

### Determination of Capacity of OHR - I for Zone - I

(To be designed for 15 years) i.e. for demand in 2023

Design demand	1610	Cum/day
Pumping hour	12	6 AM to 12 NOON & 2 PM to 8 PM
Hourly pumping	134.17	Cum/hr
Supply hour	8	7 AM to 10 AM, 12 NOON to 2 PM & 5 PM to 8 PM
Hourly supply	201.25	Cum/hr

Operation time	Cumulative Supply	Cumulative pumping	Surplus / Deficit	Maximum Surplus	Maximum Deficit	Max. surplus + deficit
06 - 07	0.00	134.17	134.17	201.25	-201.25	402.50
07 - 08	201.25	268.33	67.08			
08 - 09	402.50	402.50	0.00			
09 - 10	603.75	536.67	-67.08			
10 - 11	603.75	670.83	67.08			
11 - 12	603.75	805.00	201.25			
12 - 13	805.00	805.00	0.00			
13 - 14	1006.25	805.00	-201.25			
14 - 15	1006.25	939.17	-67.08			
15 - 16	1006.25	1073.33	67.08			
16 - 17	1006.25	1207.50	201.25			
17 - 18	1207.50	1341.67	134.17			
18 - 19	1408.75	1475.83	67.08			
19 - 20	1610.00	1610.00	0.00			
20 - 21	1610.00	1610.00	0.00			
21 - 22	1610.00	1610.00	0.00			
22 - 23	1610.00	1610.00	0.00			
23 - 24	1610.00	1610.00	0.00			
24 - 01	1610.00	1610.00	0.00			
01 - 02	1610.00	1610.00	0.00			
02 - 03	1610.00	1610.00	0.00			
03 - 04	1610.00	1610.00	0.00			
04 - 05	1610.00	1610.00	0.00			
05 - 06	1610.00	1610.00	0.00			

Capacity of reservoir	402.50	cum
Provide	450.00	cum

450 cum (1 lakh gallon) Capacity OHR for Zone - I is provided (existing)

### Determination of Capacity of OHR - II for Zone - II

(To be designed for 15 years) i.e. for demand in 2023

Design demand	1920	Cum/day
Pumping hour	12	6 AM to 12 NOON & 2 PM to 8 PM
Hourly pumping	160.00	Cum/hr
Supply hour	8	7 AM to 10 AM, 12 NOON to 2 PM & 5 PM to 8 PM
Hourly supply	240.00	Cum/hr

Operation time	Cumulative Supply	Cumulative pumping	Surplus / Deficit	Maximum Surplus	Maximum Deficit	Max. surplus + deficit
06 - 07	0.00	160.00	160.00			
07 - 08	240.00	320.00	80.00			
08 - 09	480.00	480.00	0.00			
09 - 10	720.00	640.00	-80.00			
10 - 11	720.00	800.00	80.00			
11 - 12	720.00	960.00	240.00			
12 - 13	960.00	960.00	0.00			
13 - 14	1200.00	960.00	-240.00			
14 - 15	1200.00	1120.00	-80.00			
15 - 16	1200.00	1280.00	80.00			
16 - 17	1200.00	1440.00	240.00			
17 - 18	1440.00	1600.00	160.00	240.00	-240.00	480.00
18 - 19	1680.00	1760.00	80.00			
19 - 20	1920.00	1920.00	0.00			
20 - 21	1920.00	1920.00	0.00			
21 - 22	1920.00	1920.00	0.00			
22 - 23	1920.00	1920.00	0.00			
23 - 24	1920.00	1920.00	0.00			
24 - 01	1920.00	1920.00	0.00			
01 - 02	1920.00	1920.00	0.00			
02 - 03	1920.00	1920.00	0.00			
03 - 04	1920.00	1920.00	0.00			
04 - 05	1920.00	1920.00	0.00			
05 - 06	1920.00	1920.00	0.00			

Capacity of reservoir	480.00	cum
Provide	500.00	cum

500 cum (1 lakh 10 thousand gallon) Capacity OHR for Zone - II is provided.

### Determination of Capacity of OHR - III for Zone - III

(To be designed for 15 years) i.e. for demand in 2023

Design demand	1370	Cum/day
Pumping hour	12	6 AM to 12 NOON & 2 PM to 8 PM
Hourly pumping	114.17	Cum/hr
Supply hour	8	7 AM to 10 AM, 12 NOON to 2 PM & 5 PM to 8 PM
Hourly supply	171.25	Cum/hr

Operation time	Cumulative Supply	Cumulative pumping	Surplus / Deficit	Maximum Surplus	Maximum Deficit	Max. surplus + deficit
06 - 07	0.00	114.17	114.17	171.25	-171.25	342.50
07 - 08	171.25	228.33	57.08			
08 - 09	342.50	342.50	0.00			
09 - 10	513.75	456.67	-57.08			
10 - 11	513.75	570.83	57.08			
11 - 12	513.75	685.00	171.25			
12 - 13	685.00	685.00	0.00			
13 - 14	856.25	685.00	-171.25			
14 - 15	856.25	799.17	-57.08			
15 - 16	856.25	913.33	57.08			
16 - 17	856.25	1027.50	171.25			
17 - 18	1027.50	1141.67	114.17			
18 - 19	1198.75	1255.83	57.08			
19 - 20	1370.00	1370.00	0.00			
20 - 21	1370.00	1370.00	0.00			
21 - 22	1370.00	1370.00	0.00			
22 - 23	1370.00	1370.00	0.00			
23 - 24	1370.00	1370.00	0.00			
24 - 01	1370.00	1370.00	0.00			
01 - 02	1370.00	1370.00	0.00			
02 - 03	1370.00	1370.00	0.00			
03 - 04	1370.00	1370.00	0.00			
04 - 05	1370.00	1370.00	0.00			
05 - 06	1370.00	1370.00	0.00			

Capacity of reservoir	342.50	cum
Provide	350.00	cum

350 cum (80 thousand gallon) Capacity OHR for Zone - III is provided.

### Determination of Capacity of OHR - IV for Zone - IV

(To be designed for 15 years) i.e. for demand in 2023

Design demand	2170	Cum/day
Pumping hour	12	6 AM to 12 NOON & 2 PM to 8 PM
Hourly pumping	180.83	Cum/hr
Supply hour	8	7 AM to 10 AM, 12 NOON to 2 PM & 5 PM to 8 PM
Hourly supply	271.25	Cum/hr

Operation time	Cumulative Supply	Cumulative pumping	Surplus / Deficit	Maximum Surplus	Maximum Deficit	Max. surplus + deficit
06 - 07	0.00	180.83	180.83	271.25	-271.25	542.50
07 - 08	271.25	361.67	90.42			
08 - 09	542.50	542.50	0.00			
09 - 10	813.75	723.33	-90.42			
10 - 11	813.75	904.17	90.42			
11 - 12	813.75	1085.00	271.25			
12 - 13	1085.00	1085.00	0.00			
13 - 14	1356.25	1085.00	-271.25			
14 - 15	1356.25	1265.83	-90.42			
15 - 16	1356.25	1446.67	90.42			
16 - 17	1356.25	1627.50	271.25			
17 - 18	1627.50	1808.33	180.83			
18 - 19	1898.75	1989.17	90.42			
19 - 20	2170.00	2170.00	0.00			
20 - 21	2170.00	2170.00	0.00			
21 - 22	2170.00	2170.00	0.00			
22 - 23	2170.00	2170.00	0.00			
23 - 24	2170.00	2170.00	0.00			
24 - 01	2170.00	2170.00	0.00			
01 - 02	2170.00	2170.00	0.00			
02 - 03	2170.00	2170.00	0.00			
03 - 04	2170.00	2170.00	0.00			
04 - 05	2170.00	2170.00	0.00			
05 - 06	2170.00	2170.00	0.00			

Capacity of reservoir	<b>542.50</b>	cum
Provide	<b>550.00</b>	cum

550 cum (1 lakh 20 thousand gallon) Capacity OHR for Zone - IV is provided.



