cast (spun) Ductile Iron Pressure Pipes DI conforming to (IS 8329:2000) upto 700 mm dia & M.S. pipe conforming to IS 3585:2001 (with inside lining & out coating & from 800mm & above are proposed.

3.2] NETWORK DESIGN:-

The hydraulic analysis of distribution network of existing and proposed mains is carried out in following steps. The hydraulic analysis will be carried out by Water CAD by Hasted Methods as per the TOR.

Step No. 1:-

The existing distribution lines are analyzed considering peak demand of down stream nodes along the alignment for the year 2011. If the carrying

capacity of existing lines exceeds than its limit (Parameters of Permissible velocity & rate of Head loss as mentioned above) then demand of D/s nodes is either supplemented by proposing parallel pipe or shifted to proposed near by nodes or connected to form loops to balance demand & pressure head.

Step No. 2:-

The above transmission network is again analyzed for the projected demand for year 2021 and diameter of parallel / new pipes proposed are modified to meet demand by year 2021.

Step No. 3:-

The pipes required for water demand of 2021 will be proposed and parallel pipe required to supplement the demand through existing pipes are phased out for proposed to be laid in year 2011 & 2021 (as per the analysis in Step-2)

Detailed estimates Phased & prepared for proposed pipe lines required in year 2011 & 2021 under Pench-IV.

Step No. 4:-

Hydraulic analysis for the projected demand of 2031 over and above designed network of 2021 (Step No. 2) will be carried out for perspective planning.

3.3] COST ESTIMATES:-

Estimates of Distribution Network are prepared for each ESR command area separately. Estimates are based on rates of MJP & PWD CSR of Nagpur Region for Year (2005-2006). The Items for which rates are not given in the both the CSR, relevant markets rates are adopted for the same. Finished rate of Items are inclusive of all taxes as applicable, lead & lift of material and labour as and where applicable.

Provision of following sub-work is specially taken care of while estimating the cost of Distribution lines.

3.3.1] Pipelines in Ongoing Projects:-

Length of pipelines already considered under various ongoing project of NMC for connectivity of existing distribution network to network of pipe line laid by NIT in different sanction layouts within NMC limits are not considered in the estimate of this project.

Similarly parallel pipe line required to supplement the existing pipe line in design Year 2021 are phased out & not considered in the estimate.

3.3.2] Valves:-

Provision of required number of Controlling valves, air valves, scour valves is made in the estimates as per the standard practices or as described below.

Control valve: This will be positioned as follows:

- At the beginning and branching of distribution line.
- At intermediate interlinking point for parallel main.
- At intermediate location on major lines for controlling/ isolating the flow in supply hours to distribute the water in zoning pattern in command area. This is considering convenience of daily operation.

Sluice Valve for pipe dia. upto 700 mm dia should be confirming to IS 14846-2000 and butterfly valve for pipe dia. 800 mm and above shall be confirming to IS 13095-1991 with PN -1.0 rating.

Air Valves: Kinetic double air valves of approved make confirming to (IS:14845) from 40 mm to 150 mm dia. are proposed for pipe dia. ranging from 150 to 700mm.

Air valves are proposed at

- All peaks with respect to horizontal datum and with respect to maximum hydraulic gradient.

Scour Valves: This valves confirming to IS 780 and 2906 -1984 are proposed at major natural drains crossing along the long run of distribution main.

3.3.2] Survey of existing under ground utilities:-

At present there is huge network of telephone & other cables, underground piping for water supply & drainage. Hence it is necessary to locate the same to carry out work of laying new pipe lines without major damage to the same. Hence Necessary provision for Survey of existing under ground utilities is made in the Estimate.

3.3.3] Horizontal Direction Drilling (HDD):-

Necessary provision of same is also made in the estimate in following conditions:

- Crossing of pipe line at Concrete roads.
- Crossing of Major Road having higher traffic intensity.
- Crossing at National Highway, Railway etc in city area.

3.3.4] IRDP / PWD / NMC / NIT Existing Road Cutting:-

Most of major road in the city are of concrete or asphalted and widened along with covered side drains & footpath. There is also network of major distribution pipe line on either side of road. Hence at unavoidable locations, proposed pipe line & branches are has to be laid by cutting strip of roads. Hence necessary provision of cutting of existing road and reinstating the same is made in the Estimates. Necessary provision of payment of fees to various departments for obtaining the permission to cross or lay pipe line along road is also made is the Estimates.

3.3.4] Nalla Crossing:-

Crossing of Pipe line at Nalla portion is considered with following way as per site conditions.

- Laying of pipe with crown of pipe 0.3 m below bed level and encasing the pipe line in concrete.
- Laying of pipe line on concrete pillar supports.
- Laying of pipe line along existing cross drainage structure.

Chapter-4 (Up-gradation & Proposed D/System)

CHAPTER - FOUR

Up-gradation & Proposed Distribution System ESR command Area

4.0] Nagpur City with total area of 217.56 sq. km within NMC limits is proposed to be divided in to following six water distribution zones. Details of the same are as per below:

4.1] South East Zone:-



The zone covers an area of 18.108 sq. Km. with usable CA of 14.355 Sq. Km. Projected population for year 2011 works out to 3,86,166 souls with a corresponding water demand of 62.76 mld at service reservoir. The Raw water source for the zone is Navegaon Khairy Reservoir (Pench Project).

Pure water to the zone is made available from the existing WTP at Gorewada. Pure water from Gorewada WTP will be conveyed to existing MBR at Seminary Hills from where it is gravited to ESR's Via Govt. House MBR.

Detail design of Transmission main, Connecting MBR to ESR's is given In Part –III Report. Nagpur City Map attached herewith indicates Location of Existing & Proposed ESR's along with alignment of existing & proposed transmission main from MBR to ESRs.

Total demand of the zone is 62.76 MLD. 30% Storage capacity required is 18.83 ml. However Existing Storage capacity available with following existing ESRs is only 11.05 ml. Hence additional storage capacity of 8.84 is proposed with ESRs in area as mentioned below. Following Proposed / Existing ESRs fed through MBR at Seminary Hills.

Existing ESRs: (5 Nos)

- 1) Wanjari Nagar-I & II, 2) Onkarnagar , 3) Hudkeshwar,
- 4) Reshimbag-I

Proposed ESRs: (4 Nos)

- 1) Hanuman Nagar 2) Onkarnagar Prop., 3) Nalanda Nagar
- 4) Shrinagar (Narendra Nagar)

Detailed design & drawing of distribution network in each ESR command area is given separately in Draft report Part-IV, Volume-2

4.2] East Zone (Kanhani):-

Out of total 217.56 Sq. Km. within NMC limits, the zone covers an area of 47.458 Sq. km. with usable command area (CA) of 34.15 Sq. km. Projected population for year 2011 works out to 7,31,921 souls with corresponding water demand of 120.50 mld at service reservoir. The Raw water source for the zone is Kanhani River.

Pure water to Zone is made available from WTP at Kanhani water works. Total demand of the zone at service reservoir is 120.50 mld. 33% Storage capacity reqd. is 39.78 ml. However Existing Storage capacity available with following existing ESRs is only 22.10ml (Excluding capacity of Minimatnagar ESR). Hence additional storage capacity of 17.68 ml is proposed with 8 ESRs (each of 2.27 ml) for ESR command area as mentioned below.

Existing ESRs: (11 Nos)

- 1) Minimatnagar, 2) Lakadganj -I & II, 3) Subhan Nagar
- 4) Nandanvan-I, 5) Wanjri, 6) Kalamna (Dipti Signal),
- 7) Bharatwadi, 8) Dighori, 9) Sakkardara I & II

Proposed ESRs: (7 Nos)

- 1) Nandanvan Prop.1&2, 2) Kharbi Road, 3) Paradi Road-1&2,
- 4) Sakkardara Prop. 5) Lakkadganj Prop. 6) Bhandewadi

Deviation from Part -3 Report:

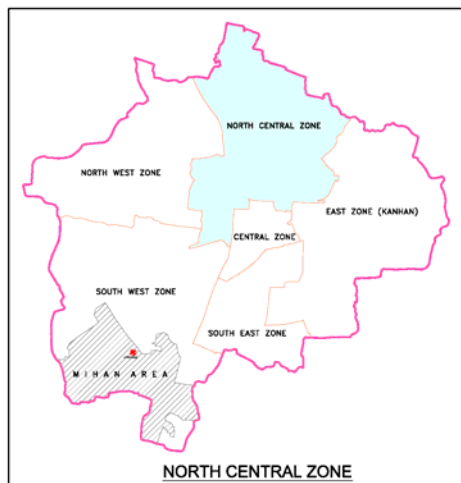
- Distribution Network of Minimatanagr Ext ESR is proposed to be connected to Kalamna ESR located at same elevation & nearer to this ESR with suitable up-gradation of network, as this ESR has already completed its use full life. Hence Command Area (CA) of this ESR as indicated in Part -3 report is modified during detailing of Distribution network.
- Similarly Higher level part area from Kharabi ESR CA & Part area from Bhataratwadi ESR CA is shifted to newly proposed Bhandewadi ESR CA. Bhandewadi proposed ESR is proposed after discussion with NMC authorities considering practical & operational difficulties of supplying High level area in command.
- Command area of Lakkadganj existing, Bagaddganj Prop ESR, Shantinagar ESR are also modified suitably.

Detail design of Transmission main, connecting MBR to ESR's is given In Part –III Report. Nagpur City Map attached herewith indicates Location of Existing & Proposed ESR's along with alignment of existing & proposed transmission main from MBR to ESRs.

Detailed design & drawing of distribution network in each ESR command area is given separately in Draft report Part-IV, Volume-3.