### Determination of Capacity of OHR - V for Zone - V

(To be designed for 15 years) i.e. for demand in 2023

Design demand	540	Cum/day
Pumping hour	12	6 AM to 12 NOON & 2 PM to 8 PM
Hourly pumping	45.00	Cum/hr
Supply hour	8	7 AM to 10 AM, 12 NOON to 2 PM & 5 PM to 8 PM
Hourly supply	67.50	Cum/hr

Operation time	Cumulative Supply	Cumulative pumping	Surplus / Deficit	Maximum Surplus	Maximum Deficit	Max. surplus + deficit
06 - 07	0.00	45.00	45.00	67.50	-67.50	135.00
07 - 08	67.50	90.00	22.50			
08 - 09	135.00	135.00	0.00			
09 - 10	202.50	180.00	-22.50			
10 - 11	202.50	225.00	22.50			
11 - 12	202.50	270.00	67.50			
12 - 13	270.00	270.00	0.00			
13 - 14	337.50	270.00	-67.50			
14 - 15	337.50	315.00	-22.50			
15 - 16	337.50	360.00	22.50			
16 - 17	337.50	405.00	67.50			
17 - 18	405.00	450.00	45.00			
18 - 19	472.50	495.00	22.50			
19 - 20	540.00	540.00	0.00			
20 - 21	540.00	540.00	0.00			
21 - 22	540.00	540.00	0.00			
22 - 23	540.00	540.00	0.00			
23 - 24	540.00	540.00	0.00			
24 - 01	540.00	540.00	0.00			
01 - 02	540.00	540.00	0.00			
02 - 03	540.00	540.00	0.00			
03 - 04	540.00	540.00	0.00			
04 - 05	540.00	540.00	0.00			
05 - 06	540.00	540.00	0.00			

Capacity of reservoir	135.00	cum
Provide	135.00	cum

135 cum (30 thousand gallon) Capacity OHR for Zone - V is provided.

10.1 The staging height of RCC elevated reservoir is estimated as below:-

**Zone - I**

RL of highest point / node in Zone - I = 14.860 m  
RL of RCC OHR - I = 12.890 m  
So, Maximum level difference = 14.860 - 12.890  
= 1.97 m, say 2.00 m (A1)

Assume, Losses for bends, specials, valves etc. = 2.00 m (B1)

Staging height of existing OHR - I = 16.76 m (C1)

Thus, Maximum head available at head works site to keep 7 m of terminal head

in the distribution system = C1 - A1 - B1  
= 16.76 - 2.00 - 2.00  
= 12.76 m

Provide 16.76 m (55 feet) staging height in OHR - I.

**Zone - II**

RL of highest point / node in Zone - II = 14.860 m  
RL of RCC OHR - II = 12.890 m  
So, Maximum level difference = 14.860 - 12.890  
= 1.97 m, say 2.00 m (A2)

Assume, Losses for bends, specials, valves etc. = 2.00 m (B2)

Maximum head available at head works site to keep 7 m of terminal head in the distribution system

= 16.50 m (C2)  
Thus, staging height required = A2 + B2 + C2  
= 1.50 + 2.00 + 16.50  
= 20.00 m

Provide 20.00 m (65 feet) staging height in OHR - II.

**Zone - III**

RL of highest point / node in Zone - III = 13.965 m

RL of RCC OHR - III = 12.410 m

So, Maximum level difference = 13.965 - 12.410  
= 1.555 m, say 1.60 m (A3)

Assume, Losses for bends, specials, valves etc. = 2.00 m (B3)

Maximum head available at head works

site to keep 7 m of terminal head in the

distribution system = 16.40 m (C3)

Thus, staging height required = A3 + B3 + C3

= 1.60 + 2.00 + 16.40

= 20.00 m

Provide 20.00 m (65 feet) staging height in OHR - III.

**Zone - IV**

RL of highest point / node in Zone - IV = 13.965 m

RL of RCC OHR - IV = 12.410 m

So, Maximum level difference = 13.965 - 12.410  
= 1.555 m, say 1.60 m (A4)

Assume, Losses for bends, specials, valves etc. = 2.00 m (B4)

Maximum head available at head works

site to keep 7 m of terminal head in the

distribution system = 16.40 m (C4)

Thus, staging height required = A4 + B4 + C4

= 0.50 + 2.00 + 17.50

= 20.00 m

Provide 20.00 m (65 feet) staging height in OHR - IV.

**Zone - V**

RL of highest point / node in Zone - V = 14.940 m

RL of RCC OHR - V = 13.855 m

So, Maximum level difference = 14.940 - 13.855

= 1.085 m, say 1.10 m (A5)

Assume, Losses for bends, specials, valves etc. = 1.50 m (B5)

Maximum head available at head works

site to keep 7 m of terminal head in the

distribution system = 11.00 m (C5)

Thus, staging height required = A5 + B5 + C5

= 1.10 + 1.50 + 11.00

= 13.60 m

Provide 13.60 m (45 feet) staging height in OHR - V.

**Summary of Capacity of OHR**

<b>Zone No.</b>	<b>OHR Capacity (staging height in m) required (Cum)</b>	<b>OHR Capacity (staging height in m) provided (Cum)</b>	<b>Remarks</b>
<b>I</b>	402.50 (16.76)	450 (16.76)	Existing OHR utilised
<b>II</b>	480 (20.00)	500 (20.00)	New OHR proposed
<b>III</b>	342.50 (20.00)	350 (20.00)	New OHR proposed
<b>IV</b>	542.50 (20.00)	550 (20.00)	New OHR proposed
<b>V</b>	135.00 (13.60)	135 (13.60)	New OHR proposed



## CHAPTER - XI

### DESIGN OF ECONOMIC SIZE OF RISING MAINS FOR ZONE-II, ZONE-III, ZONE-IV AND ZONE-V

- 11.0 In the existing water supply scheme, PH - 1, PH - 2 and PH - 3 are delivering the water through 200 mm dia CI rising main to the existing OHR for gravity supply to the consumers. All other TWs are discharging the water directly to the distribution grid. Here all the existing rising mains will remain as far as practicable. New Rising mains is designed for a period of 30 years i.e. for the year 2038.

#### From TW to CWR for Zone - II, Zone - III & Zone - IV

In Zone - II, all tube wells will operate simultaneously for 12 hours and will discharge the water from TW to CWR. For Zone - III, one new tube well and one existing tube well will be used and in Zone - IV, though all tube wells will operate, however, existing tube well (TW no. 14) will be utilized for boosting only due to far away from OHR. Static head against which rising main will discharge water is calculated below:

#### Static head Calculation

1	Static water Level	:	6.10 m
2	Draw down during pumping	:	5.00 m
3	Yearly fluctuation of water table	:	5.00 m
4	Level difference between TW and CWR	:	1.50 m
5	Free delivery head at the inlet of CWR	:	3.00 m
	TOTAL HEAD	:	<hr/> 20.60 m
			Say, 21 m

### **Zone - II**

In Zone - II, 3 (three) nos. of existing tube wells (PH - 4, PH - 10 and PH - 15) will be used. All existing TW needs new rising mains to discharge the water to the CWR - 2.

No. of Source = 3

	Total	Source-wise
Water demand in 2008	1.56 MLD	0.52 MLD
Water demand in 2023	1.92 MLD	0.64 MLD
Water demand in 2038	2.20 MLD	0.73 MLD

### **Zone - III**

In this Zone, either one of 2 (two) nos. of existing tube wells (PH - 11 and PH - 12) will be operated and 1 (one) no. of new tube well (NEW - 1) will be constructed for use. These TW (except PH - 11) will discharge the water to the CWR - 3.

No. of Source = 2

	Total	Source-wise
Water demand in 2008	1.12 MLD	0.56 MLD
Water demand in 2023	1.37 MLD	0.59 MLD
Water demand in 2038	1.57 MLD	0.79 MLD

### **Zone - IV**

In Zone - IV, 1 (one) no. of existing tube well (PH - 14) will be used and 2 (two) nos. of new tube wells namely NEW - 2 and NEW - 3 will be in operation simultaneously for 12 hours. Each TW will discharge the water through rising mains to the CWR - 4.