4.3] North Central Zone:-

The zone covers an area of 43.316 sq.km. with usable CA of 25.13 Sq.km. Projected population for year 2011 works out to 7,42,399 souls with a corresponding water demand of 118.66 mld. at service reservoir. The Raw water source for the zone is Navegaon Khairy Reservoir (Pench Project).



Pure water to the zone is proposed to be made available from the proposed WTP at Godhani through Govt. House GSR. Total demand of the zone is 118.66 mld. Demand of command area served through direct tapping & direct distribution from MBR is 43.08 ml. Demand of remaining area served through service reservoirs is 75.58 ml.

33% total Storage capacity required is 39.55 ml. However Existing Storage capacity available with following existing ESRs + GSR @ Govt. House is only (11.35 +15.0) 26.35 ml. Hence additional storage capacity of 13.26 ml is proposed with 6 ESRs in area as mentioned below.

Existing ESRs/ GSR: (8 Nos)

- 1) Jaripatka -I, 2) Nari -I, 3) Nara, 4) Bezanbag, 5) Binaki-I,
- 6) Govt. House GSR -2 Nos. 7) Lal Taki @ Govt. House.

Proposed ESRs: (6 Nos)

- 1) Binaki Prop., 2) Bastrawari- I&II, 3) Indora I &II
- 4) Shantinagar.

Detail design of Transmission main, connecting MBR to ESR's is given In Part-III Report. Nagpur City Map attached herewith indicates Location of Existing & Proposed ESR's along with alignment of existing & proposed transmission main from MBR to ESRs.

Detailed design & drawing of distribution network in each ESR command area is given separately in Draft report Part-IV, Volume-4

4.4] Central Zone:-



The zone covers an area of 7.281 sq. km. with usable CA of 5.39 Sq.km. Projected population for year 2011 works out to 2,68,691 souls with a corresponding water demand of 41.83 mld at service reservoir. The Raw water source for the zone is Navegaon Khairi Reservoir (Pench Project).

Pure water to the zone is made available from the existing WTP at Gorewada. Pure water from Gorewada WTP will be conveyed to existing GSR at Sitabuldi-Fort through MBR at Seminary Hills.

Total demand of the zone is 40.56 mld. Demand of command area served through Direct distribution from GSR is 25.35 ml. Demand of remaining area served through service reservoirs is 15.21 ml. 33% total Storage capacity required is 13.94 ml. Existing Storage capacity available with following existing ESRs / GSR @ Sitabuldi Fort is 27.28 ml.

Existing ESRs/ GSR: (4 Nos)

- 1) Sitabuldi Fort GSRs, 2) Killa Mahal , 3) Boriyapura,

Deviation from Part -3 Report:

- Area previously proposed in Bagadganj Prop. ESR command area is modified and shifted to Lakkadganj Existing & Proposed area. As location of Bagadganj ESR is shifted as per discussion with NMC authorities considering practical & operational difficulties in supplying water at extreme end with required pressure.

Detailed design & drawing of distribution network in each ESR command area is given separately in Draft report Part-IV, Volume-5

4.5] North West Zone:-



The zone covers an area of 38.35 sq.km. with usable CA of 17.04 Sq. km. Projected population for year 2011 works out to 2,81,000 souls with a corresponding water demand of 45.65 mld at service reservoir. The Raw water source for the zone is Navegaon Khairi Reservoir (Pench Project).

Pure water to the zone is made available from the existing WTP at Gorewada. Pure water from Gorewada WTP will be conveyed to existing MBR at Seminary Hills.

Total demand of the zone is 45.65 mld. Demand of command area served through direct distribution from MBR is 13.45 ml. Demand of remaining area served through service reservoirs is 32.20 ml. 33% total Storage capacity required is 15.22 ml. The Existing Storage capacity available (including MBR capacity at Seminary Hills for D/S ESRs) at existing MBR / ESRs is only 34.03 ml. However additional storage capacity of 2.27 ml is proposed with one ESR located in the premises of Seminary Hills MBR to serve the high level area of the zone. Following Proposed / Existing ESRs are feed through MBR at Seminary Hills.

Existing ESRs/ GSR: (6 Nos)

- 1) Seminary Hills (MBR) – 3 Nos, 2) Gittikhadan, 3) Dabha,
- 4) Wadi Tekadi.

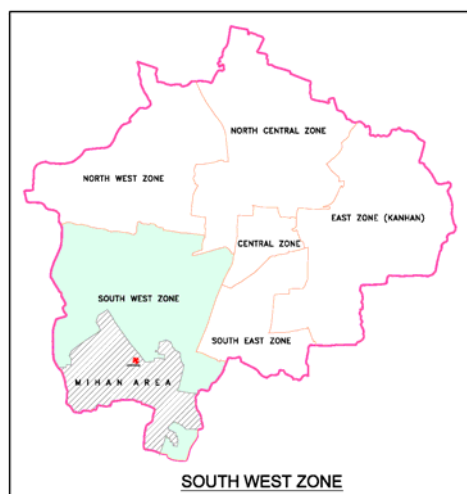
Proposed ESRs: (1 Nos)

- 1) Seminary Hills (For High Land Drive area).

Detail design of Transmission main, connecting MBR to ESR's is given In Part-III Report. Nagpur City Map attached herewith indicates Location of Existing & Proposed ESR's along with alignment of existing & proposed transmission main from MBR to ESRs.

Detailed design & drawing of distribution network in each ESR command area is given separately in Draft report Part-IV, Volume-6

4.6] South West Zone:-



The zone covers an area of 63.05 sq. km. with usable CA of 21.28 sq. km. Projected population for year 2011 works out to 4,62,966 souls with a corresponding water demand of 76.99 mld at service reservoir. The Raw water source for the zone is Navegaon Khairi Reservoir (Pench Project).

Pure water to the zone is made available from the existing WTP at Gorewada. Pure water from Gorewada WTP will be conveyed to existing MBR at Seminary Hills. Total domestic demand of the zone is 76.99 mld. 33% Storage capacity required is 25.66 ml. However Existing Storage capacity available with following existing ESRs is only 19.07 ml. Hence additional storage capacity of 8.31 ml is proposed with 3 ESRs and one Sump in area as mentioned below. Following Proposed / Existing ESRs fed through MBR at Seminary Hills.

Existing ESRs: (9 Nos)

- 1) Ram Nagar-I & II, 2) Laxmi Nagar-I & II, 3) Khamla,
- 4) Takali Seem, 5) Gayatri Nagar, 6) Dhantoli, 7) Chinchbhuvan.

Proposed ESRs: (3 Nos)

1) Dharampeth, 2) Pratap Nagar, 3) Trimurti Nagar,

Proposed Sump: (1 No.)

1) Jaitala.

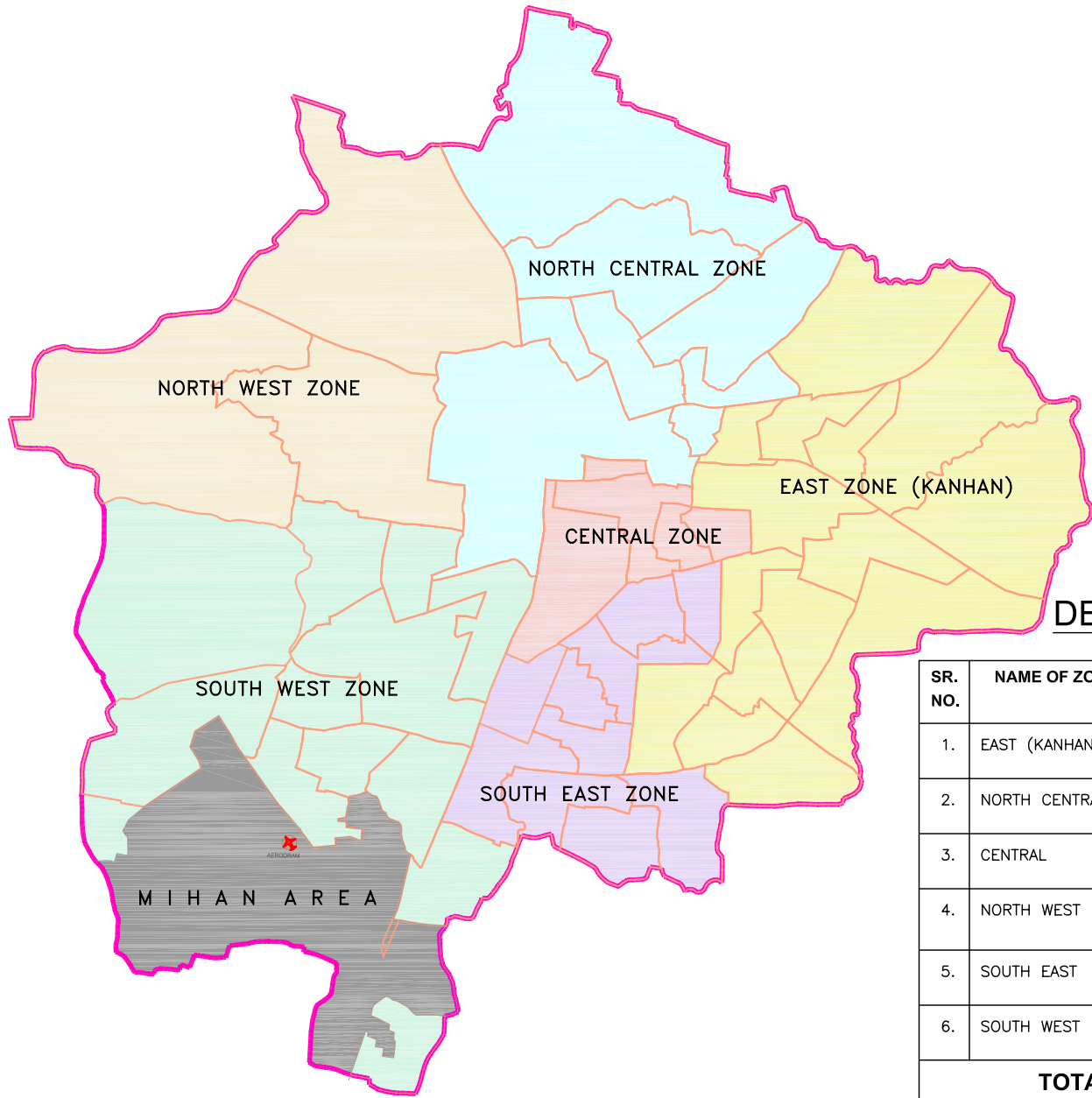
Detail design of Transmission main, connecting MBR to ESR's is given In Part-III Report. Nagpur City Map attached herewith indicates Location of Existing & Proposed ESR's along with alignment of existing & proposed transmission main from MBR to ESRs.

Detailed design & drawing of distribution network in each ESR command area is given separately in Draft report Part-IV, Volume-7

4.7] PROPOSED SERVICE RESERVOIRS:-

Sr. No.	Name	Location	No.	Cap. (ML)	GL (m)	LSL (m)	FSL (m)	St. Ht. (m)
South East Zone								
1	Shrinagar	In ward No 13, at N.I.T. garden, North of Ring Road, near Narendra Ngr.	1	2.27	298.185	319.185	324.185	21.00
2	Nalanda Nagar	In ward No 42, at N.I.T.gorund, North of Ring Road, near Rameshwari	1	2.27	297.900	318.900	323.900	21.00
3	Onkar Ngr - 2	In ward No.12, At Existing ESR site	1	2.27	299.580	320.580	325.580	21.00
4	Hanuman Nagar	In ward No.102, Near NMC Zn.Office (Badminton ground)	1	2.27	302.160	323.160	328.160	21.00
East Zone (Kanhana)								
5	Sakkardara Prop-1	In ward No.39 At Existing ESR site	1	2.27	303.460	324.460	329.460	21.00
6	Nandanvan Prop.-1 & 2	In ward No.36 At Existing ESR site	2	4.54	296.000	317.000	322.000	21.00
7	Kharabi Rd.	In ward No. 8, NW of Kharbi Chk. On Ring Rd.	1	2.27	297.000	318.000	323.000	21.00
8	Bhandewadi	Near STP Premises in NMC Area	1	2.27	300.500	318.500	323.500	18.00
9	Paradi Rd.	In ward No. 7, near Paradi Naka	2	4.54	293.225	314.225	319.225	21.00
10	Lakkadganj	In Ward No. 32 in NMC office comp.	1	2.27	292.500	313.500	318.500	21.00
North Central Zone								
11	Shanti Nagar	In ward No. 29, In Nagsen Udyan	1	2.27	297.000	318.000	323.000	21.00
12	Indora 1 & 2	In ward No. 62, NW of Indora Chk.	2	4.54	302.500	323.500	328.500	21.00
13	Bastarwari 1 & 2	In ward No. 67, Near Yendal Wadi Pr. School	2	4.54	300.500	321.500	326.500	21.00
14	Binaki Prop. 1 & 2	In ward No.25 At Existing ESR site	2	4.54	291.680	312.680	318.680	21.00
North West Zone								
15	Seminari Hills	Near Existing MBR	1	2.27	349.000	367.000	372.000	18.00
South West Zone								
16	Dharampeth	In ward No.85 At NMC Traffic Park	1	2.27	306.000	327.000	332.000	21.00
17	Pratap Nagar	In ward No.50, N.I.T.Play ground behind Durga Mandir	1	2.27	310.000	331.000	336.000	21.00
18	Trimurtinagar	In ward No.16, in play ground, Trimurti Nagar.	1	2.27	309.000	330.000	335.000	21.00
19	Jaitala Sump	In ward No.15 At NMC School	1	1.50	335.000	332.000	335.000	

WATER DISTRIBUTION ZONE (2011)



LEGEND :-

- EAST ZONE (KANHAN)
- NORTH CENTRAL ZONE
- CENTRAL ZONE
- NORTH WEST ZONE
- SOUTH EAST ZONE
- SOUTH WEST ZONE

DETAILS OF WATER DISTRIBUTION ZONE (2011)

SR. NO.	NAME OF ZONE	AREA (SQ. KM)	POPULATION	WATER DEMAND @ SERVICE RESERVOIR	SERVICE RESERVOIR		RAW WATER SOURCE
					EXIST.	PROP.	
1.	EAST (KANHAN)	48.4758	747103	123.23	11 ESR	7 ESR	KANHAN SOURCE
2.	NORTH CENTRAL	41.8097	742399	118.66	5 ESR 3 GSR	6 ESR	PENCH SOURCE
3.	CENTRAL	8.1398	274411	41.83	2 ESR 2 GSR	1 ESR	PENCH SOURCE
4.	NORTH WEST	38.3479	281000	45.65	3 ESR 3 GSR	1 ESR	PENCH SOURCE
5.	SOUTH EAST	17.7353	365264	58.76	5 ESR	4 ESR	PENCH SOURCE
6.	SOUTH WEST	63.0516	462966	76.99	8 ESR 1 GSR	3 ESR 1 SUMP	PENCH SOURCE
TOTAL		217.56	2873143	465.12	34 ESR 9 GSR	22 ESR 1 SUMP	

	Cost Abstract

ABSTRACT OF COST ESTIMATE

(DPR PART-IV)

Up-gradation & Proposed Distribution Network

Sr. No.	DESCRIPTION	AMOUNT (Rs.)
1.	South East Zone	154180000
2.	East Zone Kanhan	310610000
3.	North Central Zone	263030000
4.	Central Zone	75225000
5.	North West Zone	123526000
6	South West	180942000
	TOTAL Rs.	1107513000

Note: Detail Estimate of Up-gradation & Proposed Distribution Network in Existing & Proposed ESR command area from respective Zone is given separately in respective volume No 2 to 7

Annexure

ANNEXURE - 2
Augumentation to Nagpur Water Supply Scheme (Pench-4) :
Statement of Ward area & Population distribution for Design of Distribution Network