No. of Source = 3

	Total	Source-wise
Water demand in 2008	1.76 MLD	0.59 MLD
Water demand in 2023	2.17 MLD	0.72 MLD
Water demand in 2038	2.49 MLD	0.83 MLD

**From CWR to OHR for Zone - I, Zone - II, Zone - III & Zone - IV**

From CWR water will be discharged to OHR for a period of 12 hours and operation hour is synchronized with the 12 hour operation of tube well. Rising mains are designed using latest soft ware. Static head against which rising mains will work is calculated below:

**Static head Calculation for Zone-II, Zone-III & Zone-IV**

1	Water Level at CWR	:	3.00 m
2	Staging height of O. H. R.	:	20.00 m
3	Wall height of O. H. R.	:	4.50 m
4	Free delivery head at the inlet of O. H. R.	:	3.00 m
	<b>TOTAL HEAD</b>	:	<u>30.50 m</u>
			Say, 31 m

Zone-wise water demand is reproduced below:

Zone	Base Year 2008	Intermediate Year 2023	Final Year of Design Period 2038
II	1.56	1.92	2.20
III	1.12	1.37	1.57
IV	1.76	2.17	2.49

**From TW to OHR for Zone - V**

There are two tube wells in Zone - V. As the demand is met by one tube well, that tube well will be in operation and the other will function as stand by. The only tube well will discharge extracted water directly to the OHR for 12 hours. Rising mains coming from each tube well will meet a point JP, the common/junction point, from where one rising mains will traverse to the OHR. The static head in this case is also calculated and is given below:

**Static head Calculation**

1	Static water Level	:	6.10 m
2	Draw down during pumping	:	5.00 m
3	Yearly fluctuation of water table	:	5.00 m
4	Level difference between TW and OHR	:	2.00 m
5	Staging height of O. H. R.	:	13.60 m
6	Wall height of O. H. R.	:	3.50 m
7	Free delivery head at the inlet of O.H.R.	:	3.00 m
	<b>TOTAL HEAD</b>	:	<b>38.20 m</b>
			Say, 39 m

Water demand for Zone - V is furnished below

<b>Zone</b>	<b>Base Year 2008</b>	<b>Intermediate Year 2023</b>	<b>Final Year of Design Period 2038</b>
V	0.44	0.54	0.62

The design of all rising main has been furnished in page no. 83 to 103.



Summary of Rising mains

From	To	Length	Dia	Material	Remarks
<b>Zone - II</b>					
PH - 4	CWR - 2	50 m	150 mm	DI, K9 pipe	New
PH - 10	CWR - 2	990 m	150 mm	DI, K9 pipe	New
PH - 15	CWR - 2	1940 m	150 mm	DI, K9 pipe	New
CWR - 2	OHR - 2	50 m	250 mm	DI, K9 pipe	New
<b>Zone - III</b>					
PH - 12	CWR - 3	50 m	150 mm	DI, K9 pipe	New
NEW - 1	CWR - 3	780 m	150 mm	DI, K9 pipe	New
CWR - 3	OHR - 3	50 m	200 mm	DI, K9 pipe	New
<b>Zone - IV</b>					
NEW - 2	CWR - 4	50 m	150 mm	DI, K9 pipe	New
NEW - 3 (located at PH-5)	CWR - 4	710 m	150 mm	DI, K9 pipe	New
CWR - 4	OHR - 4	50 m	250 mm	DI, K9 pipe	New
<b>Zone - V</b>					
NEW - 4	JP	50 m	150 mm	DI, K9 pipe	New
NEW - 5 (located at PH -7)	JP	250 m	150 mm	DI, K9 pipe	New
JP	OHR - 5	50 m	150 mm	DI, K9 pipe	New

## DESIGN CALCULATION FOR ECONOMIC SIZE OF PUMPING MAIN FOR ZONE - II

Project Name : Augmentation of Arambagh Municipal water supply scheme

From : Existing TW (PH-15)  
To : CWR-II of ZONE-II

### P I P E D A T A

	Year Discharge	DIAMETER (MM)	MATERIAL CLASS	THICKNESS (MM)	WORKING PRESSURE (M)	HWC	RATE (Rs. / M)
1) Water Requirement :							
A. Initial	2008	100	DI	6.00	180	140	969
B. Intermediate :	2023	150	DI	6.00	180	140	1464
C. Ultimate :	2038	200	DI	6.30	180	140	1948
2) Pumping MAIN	LENGTH	250	DI	6.80	180	140	2554
3) Static Head for Pump	ST. HEAD	300	DI	7.20	180	140	3234
4) Design Period	YEAR	150	CI	8.30	100	100	1356
5) Combined Eff. Of Pumping Set	EFF. %	200	CI	9.20	100	100	1979
6) Cost of Pumping Set	Rs. / KW	250	CI	10.00	100	100	2667
7) Interest Rate	INTEREST	150	CI	10.1	125	100	1486
8) Life of Elec. Motor & Pump Set	P. Yrs.	200	CI	11.0	125	100	2148
9) Energy Charges / KWH Unit	P / KWH	250	CI	11.9	125	100	2904
10) Pumping Hours for Discharge at the end of 15 Years	PUMPING HOURS						

	1st 15 years	2nd 15 years
1) Discharge at Start of period	0.52 mld	0.64 mld
2) Discharge at the end of 15 years	0.64 mld	0.73 mld
3) Average Discharge	0.58 mld	0.69 mld
4) Avg. pumping hours during the period	10.88 hrs.	11.26 hrs.
5) KW required at combined efficiency of pumping set	0.22 * H1	0.25 * H2
6) Avg. annual charges for electrical energy Rs.	15887.94 * KW1	16450.81 * KW2

**TABLE - 1 : VELOCITY AND HEAD LOSSES FOR DIFFERENT PIPE SIZES**

Sl No.	Pipe Size in mm	Pipe Material	Frictional Head loss per 1000 m		Velocity in m/s		Total head (m) for 1940.00 m length pipe including 21.00 m static head							
			1st stage flow	2nd stage flow	1st stage flow	2nd stage flow	1st stage flow		2nd stage flow					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	100	DI	34.93	44.55	1.89	2.15	67.75	6.78	95.53	86.43	8.64	116.07	284.84	305.84
2	150	DI	4.85	6.18	0.84	0.96	9.41	0.94	31.35	12.00	1.20	34.20	121.57	142.57
3	200	DI	1.19	1.52	0.47	0.54	2.32	0.23	23.55	2.96	0.30	24.25	66.33	87.33
4	250	DI	0.40	0.51	0.30	0.34	0.78	0.08	21.86	1.00	0.10	22.10	41.54	62.54
5	300	DI	0.17	0.21	0.21	0.24	0.32	0.03	21.35	0.41	0.04	21.45	28.27	49.27
6	150	CI	9.03	11.52	0.84	0.96	17.53	1.75	40.28	22.36	2.24	45.59	113.41	134.41
7	200	CI	2.23	2.84	0.47	0.54	4.32	0.43	25.75	5.51	0.55	27.06	61.74	82.74
8	250	CI	0.75	0.96	0.30	0.34	1.46	0.15	22.60	1.86	0.19	23.04	38.45	59.45
9	150	CI	9.03	11.52	0.84	0.96	17.53	1.75	40.28	22.36	2.24	45.59	116.93	137.93
10	200	CI	2.23	2.84	0.47	0.54	4.32	0.43	25.75	5.51	0.55	27.06	63.73	84.73
11	250	CI	0.75	0.96	0.30	0.34	1.46	0.15	22.60	1.86	0.19	23.04	39.77	60.77

**TABLE - 2 : KILOWATTS & COST OF PUMP SETS REQUIRED FOR DIFFERENT PIPE SIZES AND PIPE COST**

Sl. No.	Pipe Size in mm	Pipe Material	Cost of pipe per unit length (Rs.)	Cost of 1940 metre pipe line (Rs. THS)	1st stage flow			2nd stage flow		
					Total head H1 in metre	KW reqd. plus % 50 standby	Pump cost @ Rs 15000 per KW (Rs. THS)	Total head H2 in metre	KW reqd. plus % 50 standby	Pump cost @ Rs 15000 per KW (Rs. THS)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	100	DI	969	1880	96	32	483	116	44	665
2	150	DI	1464	2840	31	10	156	34	13	195
3	200	DI	1948	3779	24	8	121	24	9	138
4	250	DI	2554	4955	22	7	111	22	8	126
5	300	DI	3234	6274	21	7	106	21	8	120
6	150	CI	1356	2631	40	13	201	46	18	264
7	200	CI	1979	3839	26	9	131	27	10	155
8	250	CI	2667	5174	23	8	116	23	9	132
9	150	CI	1486	2883	40	13	201	46	18	264
10	200	CI	2148	4167	26	9	131	27	10	155
11	250	CI	2904	5634	23	8	116	23	9	132



**TABLE - 3 : COMPARATIVE STATEMENT OF OVERALL COST STRUCTURE OF PUMPING MAIN FOR DIFFERENT PIPE SIZES**

Sl. No.	Cost of pipe lines THS (Rs.)	1st stage flow		2nd stage flow		GRAND TOTAL of Capitalised cost for 30 years THS (Rs.)	Pipe Size in mm	Pipe Material	Class of Pipe	Whether water hammer device required				
		Cost of pump sets THS (Rs.)	Annual Energy Charges THS (Rs.)	Capitalised Energy Charges THS (Rs.)	Annual Energy Charges THS (Rs.)						Capitalised Total Cost THS (Rs.)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	1880	483	511	3888	6251	665	730	5549	1488	7739	100	DI	K9	Yes
2	2840	156	165	1256	4251	195	214	1626	436	4687	150	DI	K9	No
3	3779	121	128	972	4872	138	151	1148	308	5180	200	DI	K9	No
4	4955	111	117	891	5957	126	138	1052	282	6239	250	DI	K9	No
5	6274	106	112	851	7230	120	132	1005	269	7499	300	DI	K9	No
6	2631	201	213	1620	4452	264	289	2201	590	5042	150	CI	LA	Yes
7	3839	131	138	1053	5023	155	170	1292	346	5369	200	CI	LA	No
8	5174	116	122	932	6221	132	145	1100	295	6516	250	CI	LA	No
9	2883	201	213	1620	4704	264	289	2201	590	5294	150	CI	A	Yes
10	4167	131	138	1053	5351	155	170	1292	346	5697	200	CI	A	No
11	5634	116	122	932	6681	132	145	1100	295	6976	250	CI	A	No