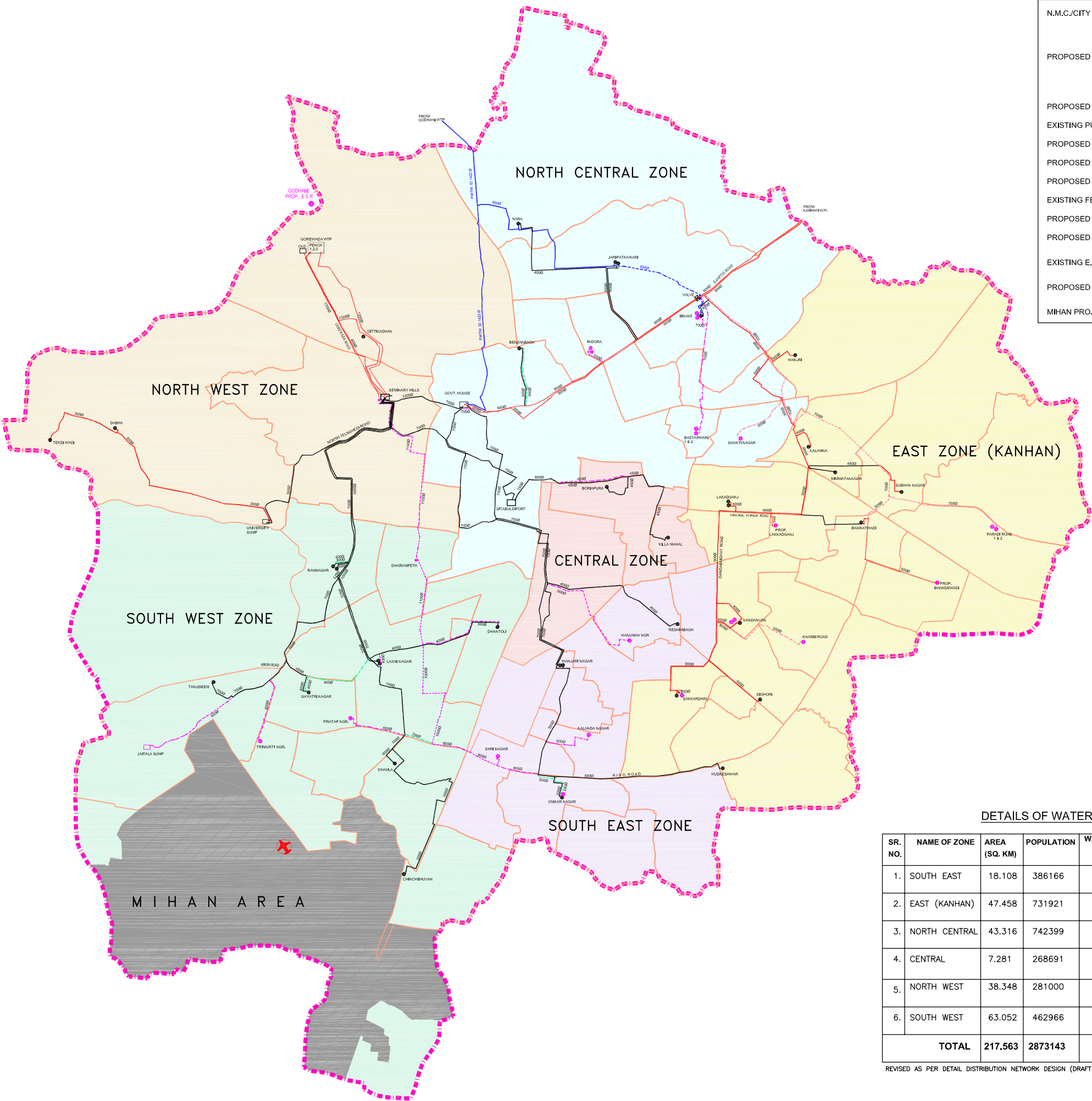
Ward No.	Ward Name	Total Area of Ward (Ha.)	Total Usable Area of Ward (Ha)	Total Non Usable Area of Ward(Ha.)	Area not Covered in CA of any ESR (Ha.)	% Growth rate of Pop. Assumed for Design (Per Year)			Modified Population Density as per assumed growth rate			Projected Population of Ward (Total) as per Modified Density			Slum Pop. As per JTZ	Projected Slum Population in Ward (Total) as per Modified Density		
						2001 to 2011	2011 to 2021	2021 to 2031	2011	2021	2031	2011	2021	2031		2011	2021	2031
1	2	3	4	5	6	9	10	11	12	13	14	15	16	17		18	19	20
1	Gorewada	875.1663	554.1095	321.0568		12.0	10.0	6.0	74.88	149.76	239.62	41492	82984	132774	6835	15037	30074	48118
2	Nara	1142.0422	778.3023	363.7040		11.0	8.0	6.0	87.07	156.72	250.75	67763	121973	195157	6584	13826	24887	39819
3	Nari	947.2512	516.4832	430.9943		13.0	8.0	6.0	117.89	212.20	339.52	60888	109598	175357	12228	28124	50623	80997
4	Yashodhara Ngr	169.1782	123.2070	45.9206		8.0	4.0	3.0	524.16	733.82	953.97	64580	90412	117536	7060	12708	17791	23128
5	Kalamna	600.3785	325.7409	274.8672		8.0	6.0	6.0	128.95	206.31	330.10	42003	67205	107528	7811	14060	22496	35994
6	Pardi	1079.1833	685.9390	393.2443		10.0	6.0	6.0	111.73	178.77	286.03	76640	122624	196198	4899	9798	15677	25083
7	Bhandewadi	314.9406	220.7180	94.7300		8.0	5.0	4.0	270.79	406.19	568.67	59769	89654	125515	10747	19345	29018	40625
8	Wathoda	814.5017	567.9414	246.5603		12.0	7.0	7.0	148.79	252.95	430.01	84506	143660	244222	7624	16773	28514	48474
9	Dighori	374.4525	374.4525	0.0000		8.0	5.0	5.0	147.06	220.59	330.89	55067	82601	123901	7880	14184	21276	31914
10	Mhalgi Ngr	372.5878	368.0461	4.5417		10.0	7.0	6.0	169.16	287.58	460.12	62260	105842	169347	3248	6496	11043	17669
11	Manewada	380.7568	380.7568	0.0000		10.0	6.0	6.0	171.60	274.56	439.30	65338	104541	167265	2000	4000	6400	10240
12	Jogi Ngr	190.2499	190.2499	0.0000		10.0	6.0	6.0	250.08	400.13	640.21	47578	76125	121800	9801	19602	31363	50181
13	Narendra Ngr	1112.6733	455.3195	657.3538		12.0	8.0	7.0	138.87	249.96	424.93	63228	113810	193478	1588	3494	6289	10691
14	Sonegaon	759.9350	198.3692	53.2981	508.2356	5.0	3.0	3.0	157.63	204.92	266.40	31269	40650	52845	5789	8684	11289	14676
15	Jaitala	1296.7270	234.7158	282.3276	779.6836	5.0	4.0	3.0	152.87	214.01	278.22	35880	50232	65302	14203	21305	29827	38775
16	Ambazari	1454.7844	256.0057	108.8162	1097.7754	6.0	4.0	4.0	146.83	205.56	287.78	37589	52625	73674	5246	8394	11752	16453
17	Hajari Pahad	1322.8041	613.8411	708.9630		12.0	6.0	4.0	106.95	171.12	239.57	65652	105043	147060	14838	20714	24815	28091
18	Borgaon	238.0204	206.1330	31.9375		6.0	5.0	4.0	189.05	283.58	397.01	38970	58455	81837	2520	4032	6048	8467
19	Police Line Takali	138.9025	66.4555	72.4724		2.5	2.0	1.5	324.28	389.13	447.50	21550	25860	29739	4114	5143	6172	7098
20	Mankapur	188.1806	111.4477	76.7329		4.0	3.0	2.0	291.91	379.49	455.38	32533	42293	50751	5005	7007	9109	10931
21	Chhawani	112.7538	76.3491	36.4047		2.0	1.5	1.5	232.48	267.36	307.46	17750	20413	23474	5009	6011	6913	7950
22	Jaripatka	57.2919	51.2001	6.0918		2.0	2.0	2.0	350.35	420.42	504.51	17938	21526	25831	4055	4866	5839	7007
23	Nagsen Ngr	59.2444	59.2752	0.0000		2.5	2.0	1.5	392.88	471.46	542.17	23288	27946	32137	10393	12991	15589	17927
24	Sidhartha Ngr	118.3155	94.4333	23.8822		3.5	2.5	2.0	253.61	295.93	380.41	23949	27946	35924	5128	6923	8654	10385
25	Mahendra Ngr	75.9881	75.9403	0.0000		2.0	2.0	1.5	278.09	333.70	383.76	21118	25342	29143	11113	13336	16003	18403
26	Rani Durgawati Ngr	60.9713	57.7403	3.2506		5.0	2.5	1.5	581.33	726.66	835.66	33566	41958	48251	18148	27222	34028	39132
27	Navi Mangalwari	82.8723	79.6381	3.2391		3.5	2.5	2.0	338.76	423.45	508.14	26978	33723	40467	10747	14508	18135	21762
28	Prem Ngr	44.0455	40.6802	3.3640		2.5	2.0	2.0	460.17	552.21	662.65	18720	22464	26957	3799	4749	5699	6839
29	Shanti Ngr	72.4643	66.7845	5.6765		4.0	2.5	2.0	426.93	533.66	640.39	28512	35640	42768	16520	23128	28910	34692
30	Dipti Signal	79.6537	76.3183	0.0000	3.3290	3.0	2.0	1.5	285.31	342.37	393.72	21774	26129	30048	14438	18769	22523	25901
31	Minimata Ngr	55.6151	55.6776	0.0000		5.0	2.5	1.5	557.17	696.47	800.93	31022	38778	44594	11941	17912	22390	25749

Ward No.	Ward Name	Total Area of Ward (Ha.)	Total Usable Area of Ward (Ha)	Total Non Usable Area of Ward(Ha.)	Area not Covered in CA of any ESR (Ha.)	% Growth rate of Pop. Assumed for Design (Per Year)			Modified Population Density as per assumed growth rate			Projected Population of Ward (Total) as per Modified Density			Slum Pop. As per JTZ	Projected Slum Population in Ward (Total) as per Modified Density		
						2001 to 2011	2011 to 2021	2021 to 2031	2011	2021	2031	2011	2021	2031		2011	2021	2031
1	2	3	4	5	6	9	10	11	12	13	14	15	16	17		18	19	20
32	Vardhaman Ngr	102.3120	89.2579	12.6614		2.0	1.5	1.5	214.93	247.17	284.24	19184	22062	25371	0	0	0	0
33	Hiwari	39.7916	39.1213	0.6703		2.0	1.5	1.0	531.22	610.9	671.99	20782	23899	26289	6614	7937	9128	10041
34	Kumbhar Toli	47.0758	25.8683	21.2142		2.0	1.0	0.5	791.7	870.87	914.42	20480	22528	23654	13981	16777	18455	19378
35	Darshan Colony	56.0623	52.6590	3.4093		3.0	2.0	1.5	519.4	623.28	716.77	27351	32821	37744	6506	8458	10150	11673
36	Nandanvan	65.8457	58.5649	7.2392		3.0	2.0	2.0	384.33	461.19	553.43	22508	27010	32412	5768	7498	8998	10798
37	Harpur	90.4851	57.2931	33.1938		3.0	1.0	1.0	297.78	327.56	360.32	17061	18767	20644	1105	1437	1581	1739
38	Sakkardara	63.7279	53.6316	10.0453		3.0	2.5	2.0	481.13	601.42	721.70	25804	32255	38706	15002	19503	24379	29255
39	Bidipeth	77.9657	71.9190	6.0527		3.0	2.5	2.0	380.23	475.29	570.35	27346	34183	41019	4563	5932	7415	8898
40	New Subhedar	54.2466	54.1146	0.0000		1.0	0.5	0.5	292.08	306.69	322.02	15806	16596	17426	1893	2082	2186	2295
41	Ayodha Ngr	57.9275	57.4690	0.4657		3.0	2.0	1.5	361.05	433.26	498.24	20749	24899	28634	1500	1950	2340	2691
42	Gyaneshwar Ngr	46.5651	46.5651	0.0000		1.0	1.0	0.5	340.49	374.54	393.27	15855	17441	18313	1832	2015	2217	2328
43	Parvati Ngr	44.0968	44.0968	0.0000		1.0	0.5	0.0	377.26	396.12	396.12	16636	17468	17468	11619	12781	13420	13420
44	Ajni	133.4483	68.1820	65.5754		0.0	0.0	0.0	166.14	166.14	166.14	11328	11328	11328	0	0	0	0
45	Chunabhati	91.6616	83.4636	8.1980		1.5	1.0	1.0	220.99	243.09	267.40	18445	20290	22318	6818	7841	8625	9488
46	Sai Mandir	122.3120	111.7708	9.3951		3.5	2.5	2.0	207.46	259.33	311.19	23188	28985	34782	0	0	0	0
47	Khamla	79.1793	76.4032	2.7634		2.5	2.0	2.0	251.49	301.79	362.15	19215	23058	27670	5544	6930	8316	9979
48	Swavalambi Ngr	180.8684	169.4654	11.3070		5.0	3.5	3.0	208.32	281.23	365.60	35303	47659	61957	700	1050	1418	1843
49	Subhash Ngr	86.9421	81.2277	5.7143		5.0	3.5	3.0	385.10	519.89	675.86	31281	42229	54898	9744	14616	19732	25652
50	Gopal Ngr	86.3262	74.3015	12.0247		2.5	2.0	2.0	276.39	331.66	398.00	20536	24643	29572	1743	2179	2615	3138
51	Vishvashvaraiya	173.4696	70.8812	6.1829	96.4055	1.5	1.5	1.0	250.39	287.95	316.74	17748	20410	22451	644	741	852	937
52	Hill Top	46.3062	46.3062	0.0000		2.0	1.5	1.0	551.37	634.08	697.49	25532	29362	32298	14445	17334	19934	21927
53	Ram Ngr	57.7804	45.3482	12.4322		2.5	1.5	1.0	346.76	398.78	438.65	15725	18084	19892	7116	7294	7403	7477
54	Telenkhedi	53.6874	39.4599	14.2275		2.0	1.5	1.0	401.27	461.46	507.60	15834	18209	20030	5370	6444	7411	8152
55	Ravi Ngr	253.0673	105.0361	148.0312		1.0	1.0	1.0	119.38	131.32	144.45	12539	13793	15172	300	330	363	399
56	Surendra Ngr	250.4743	87.0598	163.4145		2.5	1.5	1.0	332.39	382.25	420.48	28938	33279	36607	15580	19475	22396	24636
57	Seminary Hills	184.9320	46.8406	138.0914		2.0	1.0	1.0	427.49	470.24	517.27	20024	22026	24229	10832	12998	14298	15728
58	Sadar	106.6960	43.2623	63.4337		1.0	1.0	1.0	291.39	320.52	352.58	12606	13867	15253	3970	4367	4804	5284
59	Nai Basti	75.0030	49.4726	25.5304		1.5	1.0	1.0	299.26	329.18	362.10	14805	16286	17914	7810	8982	9880	10868
60	Mekosa Bagh	107.3339	74.7182	32.6157		3.0	2.5	2.0	307.42	384.28	461.13	22970	28713	34455	6043	7856	9820	11784
61	Indora	49.2343	49.2343	0.0000		0.5	0.5	0.5	288.62	303.05	318.20	14210	14921	15667	1521	1597	1677	1761
62	Choukse Colony	43.7466	43.7328	0.0000		0.5	0.5	0.5	349.28	366.74	385.08	15275	16039	16841	2284	2398	2518	2644
63	Budha Ngr	43.9206	43.4122	0.0000		0.0	0.0	0.0	272.94	272.94	272.94	11849	11849	11849	293	293	293	293
64	Vaishali Ngr	47.4644	43.8597	3.6047		1.5	1.5	1.5	385.59	443.43	509.95	16912	19449	22366	6199	7129	8198	9428
65	Panchasil Ngr	46.9643	46.8479	0.1165		1.5	1.5	1.5	371.59	427.32	491.42	17408	20019	23022	7266	8356	9609	11050
66	Naik Talav	20.3000	20.3000	0.0000		0.5	0.5	0.0	723.4	759.57	759.57	14685	15419	15419	7787	8176	8585	8585

Ward No.	Ward Name	Total Area of Ward (Ha.)	Total Usable Area of Ward (Ha)	Total Non Usable Area of Ward(Ha.)	Area not Covered in CA of any ESR (Ha.)	% Growth rate of Pop. Assumed for Design (Per Year)			Modified Population Density as per assumed growth rate			Projected Population of Ward (Total) as per Modified Density			Slum Pop. As per JTZ	Projected Slum Population in Ward (Total) as per Modified Density		
						2001 to 2011	2011 to 2021	2021 to 2031	2011	2021	2031	2011	2021	2031		2011	2021	2031
1	2	3	4	5	6	9	10	11	12	13	14	15	16	17		18	19	20
67	Khairipura	24.8385	24.0145	0.8172		0.0	0.0	0.0	486.71	486.71	486.71	11688	11688	11688	5609	5609	5609	5609
68	Bastarwari	18.6445	18.6473	0.0000		0.0	0.0	0.0	693.93	693.93	693.93	12940	12940	12940	8248	8248	8248	8248
69	Subhash Chandra	48.4493	30.3764	18.0714		0.0	0.0	0.0	367.92	367.92	367.92	11176	11176	11176	6414	6414	6414	6414
70	Harihar Mandir	107.1989	91.7661	15.3782		0.0	0.0	0.0	140.05	140.05	140.05	12852	12852	12852	2846	2846	2846	2846
71	Lakhadganj	65.0258	64.9725	0.0000		2.0	2.0	1.5	293.68	352.41	405.28	19081	22897	26332	845	1014	1217	1400
72	Bagadganj	38.5022	38.5290	0.0000		0.5	0.0	0.0	355.47	355.47	355.47	13696	13696	13696	6131	6438	6438	6438
73	Shiv Ngr	52.3281	47.7395	4.5430		2.0	1.5	1.5	394.12	453.24	521.22	18815	21637	24883	1070	1284	1477	1699
74	Om Ngr	45.5564	39.2764	5.6728		0.0	0.0	0.0	311.59	311.59	311.59	12238	12238	12238	0	0	0	0
75	Raghuji Ngr	55.8602	55.1318	0.7903		1.0	1.0	0.5	304.22	334.64	351.37	16772	18449	19372	0	0	0	0
76	Vishvakarma Ngr	43.8196	43.8196	0.0000		2.0	1.0	0.5	507.4	558.14	586.05	22234	24457	25680	5200	6240	6864	7207
77	Chandramani Ngr	59.5473	59.2413	0.3549		2.0	1.0	0.5	441.8	485.98	510.28	26173	28790	30230	4669	5603	6163	6471
78	Kausalya Ngr	38.0647	29.2896	8.6868		0.5	0.5	0.5	463.61	486.79	511.13	13579	14258	14971	6430	6752	7090	7445
79	T.B. Ward	94.8216	19.1552	75.6664		0.5	0.5	0.0	792.37	831.99	831.99	15178	15937	15937	8810	9251	9714	9714
80	Jail Ward	183.8068	52.0480	131.7588		1.0	1.0	1.0	275.02	302.52	332.77	14314	15745	17320	287	316	348	383
81	Pratap Ngr	89.5749	59.5657	30.0092		1.5	1.0	1.0	278.78	306.66	337.33	16606	18267	20093	2443	2809	3090	3399
82	Diksha Bhumi	133.8978	65.9811	67.9167		1.5	1.5	1.0	204.15	234.77	258.25	13470	15491	17040	0	0	0	0
83	Ramdaspath	116.3858	70.8938	45.4920		2.5	1.5	1.5	227.81	261.98	301.27	16150	18573	21358	3878	4848	5575	6411
84	Shivaji Ngr	84.0268	82.4740	1.5528		2.5	1.5	1.5	220.17	253.19	291.17	18158	20882	24014	0	0	0	0
85	Dharampath	53.0424	53.0220	0.0000		0.0	0.0	0.0	221.46	221.46	221.46	11742	11742	11742	937	937	937	937
86	Civil Lines	312.6582	81.0405	231.6177		1.0	1.0	1.0	202.82	223.11	245.42	16437	18081	19889	2352	2587	2846	3131
87	Gaddigodam	129.9973	39.2032	90.7941		0.0	0.0	0.0	313.67	313.67	313.67	12297	12297	12297	6205	6205	6205	6205
88	Motibagh	60.1750	34.1212	26.0538		0.0	0.0	0.0	334.45	334.45	334.45	11412	11412	11412	1781	1781	1781	1781
89	Naya Naksha	43.4737	43.4737	0.0000		0.5	0.5	0.0	273.22	286.88	286.88	11878	12472	12472	0	0	0	0
90	Lashkaribagh	25.8232	24.6925	1.1307		1.5	1.0	0.5	564.02	620.42	651.44	13927	15320	16086	5415	6227	6850	7193
91	Balabhaupt	25.5854	25.5854	0.0000		0.0	0.0	0.0	534.13	534.13	534.13	13666	13666	13666	7380	7380	7380	7380
92	Tandapeth	18.1835	18.1677	0.0000		0.5	0.5	0.5	879.31	923.27	969.44	15975	16774	17612	11806	12396	13016	13667
93	Lendi Talav	19.3171	15.1688	4.1483		0.0	0.0	0.0	944.83	944.83	944.83	14332	14332	14332	3652	3652	3652	3652
94	Bhagwan Mahavir	26.2853	25.3186	0.9667		0.0	0.0	0.0	449.71	449.71	449.71	11386	11386	11386	2646	2646	2646	2646
95	Chintesar Ngr	25.1315	25.1315	0.0000		0.0	0.0	0.0	495.55	495.55	495.55	12454	12454	12454	8915	8915	8915	8915
96	Juni Mangalwari	22.4480	22.4370	0.0000		0.0	0.0	0.0	579.36	579.36	579.36	12999	12999	12999	14147	14147	14147	14147
97	Nawabpura	27.3120	27.3690	0.0000		0.0	0.0	0.0	502.32	502.32	502.32	13748	13748	13748	6793	6793	6793	6793
98	Chitnispora	19.5101	19.5101	0.0000		0.0	0.0	0.0	679.14	679.14	679.14	13250	13250	13250	11144	11144	11144	11144
99	Juni Shukarawari	33.6964	31.7906	1.9197		0.0	0.0	0.0	375.24	375.24	375.24	11929	11929	11929	8862	8862	8862	8862
100	Reshimbagh	78.3505	31.8636	46.4869		0.5	0.5	0.5	442.32	464.44	487.66	14094	14799	15539	2667	2800	2940	3087
101	Somwarpath	39.6672	38.3651	1.2670		1.0	0.5	0.5	434.67	456.4	479.22	16676	17510	18385	1468	1615	1696	1781