**TABLE - 3 shows that the most economical size of MAIN is :**

Pipe Size in mm	150
Pipe Material	DI
Pipe Class	K9
Capitalised Cost Rs.	4687000



## DESIGN CALCULATION FOR ECONOMIC SIZE OF PUMPING MAIN FOR ZONE - III

Project Name : Augmentation of Arambagh Municipal water supply scheme

From : NEW TW (NEW-4)  
To : CWR-III of ZONE-III

### P I P E D A T A

DIAMETER (MM)	MATERIAL CLASS	THICKNESS (MM)	WORKING PRESSURE (M)	HWC	RATE (Rs. / M)
100	DI	6.00	180	140	969
150	DI	6.00	180	140	1464
200	DI	6.30	180	140	1948
250	DI	6.80	180	140	2554
300	DI	7.20	180	140	3234
150	CI	8.30	100	100	1356
200	CI	9.20	100	100	1979
250	CI	10.00	100	100	2667
150	CI	10.1	125	100	1486
200	CI	11.0	125	100	2148
250	CI	11.9	125	100	2904

Year	Discharge
2008	0.560 mld
2023	0.590 mld
2038	0.790 mld

LENGTH	ST. HEAD	YEAR	EFF. %	Rs. / KW	INTEREST	P. Yrs.	P / KWH	PUMPING HOURS
780 M	21 M	30 yr.	65 %	15000 Rs.	10.00 %	15 yr.	400 paise	12 hrs

	1st 15 years	2nd 15 years
1) Discharge at Start of period	0.56 mld	0.59 mld
2) Discharge at the end of 15 years	0.59 mld	0.79 mld
3) Average Discharge	0.58 mld	0.69 mld
4) Avg. pumping hours during the period	11.69 hrs.	10.48 hrs.
5) KW required at combined efficiency of pumping set	0.21 * H1	0.28 * H2
6) Avg. annual charges for electrical energy Rs.	17065.60 * KW1	15312.34 * KW2

**TABLE - 1 : VELOCITY AND HEAD LOSSES FOR DIFFERENT PIPE SIZES**

Sl. No.	Pipe Size in mm	Pipe Material	Frictional Head loss per 1000 m		Velocity in m/s		Total head (m) for 780.00 m length pipe including 21.00 m static head							
			1st stage flow	2nd stage flow	1st stage flow	2nd stage flow	1st stage flow			2nd stage flow				
							Frictional loss (8)	Other losses (9)	Total losses (H1) (10)	Frictional loss (11)	Other losses (12)	Total losses (H2) (13)	Water Hammer (14)	Overall Head (15)
1	100	DI	30.05	51.56	1.74	2.33	23.44	2.34	46.78	40.22	4.02	65.24	308.25	329.25
2	150	DI	4.17	7.16	0.77	1.03	3.25	0.33	24.58	5.58	0.56	27.14	131.56	152.56
3	200	DI	1.03	1.76	0.43	0.58	0.80	0.06	21.88	1.38	0.14	22.51	71.78	92.78
4	250	DI	0.35	0.59	0.28	0.37	0.27	0.03	21.30	0.46	0.05	21.51	44.96	65.96
5	300	DI	0.14	0.24	0.19	0.26	0.11	0.01	21.12	0.19	0.02	21.21	30.60	51.60
6	150	CI	7.77	13.34	0.77	1.03	6.06	0.61	27.67	10.40	1.04	32.44	122.74	143.74
7	200	CI	1.91	3.29	0.43	0.58	1.49	0.15	22.64	2.56	0.26	23.82	66.82	87.82
8	250	CI	0.65	1.11	0.28	0.37	0.50	0.05	21.55	0.86	0.09	21.95	41.61	62.61
9	150	CI	7.77	13.34	0.77	1.03	6.06	0.61	27.67	10.40	1.04	32.44	126.55	147.55
10	200	CI	1.91	3.29	0.43	0.58	1.49	0.15	22.64	2.56	0.26	23.82	68.97	89.97
11	250	CI	0.65	1.11	0.28	0.37	0.50	0.05	21.55	0.86	0.09	21.95	43.04	64.04

**TABLE - 2 : KILOWATTS & COST OF PUMP SETS REQUIRED FOR DIFFERENT PIPE SIZES AND PIPE COST**

Sl. No.	Pipe Size in mm	Pipe Material	Cost of pipe per unit length (Rs.)	Cost of 780 metre pipe line (Rs. THS)	1st stage flow			2nd stage flow		
					Total head H1 in metre (6)	KW reqd. plus 50% standby (7)	Pump cost @ Rs 15000 per KW (Rs. THS) (8)	Total head H2 in metre (9)	KW reqd. plus 50% standby (10)	Pump cost @ Rs 15000 per KW (Rs. THS) (11)
1	100	DI	969	756	47	15	218	65	27	403
2	150	DI	1464	1142	25	8	116	27	11	168
3	200	DI	1948	1519	22	7	102	23	10	143
4	250	DI	2554	1992	21	6	97	22	9	137
5	300	DI	3234	2523	21	6	97	21	9	130
6	150	CI	1356	1058	28	9	130	32	13	199
7	200	CI	1979	1544	23	7	107	24	10	149
8	250	CI	2667	2080	22	7	102	22	9	137
9	150	CI	1486	1159	28	9	130	32	13	199
10	200	CI	2148	1675	23	7	107	24	10	149
11	250	CI	2904	2265	22	7	102	22	9	137

**TABLE - 3 : COMPARATIVE STATEMENT OF OVERALL COST STRUCTURE OF PUMPING MAIN FOR DIFFERENT PIPE SIZES**

Sl. No.	Cost of pipe lines THS (Rs.)	1st stage flow			2nd stage flow			GRAND TOTAL of Capitalised cost for 30 years THS (Rs.)	Pipe Size in mm	Pipe Material	Class of Pipe	Whether water hammer device required		
		Cost of pump sets THS (Rs.)	Annual Energy Charges THS (Rs.)	Capitalised Energy Charges THS (Rs.)	Cost of pump sets THS (Rs.)	Annual Energy Charges THS (Rs.)	Capitalised Energy Charges THS (Rs.)						Capitalised Total Cost THS (Rs.)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	756	218	248	1887	2861	403	412	3132	846	3707	100	DI	K9	Yes
2	1142	116	132	1004	2262	168	171	1301	352	2614	150	DI	K9	No
3	1519	102	116	883	2504	143	146	1108	299	2803	200	DI	K9	No
4	1992	97	111	843	2933	137	139	1060	286	3219	250	DI	K9	No
5	2523	97	111	843	3464	130	133	1012	273	3737	300	DI	K9	No
6	1058	130	148	1124	2312	199	203	1542	417	2729	150	CI	LA	Yes
7	1544	107	121	924	2574	149	152	1158	313	2887	200	CI	LA	No
8	2080	102	116	883	3065	137	139	1060	286	3351	250	CI	LA	No
9	1159	130	148	1124	2413	199	203	1542	417	2830	150	CI	A	Yes
10	1675	107	121	924	2705	149	152	1158	313	3018	200	CI	A	No
11	2265	102	116	883	3250	137	139	1060	286	3536	250	CI	A	No

**TABLE - 3 shows that the most economical size of MAIN is :**

Pipe Size in mm	150
Pipe Material	DI
Pipe Class	K9
Capitalised Cost Rs.	2614000



## DESIGN CALCULATION FOR ECONOMIC SIZE OF PUMPING MAIN FOR ZONE - IV

Project Name : Augmentation of Arambagh Municipal water supply scheme

From : NEW TW (NEW-7 located at PH-5)  
To : CWR-IV of ZONE-IV

### P I P E D A T A

	Year Discharge	DIAMETER (MM)	MATERIAL CLASS	THICKNESS (MM)	WORKING PRESSURE (M)	HWC	RATE (Rs. / M)
1) Water Requirement :							
A. Initial	2008 0.590 mld	100	DI	6.00	180	140	969
B. Intermediate :	2023 0.720 mld	150	DI	6.00	180	140	1464
C. Ultimate :	2038 0.830 mld	200	DI	6.30	180	140	1948
2) Pumping MAIN	LENGTH 710 M	250	DI	6.80	180	140	2554
3) Static Head for Pump	ST. HEAD 21 M	300	DI	7.20	180	140	3234
4) Design Period	YEAR 30 yr.	150	CI	8.30	100	100	1356
5) Combined Eff. Of Pumping Set	EFF. % 65 %	200	CI	9.20	100	100	1979
6) Cost of Pumping Set	Rs. / KW 15000 Rs.	250	CI	10.00	100	100	2667
7) Interest Rate	INTEREST 10.00 %	150	CI	10.1	125	100	1486
8) Life of Elec. Motor & Pump Set	P. Yrs. 15 yr.	200	CI	11.0	125	100	2148
9) Energy Charges / KWH Unit	P / KWH 400 paise	250	CI	11.9	125	100	2904
10) Pumping Hours for Discharge at the end of 15 Years	PUMPING HOURS 12 hrs						

	1st 15 years	2nd 15 years
1) Discharge at Start of period	0.59 mld	0.72 mld
2) Discharge at the end of 15 years	0.72 mld	0.83 mld
3) Average Discharge	0.66 mld	0.78 mld
4) Avg. pumping hours during the period	10.92 hrs.	11.20 hrs.
5) KW required at combined efficiency of pumping set	0.25 * H1	0.29 * H2
6) Avg. annual charges for electrical energy Rs.	15948.81 * KW1	16369.79 * KW2



**TABLE - 1 : VELOCITY AND HEAD LOSSES FOR DIFFERENT PIPE SIZES**

Sl. No.	Pipe Size in mm	Pipe Material	Frictional Head loss per 1000 m		Velocity in m / s		Total head (m) for 710.00 m length pipe including 21.00 m static head							
			1st stage flow	2nd stage flow	1st stage flow	2nd stage flow	1st stage flow							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	100	DI	43.43	56.49	2.12	2.45	30.83	3.08	54.92	40.11	4.01	65.12	323.86	344.86
2	150	DI	6.03	7.84	0.94	1.09	4.28	0.43	25.71	5.57	0.56	27.12	138.22	159.22
3	200	DI	1.49	1.93	0.53	0.61	1.05	0.11	22.16	1.37	0.14	22.51	75.41	96.41
4	250	DI	0.50	0.65	0.34	0.39	0.36	0.04	21.39	0.46	0.05	21.51	47.23	68.23
5	300	DI	0.21	0.27	0.24	0.27	0.15	0.01	21.16	0.19	0.02	21.21	32.15	53.15
6	150	CI	11.23	14.61	0.94	1.09	7.98	0.80	29.77	10.38	1.04	32.41	128.95	149.95
7	200	CI	2.77	3.60	0.53	0.61	1.96	0.20	23.16	2.56	0.26	23.81	70.20	91.20
8	250	CI	0.93	1.21	0.34	0.39	0.66	0.07	21.73	0.86	0.09	21.95	43.72	64.72
9	150	CI	11.23	14.61	0.94	1.09	7.98	0.80	29.77	10.38	1.04	32.41	132.95	153.95
10	200	CI	2.77	3.60	0.53	0.61	1.96	0.20	23.16	2.56	0.26	23.81	72.46	93.46
11	250	CI	0.93	1.21	0.34	0.39	0.66	0.07	21.73	0.86	0.09	21.95	45.22	66.22

**TABLE - 2 : KILOWATTS & COST OF PUMP SETS REQUIRED FOR DIFFERENT PIPE SIZES AND PIPE COST**

Sl. No.	Pipe Size in mm	Pipe Material	Cost of pipe per unit length (Rs.)	Cost of 710 metre pipe line (Rs. THS)	1st stage flow			2nd stage flow		
					Total head H1 in metre	KW reqd. plus % 50 standby	Pump cost @ Rs 15000 per KW (Rs. THS)	Total head H2 in metre	KW reqd. plus % 50 standby	Pump cost @ Rs 15000 per KW (Rs. THS)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	100	DI	969	688	55	21	311	65	28	424
2	150	DI	1464	1039	26	10	147	27	12	176
3	200	DI	1948	1383	22	8	124	23	10	150
4	250	DI	2554	1813	21	8	119	22	10	143
5	300	DI	3234	2296	21	8	119	21	9	137
6	150	CI	1356	963	30	11	170	32	14	209
7	200	CI	1979	1405	23	9	130	24	10	156
8	250	CI	2667	1894	22	8	124	22	10	143
9	150	CI	1486	1055	30	11	170	32	14	209
10	200	CI	2148	1525	23	9	130	24	10	156
11	250	CI	2904	2062	22	8	124	22	10	143

**TABLE - 3 : COMPARATIVE STATEMENT OF OVERALL COST STRUCTURE OF PUMPING MAIN FOR DIFFERENT PIPE SIZES**

Sl. No.	Cost of pipe lines THS (Rs.)	1st stage flow			2nd stage flow			GRAND TOTAL of Capitalised cost for 30 years THS (Rs.)	Pipe Size in mm	Pipe Material	Class of Pipe	Whether water hammer device required		
		Cost of pump sets THS (Rs.)	Annual Energy Charges THS (Rs.)	Capitalised Energy Charges THS (Rs.)	Cost of pump sets THS (Rs.)	Annual Energy Charges THS (Rs.)	Capitalised Energy Charges THS (Rs.)						Total Capitalised Cost THS (Rs.)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	688	311	331	2516	3515	424	463	3518	944	4459	100	DI	K9	Yes
2	1039	147	156	1189	2375	176	192	1461	392	2767	150	DI	K9	No
3	1383	124	132	1006	2514	150	164	1245	334	2848	200	DI	K9	No
4	1813	119	126	961	2892	143	157	1191	319	3211	250	DI	K9	No
5	2296	119	126	961	3375	137	149	1137	305	3680	300	DI	K9	No
6	963	170	180	1372	2505	209	228	1732	465	2970	150	CI	LA	Yes
7	1405	130	138	1052	2587	156	171	1299	348	2935	200	CI	LA	No
8	1894	124	132	1006	3025	143	157	1191	319	3344	250	CI	LA	No
9	1055	170	180	1372	2597	209	228	1732	465	3062	150	CI	A	Yes
10	1525	130	138	1052	2707	156	171	1299	348	3055	200	CI	A	No
11	2062	124	132	1006	3193	143	157	1191	319	3512	250	CI	A	No

TABLE - 3 shows that the most economical size of MAIN is :

Pipe Size in mm	150
Pipe Material	DI
Pipe Class	K9
Capitalised Cost Rs.	2767000

## DESIGN CALCULATION FOR ECONOMIC SIZE OF PUMPING MAIN FOR ZONE - II

Project Name : Augmentation of Arambagh Municipal water supply scheme

From : CWR-II of ZONE-II  
To : OHR-II of ZONE-II

### PIPE DATA

DIAMETER (MM)	MATERIAL CLASS	THICKNESS (MM)	WORKING PRESSURE (M)	HWC	RATE (Rs. / M)
100	DI	6.00	220	140	969
150	DI	6.00	220	140	1464
200	DI	6.30	220	140	1948
250	DI	6.80	220	140	2554
300	DI	7.20	220	140	3234
200	CI	9.20	100	100	1979
250	CI	10.00	100	100	2667
300	CI	10.80	100	100	3439
200	CI	11.0	125	100	2148
250	CI	11.0	125	100	2904
300	CI	11.90	125	100	3760

1) Water Requirement :	Year Discharge
A. Initial	2008 1,560 mld
B. Intermediate :	2023 1,920 mld
C. Ultimate :	2038 2,200 mld
2) Pumping MAIN	LENGTH
3) Static Head for Pump	50 M
4) Design Period	31 M
5) Combined Eff. Of Pumping Set	30 yr.
6) Cost of Pumping Set	65 %
7) Interest Rate	15000 Rs.
8) Life of Elec. Motor & Pump Set	10.00 %
9) Energy Charges / KWH Unit	15 yr.
10) Pumping Hours for Discharge at the end of 15 Years	400 paise
	12 hrs

	1st 15 years	2nd 15 years
1) Discharge at Start of period	1.56 mld	1.92 mld
2) Discharge at the end of 15 years	1.92 mld	2.2 mld
3) Average Discharge	1.74 mld	2.06 mld
4) Avg. pumping hours during the period	10.88 hrs.	11.24 hrs.
5) KW required at combined efficiency of pumping set	0.67 * H1	0.77 * H2
6) Avg. annual charges for electrical energy Rs.	15887.94 * KW1	16415.88 * KW2