Ward No.	Ward Name	Total Area of Ward (Ha.)	Total Usable Area of Ward (Ha)	Total Non Usable Area of Ward(Ha.)	Area not Covered in CA of any ESR (Ha.)	% Growth rate of Pop. Assumed for Design (Per Year)			Modified Population Density as per assumed growth rate			Projected Population of Ward (Total) as per Modified Density			Slum Pop. As per JTZ	Projected Slum Population in Ward (Total) as per Modified Density		
						2001 to 2011	2011 to 2021	2021 to 2031	2011	2021	2031	2011	2021	2031		2011	2021	2031
1	2	3	4	5	6	9	10	11	12	13	14	15	16	17		18	19	20
102	Medical College	107.5008	43.0541	64.4467		0.0	0.0	0.0	279.65	279.65	279.65	12040	12040	12040	350	350	350	350
103	Rambagh	25.4383	18.8100	6.6201		0.5	0.5	0.0	765.87	804.16	804.16	14406	15126	15126	3905	4100	4305	4305
104	Shaniwari	106.1074	39.8864	66.2210		0.5	0.5	0.0	348.97	366.41	366.41	13919	14615	14615	9139	9596	10076	10076
105	Dhantoli	70.9270	66.1659	4.7611		3.0	2.0	2.0	292.2	350.65	420.78	19334	23201	27841	5133	6673	8008	9610
106	Sangam	56.0863	47.0035	9.0828		0.0	0.0	0.0	241.64	241.64	241.64	11358	11358	11358	5432	5432	5432	5432
107	Sitabuldi	23.0252	23.0249	0.0000		0.0	0.0	0.0	436.53	436.53	436.53	10051	10051	10051	4669	4669	4669	4669
108	Khalashi Line	132.7830	23.9739	108.8091		0.0	0.0	0.0	597.48	597.48	597.48	14324	14324	14324	3427	3427	3427	3427
109	Boriapura	35.7231	20.3034	15.4197		0.0	0.0	0.0	630.04	630.04	630.04	12792	12792	12792	7437	7437	7437	7437
110	Saifi Ngr	18.7939	17.6428	1.1511		0.0	0.0	0.0	750.56	750.56	750.56	13242	13242	13242	5604	5604	5604	5604
111	Bhan Kheda	14.5299	14.5292	0.0000		0.0	0.0	0.0	964.54	964.54	964.54	14014	14014	14014	12802	12802	12802	12802
112	Barase Ngr	19.5715	17.1921	2.3794		0.0	0.0	0.0	672.4	672.4	672.40	11560	11560	11560	8739	8739	8739	8739
113	Jagannath Ngr	21.7080	21.6895	0.0000		0.0	0.0	0.0	639.48	639.48	639.48	13870	13870	13870	11089	11089	11089	11089
114	Maskasath	19.1206	19.1144	0.0000		0.0	0.0	0.0	509.67	509.67	509.67	9742	9742	9742	6813	6813	6813	6813
115	Mahatma Gandhi	26.7523	26.7588	0.0000		0.0	0.0	0.0	456.75	456.75	456.75	12222	12222	12222	7134	7134	7134	7134
116	Ayachit Mandir	29.1308	29.1308	0.0000		0.0	0.0	0.0	450.93	450.93	450.93	13136	13136	13136	7648	7648	7648	7648
117	Killa	29.4437	28.2318	1.1936		0.0	0.0	0.0	438.62	438.62	438.62	12383	12383	12383	9596	9596	9596	9596
118	Nagar Bhawan	26.6964	24.0308	2.6656	1.9611	0.0	0.0	0.0	509.76	509.76	509.76	12250	12250	12250	4726	4726	4726	4726
119	Siraspeth	38.7818	34.8101	3.9717		1.0	0.5	0.5	514.74	540.47	567.50	17918	18814	19755	11350	12485	13109	13764
120	Chandan Ngr	32.6722	27.3093	5.3641		0.0	0.0	0.0	438.61	438.61	438.61	11978	11978	11978	989	989	989	989
121	Model Mill	59.4655	29.6810	29.7845		0.0	0.0	0.0	415.65	415.65	415.65	12337	12337	12337	4367	4367	4367	4367
122	Ganeshpeth	80.3417	35.4673	44.8744		0.0	0.0	0.0	362.19	362.19	362.19	12846	12846	12846	3021	3021	3021	3021
123	Bajeria	32.8423	22.8674	9.9749		0.0	0.0	0.0	529.62	529.62	529.62	12111	12111	12111	6311	6311	6311	6311
124	Mominpura	14.1269	14.1269	0.0000		0.0	0.0	0.0	976.01	976.01	976.01	13788	13788	13788	9371	9371	9371	9371
125	Timki	14.4680	14.4661	0.0000		0.0	0.0	0.0	879.57	879.57	879.57	12724	12724	12724	1643	1643	1643	1643
126	Gandhibagh	32.8781	26.2503	6.6278		0.0	0.0	0.0	442.89	442.89	442.89	11626	11626	11626	3051	3051	3051	3051
127	Mahal	29.1493	26.8933	2.2560		0.0	0.0	0.0	386.94	386.94	386.94	10406	10406	10406	3249	3249	3249	3249
128	Ganjipeth	21.5269	19.3396	2.1873		0.0	0.0	0.0	716.2	716.2	716.20	13851	13851	13851	7267	7267	7267	7267
129	Hansapuri	18.7086	18.1587	0.5499		0.0	0.0	0.0	686.06	686.06	686.06	12458	12458	12458	3964	3964	3964	3964
Total		21078.46	12332.51	6266.476	2487.390							2881096	3720898	4810013	770979	973209	1193262	1458199

WATER DISTRIBUTION ZONE (2011)



LEGEND

- N.M.C./CITY BOUNDARY (CENSUS)
- PROPOSED WATER DIST. ZONE (2011)

EAST (KANHAN)

NORTH CENTRAL

CENTRAL

NORTH WEST

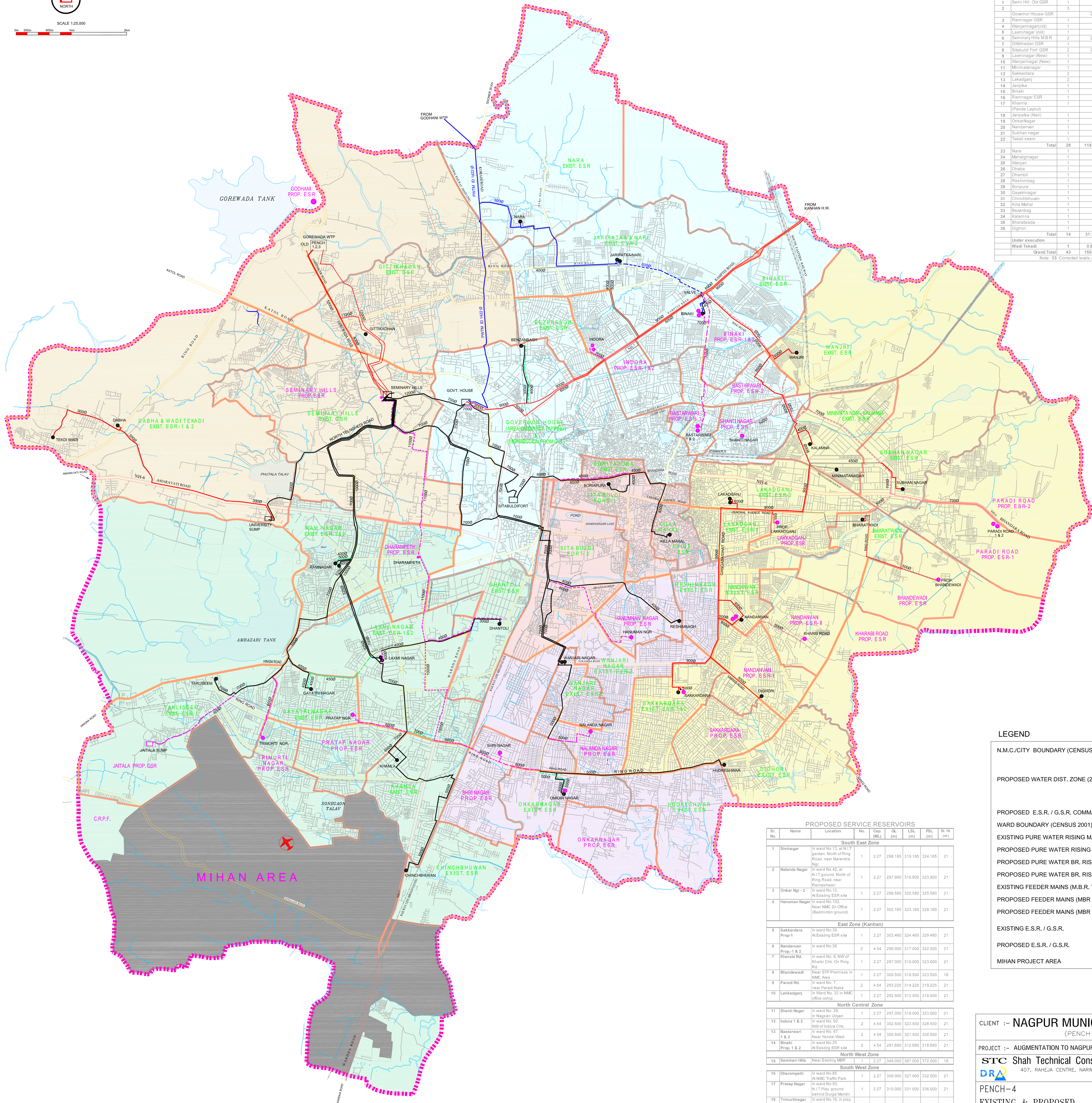
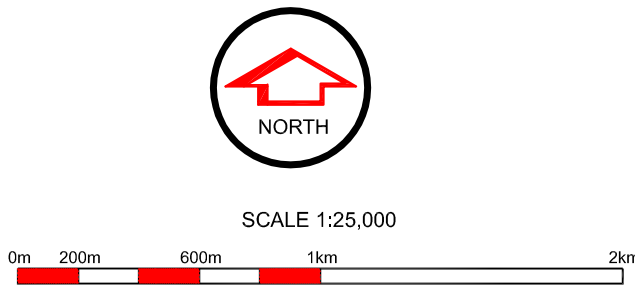
SOUTH EAST