**TABLE - 1 : VELOCITY AND HEAD LOSSES FOR DIFFERENT PIPE SIZES**

Sl. No.	Pipe Size in mm	Pipe Material	Frictional Head loss per 1000 m		Velocity in m / s		Total head (m) for 50.00 m length pipe including			31.00 m static head				
			1st stage flow	2nd stage flow	1st stage flow	2nd stage flow	1st stage flow			2nd stage flow				
							Frictional loss	Other losses	Total losses (H1)	Frictional loss	Other losses	Total losses (H2)	Water Hammer	Overall Head
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	100	DI	266.57	342.91	5.66	6.48	13.33	1.33	45.66	17.15	1.71	49.86	858.42	889.42
2	150	DI	37.00	47.80	2.51	2.88	1.85	0.19	33.04	2.38	0.24	33.62	366.38	397.38
3	200	DI	9.12	11.73	1.41	1.62	0.46	0.05	31.50	0.59	0.06	31.64	199.89	230.89
4	250	DI	3.07	3.96	0.91	1.04	0.15	0.02	31.17	0.20	0.02	31.22	125.20	156.20
5	300	DI	1.27	1.63	0.63	0.72	0.06	0.01	31.07	0.08	0.01	31.09	85.21	116.21
6	200	CI	16.99	21.85	1.41	1.62	0.85	0.08	31.93	1.09	0.11	32.20	186.08	217.08
7	250	CI	16.99	7.37	0.91	1.04	0.85	0.08	31.93	0.37	0.04	31.41	119.09	150.09
8	300	CI	5.73	3.03	0.63	0.72	0.29	0.03	31.32	0.15	0.02	31.17	80.47	111.47
9	200	CI	2.36	21.85	1.41	1.62	0.12	0.01	31.13	1.09	0.11	32.20	192.07	223.07
10	200	CI	16.99	21.85	1.41	1.62	0.85	0.08	31.93	1.09	0.11	32.20	192.07	223.07
11	250	CI	5.73	7.37	0.91	1.04	0.29	0.03	31.32	0.37	0.04	31.41	118.09	149.09

**TABLE - 2 : KILOWATTS & COST OF PUMP SETS REQUIRED FOR DIFFERENT PIPE SIZES AND PIPE COST**

Sl. No.	Pipe Size in mm	Pipe Material	Cost of pipe per unit length (Rs.)	Cost of 50 metre pipe line (Rs. THS)	1st stage flow			2nd stage flow		
					Total head H1 in metre	KW reqd. plus 50 standby	Pump cost @ Rs 15000 per KW (Rs. THS)	Total head H2 in metre	KW reqd. plus 50 standby	Pump cost @ Rs 15000 per KW (Rs. THS)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	100	DI	969	48	46	46	694	50	58	864
2	150	DI	1464	73	33	33	498	34	39	588
3	200	DI	1948	97	32	32	483	32	37	553
4	250	DI	2554	128	31	31	468	31	36	536
5	300	DI	3234	162	31	31	468	31	36	536
6	200	CI	1979	99	32	32	483	32	37	553
7	250	CI	2667	133	32	32	483	31	36	536
8	300	CI	3439	172	31	31	468	31	36	536
9	200	CI	2148	107	31	31	468	32	37	553
10	200	CI	2148	107	32	32	483	32	37	553
11	250	CI	2904	145	31	31	468	31	36	536



**TABLE - 3 : COMPARATIVE STATEMENT OF OVERALL COST STRUCTURE OF PUMPING MAIN FOR DIFFERENT PIPE SIZES**

Sl. No.	Cost of pipe lines THS (Rs.)	1st stage flow			2nd stage flow			GRAND TOTAL of Capitalised cost for 30 years THS (Rs.)	Pipe Size in mm	Pipe Material	Class of Pipe	Whether water hammer device required		
		Cost of pump sets THS (Rs.)	Annual Energy Charges THS (Rs.)	Capitalised Energy Charges THS (Rs.)	Cost of pump sets THS (Rs.)	Annual Energy Charges THS (Rs.)	Capitalised Energy Charges THS (Rs.)						Capitalised Total Cost THS (Rs.)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	48	694	735	5590	6331	864	946	7193	1929	8260	100	DI	K9	Yes
2	73	498	527	4010	4581	588	643	4891	1312	5893	150	DI	K9	Yes
3	97	483	511	3888	4468	553	605	4604	1234	5702	200	DI	K9	Yes
4	128	468	495	3767	4362	536	586	4460	1196	5558	250	DI	K9	No
5	162	468	495	3767	4396	536	586	4460	1196	5592	300	DI	K9	No
6	99	483	511	3888	4470	553	605	4604	1234	5704	200	CI	LA	Yes
7	133	483	511	3888	4504	536	586	4460	1196	5700	250	CI	LA	Yes
8	172	468	495	3767	4406	536	586	4460	1196	5602	300	CI	LA	Yes
9	107	468	495	3767	4341	553	605	4604	1234	5575	200	CI	A	Yes
10	107	483	511	3888	4478	553	605	4604	1234	5712	200	CI	A	Yes
11	145	468	495	3767	4379	536	586	4460	1196	5575	250	CI	A	Yes

**TABLE - 3 shows that the most economical size of MAIN is :**

Pipe Size in mm	250
Pipe Material	DI
Pipe Class	K9
Capitalised Cost Rs.	5558000

## DESIGN CALCULATION FOR ECONOMIC SIZE OF PUMPING MAIN FOR ZONE - III

Project Name : Augmentation of Arambagh Municipal water supply scheme

From : CWR-III of ZONE-III  
To : OHR-III of ZONE-III

### P I P E D A T A

DIAMETER (MM)	MATERIAL CLASS	THICKNESS (MM)	WORKING PRESSURE (M)	HWC	RATE (Rs. / M)
100	DI	K9	6.00	220	140
150	DI	K9	6.00	220	140
200	DI	K9	6.30	220	140
250	DI	K9	6.80	220	140
300	DI	K9	7.20	220	140
200	CI	LA	9.20	100	100
250	CI	LA	10.00	100	100
300	CI	LA	10.80	100	100
200	CI	A	11.0	125	100
250	CI	A	11.0	125	100
300	CI	A	11.90	125	100

1) Water Requirement :	Year Discharge
A. Initial	2008
B. Intermediate :	2023
C. Ultimate :	2038
	1.120 mld
	1.370 mld
	1.570 mld
2) Pumping MAIN	LENGTH
3) Static Head for Pump	50 M
4) Design Period	31 M
5) Combined Eff. Of Pumping Set	30 yr.
6) Cost of Pumping Set	65 %
7) Interest Rate	15000 Rs.
8) Life of Elec. Motor & Pump Set	10.00 %
9) Energy Charges / KWH Unit	P. Yrs.
10) Pumping Hours for Discharge	400 paise
at the end of 15 Years	12 hrs

	1st 15 years	2nd 15 years
1) Discharge at Start of period	1.12 mld	1.37 mld
2) Discharge at the end of 15 years	1.37 mld	1.57 mld
3) Average Discharge	1.25 mld	1.47 mld
4) Avg. pumping hours during the period	10.91 hrs.	11.24 hrs.
5) KW required at combined efficiency of pumping set	0.48 * H1	0.55 * H2
6) Avg. annual charges for electrical energy Rs.	15931.93 * KW1	16414.86 * KW2

**TABLE - 1 : VELOCITY AND HEAD LOSSES FOR DIFFERENT PIPE SIZES**

Sl. No.	Pipe Size in mm	Pipe Material	Frictional Head loss per 1000 m		Velocity in m/s		Total head (m) for 50.00 m length pipe including			31.00 m static head				
			1st stage flow	2nd stage flow	1st stage flow	2nd stage flow	Frictional loss	Other losses	Total losses (H1)	Frictional loss	Other losses	Total losses (H2)	Water Hammer	Overall Head
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	100	DI	142.77	183.70	4.04	4.63	7.14	0.71	38.85	9.19	0.92	41.10	612.60	643.60
2	150	DI	19.82	25.50	1.79	2.06	0.99	0.10	32.09	1.28	0.13	32.40	261.46	292.46
3	200	DI	4.88	6.28	1.01	1.16	0.24	0.02	31.27	0.31	0.03	31.35	142.65	173.65
4	250	DI	1.65	2.12	0.65	0.74	0.08	0.01	31.09	0.11	0.01	31.12	89.35	120.35
5	300	DI	0.68	0.87	0.45	0.51	0.03	0.00	31.04	0.04	0.00	31.05	60.81	91.81
6	200	CI	9.10	11.71	1.01	1.16	0.45	0.05	31.50	0.59	0.06	31.64	132.79	163.79
7	250	CI	9.10	3.95	0.65	0.74	0.45	0.05	31.50	0.20	0.02	31.22	84.99	115.99
8	300	CI	3.07	1.63	0.45	0.51	0.15	0.02	31.17	0.08	0.01	31.09	57.43	88.43
9	200	CI	1.26	11.71	1.01	1.16	0.06	0.01	31.07	0.59	0.06	31.64	137.07	168.07
10	200	CI	9.10	11.71	1.01	1.16	0.45	0.05	31.50	0.59	0.06	31.64	137.07	168.07
11	250	CI	3.07	3.95	0.65	0.74	0.15	0.02	31.17	0.20	0.02	31.22	84.27	115.27

**TABLE - 2 : KILOWATTS & COST OF PUMP SETS REQUIRED FOR DIFFERENT PIPE SIZES AND PIPE COST**

Sl. No.	Pipe Size in mm	Pipe Material	Cost of pipe per unit length (Rs.)	Cost of 50 metre pipe line (Rs. THS)	1st stage flow		2nd stage flow		Total head H2 in metre	Pump cost @ Rs 15000 per KW (Rs. THS)	Pump cost @ Rs 15000 per KW (Rs. THS)	Total head H2 in metre	KW reqd. plus 50% standby	Pump cost @ Rs 15000 per KW (Rs. THS)
					Total head H1 in metre	KW reqd. plus 50% standby	Total head H1 in metre	KW reqd. plus 50% standby						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	100	DI	969	48	39	28	420	41	34	506	506	41	34	506
2	150	DI	1464	73	32	23	344	32	26	395	395	32	26	395
3	200	DI	1948	97	31	22	334	31	25	382	382	31	25	382
4	250	DI	2554	128	31	22	334	31	25	382	382	31	25	382
5	300	DI	3234	162	31	22	334	31	25	382	382	31	25	382
6	200	CI	1979	99	32	23	344	32	26	395	395	32	26	395
7	250	CI	2667	133	32	23	344	31	25	382	382	31	25	382
8	300	CI	3439	172	31	22	334	31	25	382	382	31	25	382
9	200	CI	2148	107	31	22	334	32	26	395	395	32	26	395
10	200	CI	2148	107	32	23	344	32	26	395	395	32	26	395
11	250	CI	2904	145	31	22	334	31	25	382	382	31	25	382



**TABLE - 3 : COMPARATIVE STATEMENT OF OVERALL COST STRUCTURE OF PUMPING MAIN FOR DIFFERENT PIPE SIZES**

Sl. No.	Cost of pipe lines THS (Rs.) (2)	1st stage flow			2nd stage flow			GRAND TOTAL of Capitalised cost for 30 years THS (Rs.) (11)	Pipe Size in mm (12)	Pipe Material (13)	Class of Pipe (14)	Whether water hammer device required (15)
		Cost of pump sets THS (Rs.) (3)	Annual Energy Charges THS (Rs.) (4)	Capitalised Energy Charges THS (Rs.) (5)	Cost of pump sets THS (Rs.) (7)	Annual Energy Charges THS (Rs.) (8)	Capitalised Energy Charges THS (Rs.) (9)					
1	48	420	446	3391	506	553	4209	1129	100	DI	(14)	(15)
2	73	344	366	2782	395	432	3285	881	150	DI	K9	Yes
3	97	334	354	2695	382	418	3182	853	200	DI	K9	No
4	128	334	354	2695	382	418	3182	853	250	DI	K9	No
5	162	334	354	2695	382	418	3182	853	300	DI	K9	No
6	99	344	366	2782	395	432	3285	881	200	CI	LA	Yes
7	133	344	366	2782	382	418	3182	853	250	CI	LA	Yes
8	172	334	354	2695	382	418	3182	853	300	CI	LA	No
9	107	334	354	2695	395	432	3285	881	200	CI	A	Yes
10	107	344	366	2782	395	432	3285	881	200	CI	A	Yes
11	145	334	354	2695	382	418	3182	853	250	CI	A	No

TABLE - 3 shows that the most economical size of MAIN is :

Pipe Size in mm	200
Pipe Material	DI
Pipe Class	K9
Capitalised Cost Rs.	3979000



## DESIGN CALCULATION FOR ECONOMIC SIZE OF PUMPING MAIN FOR ZONE - IV

Project Name : Augmentation of Arambagh Municipal water supply scheme

From : CWR-IV of ZONE-IV  
To : OHR-IV of ZONE-IV

### P I P E D A T A

	Year Discharge	DIAMETER (MM)	MATERIAL CLASS	THICKNESS (MM)	WORKING PRESSURE (M)	HWC	RATE (Rs. / M)
1) Water Requirement :							
A. Initial	2008	100	DI	6.00	220	140	969
B. Intermediate :	2023	150	DI	6.00	220	140	1464
C. Ultimate :	2038	200	DI	6.30	220	140	1948
2) Pumping MAIN	LENGTH	250	DI	6.80	220	140	2554
3) Static Head for Pump	ST. HEAD	300	DI	7.20	220	140	3234
4) Design Period	YEAR	200	CI	9.20	100	100	1979
5) Combined Eff. Of Pumping Set	EFF. %	250	CI	10.00	100	100	2667
6) Cost of Pumping Set	Rs. / KW	300	CI	10.80	100	100	3439
7) Interest Rate	INTEREST	200	CI	11.0	125	100	2148
8) Life of Elec. Motor & Pump Set	P. Yrs.	250	CI	11.0	125	100	2904
9) Energy Charges / KWH Unit	P / KWH	300	CI	11.90	125	100	3760
10) Pumping Hours for Discharge at the end of 15 Years	PUMPING HOURS						

	1st 15 years	2nd 15 years
1) Discharge at Start of period	1.76 mld	2.17 mld
2) Discharge at the end of 15 years	2.17 mld	2.49 mld
3) Average Discharge	1.97 mld	2.33 mld
4) Avg. pumping hours during the period	10.87 hrs.	11.23 hrs.
5) KW required at combined efficiency of pumping set	0.76 * H1	0.87 * H2
6) Avg. annual charges for electrical energy Rs.	15875.32 * KW1	16405.00 * KW2

**TABLE - 1 : VELOCITY AND HEAD LOSSES FOR DIFFERENT PIPE SIZES**

Sl. No.	Pipe Size in mm	Pipe Material	Frictional Head loss per 1000 m		Velocity in m / s		Total head (m) for				31.00 m static head			
			1st stage flow	2nd stage flow	1st stage flow	2nd stage flow	50.00 m length pipe including		2nd stage flow		Total losses (H2)	Water Hammer	Overall Head	
							1st stage flow	2nd stage flow	Frictional loss	Other losses				Frictional loss
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	100	DI	334.31	431.19	6.39	7.34	16.72	1.67	49.39	21.56	2.16	54.72	971.57	1002.57
2	150	DI	46.41	59.86	2.84	3.26	2.32	0.23	33.55	2.99	0.30	34.29	414.67	445.67
3	200	DI	11.43	14.75	1.60	1.83	0.57	0.06	31.63	0.74	0.07	31.81	226.24	257.24
4	250	DI	3.86	4.97	1.02	1.17	0.19	0.02	31.21	0.25	0.02	31.27	141.70	172.70
5	300	DI	1.59	2.05	0.71	0.82	0.08	0.01	31.09	0.10	0.01	31.11	96.44	127.44
6	200	CI	21.30	27.48	1.60	1.83	1.07	0.11	32.17	1.37	0.14	32.51	210.61	241.61
7	250	CI	21.30	27.48	1.60	1.83	1.07	0.11	32.17	1.37	0.14	32.51	210.61	241.61
8	300	CI	7.19	9.27	1.02	1.17	0.36	0.04	31.40	0.46	0.05	31.51	133.66	164.66
9	200	CI	2.96	3.81	0.71	0.82	0.36	0.04	31.40	0.46	0.05	31.51	133.66	164.66
10	200	CI	21.30	27.48	1.60	1.83	1.07	0.11	32.17	1.37	0.14	32.51	217.38	248.38
11	250	CI	7.19	9.27	1.02	1.17	0.36	0.04	31.40	0.46	0.05	31.51	133.66	164.66