SOUTH WEST
- PROPOSED E.S.R. / G.S.R. COMMAND AREA
- EXISTING PURE WATER RISING MAIN
- PROPOSED PURE WATER RISING MAIN (2011)
- PROPOSED PURE WATER BR. RISING MAIN (2011)
- PROPOSED PURE WATER BR. RISING MAIN (2021)
- EXISTING FEEDER MAINS (M.B.R. TO E.S.R./G.S.R.)
- PROPOSED FEEDER MAINS (MBR TO ESR) 2011
- PROPOSED FEEDER MAINS (MBR TO ESR) 2021
- EXISTING E.S.R. / G.S.R.
- PROPOSED E.S.R. / G.S.R.
- MIHAN PROJECT AREA

DETAILS OF WATER DISTRIBUTION ZONE (2011)

SR. NO.	NAME OF ZONE	AREA (SQ. KM)	POPULATION	WATER DEMAND @ SERVICE RESERVOIR	SERVICE RESERVOIR		RAW WATER SOURCE
					EXIST.	PROP.	
1.	SOUTH EAST	18.108	386166	62.76	5 ESR	4 ESR	PENCH SOURCE
2.	EAST (KANHAN)	47.458	731921	120.50	10+1 ESR	8 ESR	KANHAN SOURCE
3.	NORTH CENTRAL	43.316	742399	118.66	5 ESR 3 GSR	6 ESR	PENCH SOURCE
4.	CENTRAL	7.281	268691	40.56	3 ESR 2 GSR		PENCH SOURCE
5.	NORTH WEST	38.348	281000	45.65	3 ESR 3 GSR	1 ESR	PENCH SOURCE
6.	SOUTH WEST	63.052	462966	76.99	8 ESR 1 GSR	3 ESR 1 SUMP	PENCH SOURCE
TOTAL		217.563	2873143	465.12	34 ESR 9 GSR	22 ESR 1 SUMP	

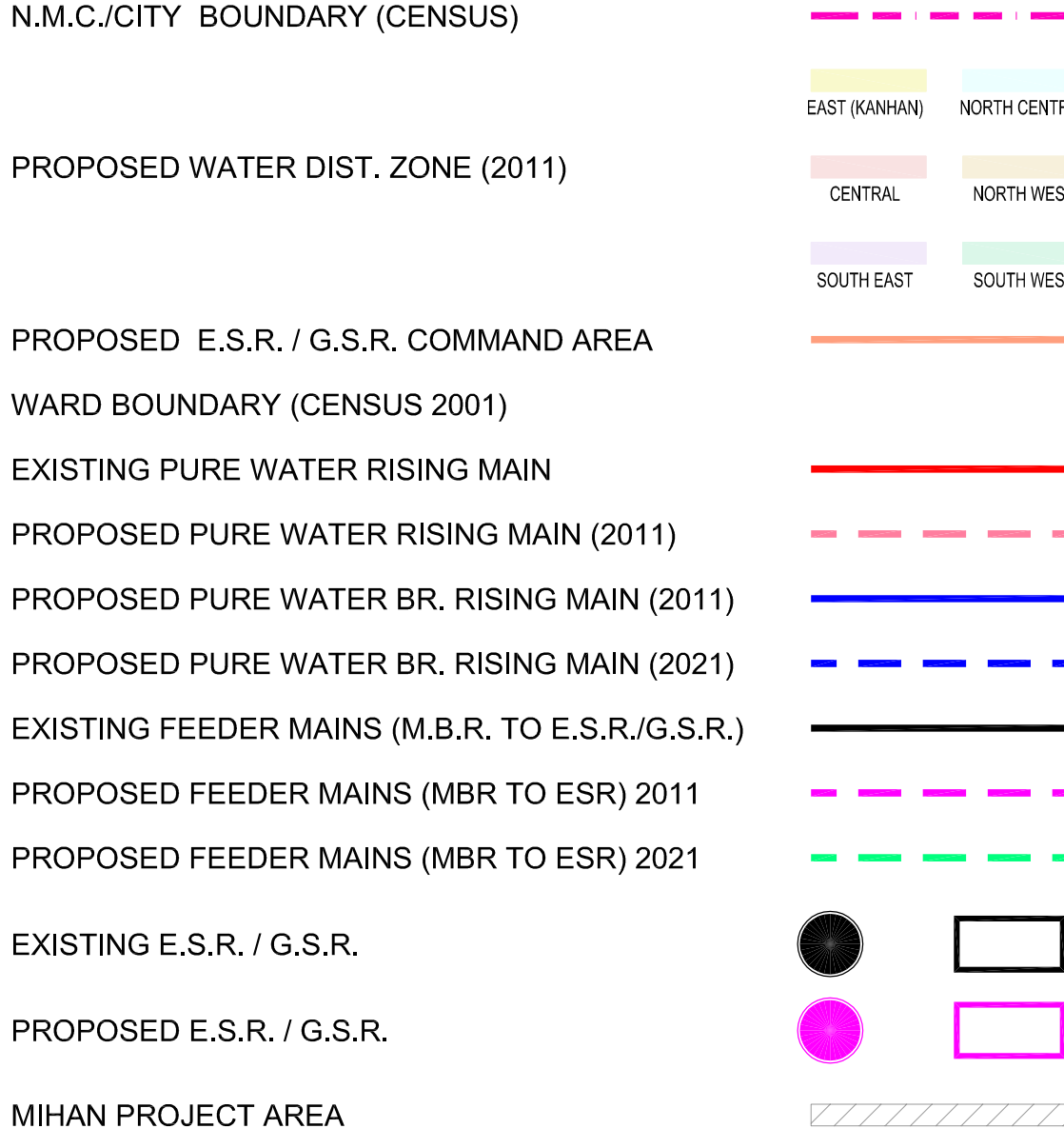
REVISED AS PER DETAIL DISTRIBUTION NETWORK DESIGN (DRAFT REPORT PART-IV)



Details of Existing OF M.B.R., E.S.R. & G.S.R.									
Sr. No.	Name of ESR	Nos	Capacity (ml)	G.L. (m)	F.S.L. (m)	L.S.L. (m)	St. Ht. (m)	Re-mark	
1	Semi Hill. Old GSR	1	4.54	349.7	356.18	348.18			
2	Governor House GSR	1	22.74	344	345.95	339.95			
3	Ramnagar GSR	1	0.91	329.175	331.975	327.975		\$S	
4	Wanjinagar(Old)	1	2.27	305.86	326.22	321.65	15.79		
5	Laxminagar (old)	1	2.27	311.7	335.28	330.7	19		
6	Seminary Hills MB R	2	20.43	349.7	356.18	348.18			
7	Gilbhadan GSR	1	5.94	338.345	343.065	336.92		\$S	
8	Shabudi Fort GSR	2	22.74	334.3	338.4	332.4			
9	Laxminagar (New)	1	2.27	311.79	335.28	330.71	18.92		
10	Wanjinagar (New)	1	2.27	305.86	326.22	321.65	15.79		
11	Minimatnagar	1	2.27	290.83	317.68	310.33	19.5	\$S	
12	Sakkardara	2	4.54	303.76	326	321	17.24		
13	Lakadganj	2	4.54	301.29	327.26	322.25	21	\$S	
14	Jaripka	1	2.27	295.76	321.76	316.76	21		
15	Binaki	1	2.27	292.675	318.675	313.675	21		
16	Ramnagar ESR	1	2.27	325.43	345.93	340.93	11.5	\$S	
17	Khamia	1	2.27	308.45	329.45	324.45	15		
18	Jaripaka (Nan)	1	2.27	295.76	321.76	316.76	21		
19	Onkar Nagar	1	2.27	299.58	325.58	320.58	21	\$S	
20	Nandanvan	1	2.27	296	322	317	21	\$S	
21	Subhan nagar	1	2.27	286.03	312.03	307.03	21		
22	Takali seem	1	2.27	322.22	341.22	337.22	15	\$S	
Total		28	118.16	ml					
23	Nara	1	2.27	298	322	317	21		
24	Mahalinganagar	1	2.27	298	324	319	21		
25	Wanjiari	1	2.27	287.325	313.325	308.325	21	\$S	
26	Dhaba	1	2.27	348.735	372.735	367.735	21	\$S	
27	Dhantoli	1	2.27	307.495	330.495	325.495	18	\$S	
28	Reshimbag	1	2.27	299.5	325.5	320.5	21		
29	Boripura	1	2.27	308	334	329	21		
30	Gayamnagar	1	2.27	314.88	338.88	333.88	19	\$S	
31	Chinchbhuvan	1	2.27	295.14	321.14	316.14	21	\$S	
32	Killa Mahal	1	2.27	298.495	324.495	319.495	21	\$S	
33	Bezanbag	1	2.27	312.435	336.435	331.435	19	\$S	
34	Kalamna	1	2.27	291.68	317.68	312.68	21	\$S	
35	Bhandewadi	1	2.27	298.175	312.175	307.175	21	\$S	
36	Dighori	1	2.27	297.875	323.875	318.875	21	\$S	
Total		14	31.78						
Under execution		1	0.85	359.48	385.48	380.48	21		
Wadi Tekadi		1	0.85	359.48	385.48	380.48	21		
Grand Total		43	150.79						

Note: \$S: Corrected levels as per survey carried out by consultants.

LEGEND



PROPOSED SERVICE RESERVOIRS									
Sr. No.	Name	Location	No.	Cap. (ML)	GL (m)	LSL (m)	PSL (m)	St. Ht. (m)	
South East Zone									
1	Shrinagar	In ward No 13 at N.I.T garden, North of Ring Road, near Narendra Ngr.	1	2.27	298.185	319.185	324.185	21	
2	Nalanda Nagar	In ward No 42, at N.I.T ground, North of Ring Road, near Ramnagar	1	2.27	297.900	318.900	323.900	21	
3	Onkar Ngr - 2	In ward No 12, At Existing ESR site	1	2.27	299.580	320.580	325.580	21	
4	Hanuman Nagar	In ward No 102, Near NMC Zn Office (Badminton ground)	1	2.27	302.160	323.160	328.160	21	
East Zone (Kanhana)									
5	Sakkardara Prop-1	In ward No.39 At Existing ESR site	1	2.27	303.460	324.460	329.460	21	
6	Nandanvan Prop-1 & 2	In ward No.36	2	4.54	296.000	317.000	322.000	21	
7	Kharabi Rd	In ward No. 8, NW of Kharabi Chk. On Ring Rd	1	2.27	297.000	318.000	323.000	21	
8	Bhandewadi	Near STP Premises in NMC Area	1	2.27	300.500	318.500	323.500	18	
9	Paradi Rd.	In ward No. 7, near Paradi Naka	2	4.54	293.225	314.225	319.225	21	
10	Lakkadganj	In Ward No. 32 in NMC office comp.	1	2.27	292.500	313.500	318.500	21	
North Central Zone									
11	Shanti Nagar	In ward No. 29, In Nagari Udyan	1	2.27	297.000	318.000	323.000	21	
12	Indora 1 & 2	In ward No. 52, NW of Indora Chk.	2	4.54	302.500	323.500	328.500	21	
13	Bastarwari 1 & 2	In ward No. 67, Near Yendi Wadi	2	4.54	300.500	321.500	326.500	21	
14	Binaki Prop. 1 & 2	In ward No.25 At Existing ESR site	2	4.54	291.680	312.680	318.680	21	
North West Zone									
15	Seminary Hills	Near Existing MBR	1	2.27	349.000	367.000	372.000	18	
South West Zone									
16	Dharanpeth	In ward No.85 At NMC Traffic Park	1	2.27	308.000	327.000	332.000	21	
17	Pratap Nagar	In ward No.50, N.I.T Play ground behind Durga Mandir	1	2.27	310.000	331.000	336.000	21	
18	Trimurtinagar	In ward No.16, in play ground, Trimurti Nagar.	1	2.27	309.000	330.000	335.000	21	
19	Jaitala Sump	In ward No.15 At NMC School	1	1.5	335.000	332.000	335.000		

CLIENT :- NAGPUR MUNICIPAL CORPORATION
(PENCH PROJECT CELL)

PROJECT :- AUGMENTATION TO NAGPUR CITY WATER SUPPLY SCHEME PENCH - IV

STC Shah Technical Consultants Private Limited
407, RAHEJA CENTRE, NARIMAN POINT, MUMBAI - 400 021

PENCH-4

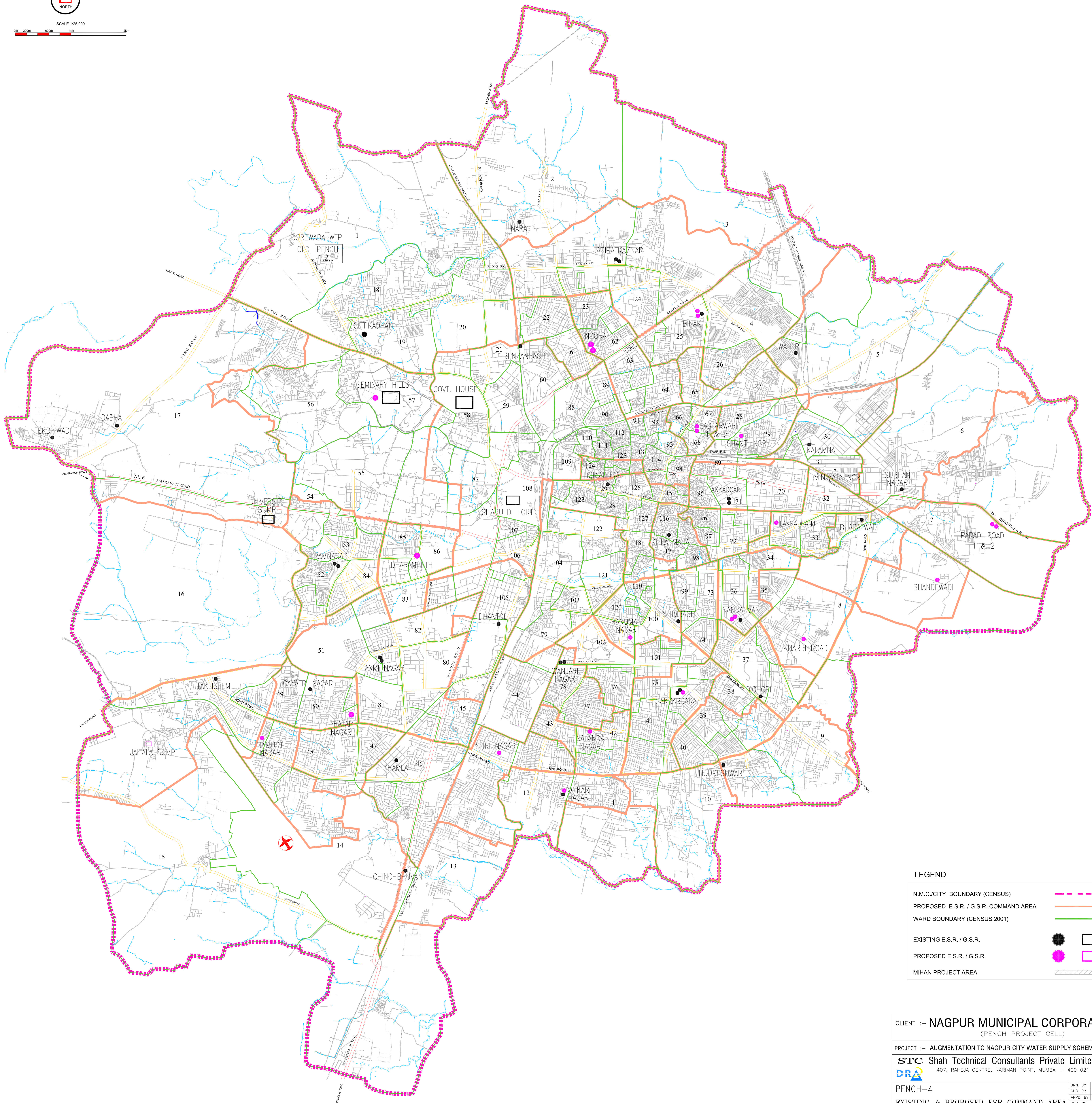
EXISTING & PROPOSED TRANSMISSION MAIN & ESR's

SCALE 1:25,000 REF. DWG. NO.

DRAWN BY: PRG
CHECKED BY: ASK
APPD. BY: DRG. NO.
SHEET 1 OF 1



SCALE 1:25,000
0m 200m 400m 600m 800m 1000m 1200m 1400m 1600m 1800m 2000m



LEGEND

N.M.C./CITY BOUNDARY (CENSUS)	
PROPOSED E.S.R. / G.S.R. COMMAND AREA	
WARD BOUNDARY (CENSUS 2001)	
EXISTING E.S.R. / G.S.R.	
PROPOSED E.S.R. / G.S.R.	
MIHAN PROJECT AREA	

CLIENT :- NAGPUR MUNICIPAL CORPORATION (PENCH PROJECT CELL)	
PROJECT :- AUGMENTATION TO NAGPUR CITY WATER SUPPLY SCHEME PENCH - IV	
STC Shah Technical Consultants Private Limited 407, RAHEJA CENTRE, NARIMAN POINT, MUMBAI - 400 021	
PENCH-4	
EXISTING & PROPOSED ESR COMMAND AREA WITH 129 WARDS BOUNDARY	
SCALE 1:25,000	REF. DWG. NO.
DRAWN BY: PRG CHECKED BY: ASK APPROVED BY: [Signature] DRG. NO.	DRA/NMC/PENCH-4/P4/02 CAD FILE:- PENCH-4/NETSDRAW/ANALYSIS/P4/02 SHEET 1 OF 1 REV. 0