**TABLE - 2 : KILOWATTS & COST OF PUMP SETS REQUIRED FOR DIFFERENT PIPE SIZES AND PIPE COST**

Sl. No.	Pipe Size in mm	Pipe Material	Cost of pipe per unit length (Rs.)	Cost of 50 metre pipe line (Rs. THS)	1st stage flow		2nd stage flow			
					Total head H1 in metre	KW reqd. plus 50 standby	Total head H2 in metre	KW reqd. plus 50 standby		
									Pump cost @ Rs 15000 per KW (Rs. THS)	Pump cost @ Rs 15000 per KW (Rs. THS)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	100	DI	969	48	49	56	835	55	72	1076
2	150	DI	1464	73	34	39	580	34	44	665
3	200	DI	1948	97	32	36	546	32	42	626
4	250	DI	2554	128	31	35	528	31	40	606
5	300	DI	3234	162	31	35	528	31	40	606
6	200	CI	1979	99	32	36	546	33	43	646
7	250	CI	2667	133	32	36	546	32	42	626
8	300	CI	3439	172	31	35	528	31	40	606
9	200	CI	2148	107	31	35	528	33	43	646
10	200	CI	2148	107	32	36	546	33	43	646
11	250	CI	2904	145	31	35	528	32	42	626

**TABLE - 3 : COMPARATIVE STATEMENT OF OVERALL COST STRUCTURE OF PUMPING MAIN FOR DIFFERENT PIPE SIZES**

Sl. No.	Cost of pipe lines THS (Rs.) (2)	1st stage flow		2nd stage flow		GRAND TOTAL of Capitalised cost for 30 years THS (Rs.) (11)	Pipe Size in mm (12)	Pipe Material (13)	Class of Pipe (14)	Whether water hammer device required (15)
		Cost of pump sets THS (Rs.) (3)	Annual Energy Charges THS (Rs.) (4)	Capitalised Energy Charges THS (Rs.) (5)	Cost of pump sets THS (Rs.) (7)					
1	48	835	884	6724	7607	1076	100	DI	K9	Yes
2	73	580	613	4666	5318	665	150	DI	K9	Yes
3	97	546	577	4391	5034	626	200	DI	K9	Yes
4	128	528	559	4254	4910	606	250	DI	K9	No
5	162	528	559	4254	4944	606	300	DI	K9	No
6	99	546	577	4391	5036	646	200	CI	LA	Yes
7	133	546	577	4391	5070	626	250	CI	LA	Yes
8	172	528	559	4254	4954	606	300	CI	LA	Yes
9	107	528	559	4254	4889	646	200	CI	A	Yes
10	107	546	577	4391	5044	646	200	CI	A	Yes
11	145	528	559	4254	4927	626	250	CI	A	Yes

TABLE - 3 shows that the most economical size of MAIN is :

Pipe Size in mm	250
Pipe Material	DI
Pipe Class	K9
Capitalised Cost Rs.	6263000



## DESIGN CALCULATION FOR ECONOMIC SIZE OF PUMPING MAIN FOR ZONE - V

Project Name : Arambagh Municipal water supply scheme

From : NEW TW of ZONE-V (NEW-9)  
To : OHR-V of ZONE-V through JP

### P I P E D A T A

DIAMETER (MM)	MATERIAL CLASS	THICKNESS (MM)	WORKING PRESSURE (M)	HWC	RATE (Rs / M)
100	DI	6.00	220	140	969
150	DI	6.00	220	140	1464
200	DI	6.30	220	140	1948
250	DI	6.80	220	140	2554
300	DI	7.20	220	140	3234
200	CI	9.20	100	100	1979
250	CI	10.00	100	100	2667
300	CI	10.80	100	100	3439
200	CI	11.0	125	100	2148
250	CI	11.0	125	100	2904
300	CI	11.90	125	100	3760

Year	Discharge
2008	0.440 mld
2023	0.540 mld
2038	0.620 mld

1) Pumping MAIN	LENGTH	300 M
2) Static Head for Pump	ST. HEAD	39 M
3) Design Period	YEAR	30 yr.
4) Combined Eff. Of Pumping Set	EFF. %	65 %
5) Cost of Pumping Set	Rs. / KW	15000 Rs.
6) Interest Rate	INTEREST	10.00 %
7) Life of Elec. Motor & Pump Set	P. Yrs.	15 yr.
8) Energy Charges / KWH Unit	P / KWH	400 paise
9) Pumping Hours for Discharge at the end of 15 Years	PUMPING HOURS	12 hrs

	1st 15 years	2nd 15 years
1) Discharge at Start of period	0.44 mld	0.54 mld
2) Discharge at the end of 15 years	0.54 mld	0.62 mld
3) Average Discharge	0.49 mld	0.58 mld
4) Avg. pumping hours during the period	10.89 hrs.	11.23 hrs.
5) KW required at combined efficiency of pumping set	0.19 * H1	0.22 * H2
6) Avg. annual charges for electrical energy Rs.	15908.23 * KW1	16400.45 * KW2



**TABLE - 1 : VELOCITY AND HEAD LOSSES FOR DIFFERENT PIPE SIZES**

Sl. No.	Pipe Size in mm	Pipe Material	Frictional Head loss per 1000 m		Velocity in m / s		Total head (m) for 300.00 m length pipe including				39.00 m static head			
			1st stage flow	2nd stage flow	1st stage flow	2nd stage flow	1st stage flow		2nd stage flow		1st stage flow		2nd stage flow	
							Frictional loss	Other losses	Frictional loss	Other losses	Frictional loss	Other losses	Frictional loss	Other losses
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	100	DI	25.51	32.93	1.59	1.83	7.65	0.77	47.42	9.88	0.99	49.87	241.92	280.92
2	150	DI	3.54	4.57	0.71	0.81	1.06	0.11	40.17	1.37	0.14	40.51	103.25	142.25
3	200	DI	0.87	1.13	0.40	0.46	0.26	0.03	39.29	0.34	0.03	39.37	56.33	95.33
4	250	DI	0.29	0.38	0.25	0.29	0.09	0.01	39.10	0.11	0.01	39.13	35.28	74.28
5	300	DI	0.12	0.16	0.18	0.20	0.04	0.00	39.04	0.05	0.00	39.05	24.01	63.01
6	200	CI	1.63	2.10	0.40	0.46	0.49	0.05	39.54	0.63	0.06	39.69	52.44	91.44
7	250	CI	1.63	0.71	0.25	0.29	0.49	0.05	39.54	0.21	0.02	39.23	33.56	72.56
8	300	CI	0.55	0.29	0.18	0.20	0.16	0.02	39.18	0.09	0.01	39.10	22.68	61.68
9	200	CI	0.23	2.10	0.40	0.46	0.07	0.01	39.07	0.63	0.06	39.69	54.13	93.13
10	200	CI	1.63	2.10	0.40	0.46	0.49	0.05	39.54	0.63	0.06	39.69	54.13	93.13
11	250	CI	0.55	0.71	0.25	0.29	0.16	0.02	39.18	0.21	0.02	39.23	33.28	72.28

**TABLE - 2 : KILOWATTS & COST OF PUMP SETS REQUIRED FOR DIFFERENT PIPE SIZES AND PIPE COST**

Sl. No.	Pipe Size in mm	Pipe Material	Cost of pipe per unit length (Rs.)	Cost of 300 metre pipe line (Rs. THS)	1st stage flow			2nd stage flow		
					Total head H1 in metre	KW reqd. plus 50 % standby	Pump cost @ Rs 15000 per KW (Rs. THS)	Total head H2 in metre	KW reqd. plus 50 % standby	Pump cost @ Rs 15000 per KW (Rs. THS)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	100	DI	969	291	47	13	199	50	16	244
2	150	DI	1464	439	40	11	170	41	13	200
3	200	DI	1948	584	39	11	165	39	13	190
4	250	DI	2554	766	39	11	165	39	13	190
5	300	DI	3234	970	39	11	165	39	13	190
6	200	CI	1979	594	40	11	170	40	13	195
7	250	CI	2667	800	40	11	170	39	13	190
8	300	CI	3439	1032	39	11	165	39	13	190
9	200	CI	2148	644	39	11	165	40	13	195
10	200	CI	2148	644	40	11	170	40	13	195
11	250	CI	2904	871	39	11	165	39	13	190

**TABLE - 3 : COMPARATIVE STATEMENT OF OVERALL COST STRUCTURE OF PUMPING MAIN FOR DIFFERENT PIPE SIZES**

Sl. No.	Cost of pipe lines THS (Rs.) (2)	1st stage flow			2nd stage flow			GRAND TOTAL of Capitalised cost for 30 years THS (Rs.) (11)	Pipe Size in mm (12)	Pipe Material (13)	Class of Pipe (14)	Whether water hammer device required (15)
		Cost of pump sets THS (Rs.) (3)	Annual Energy Charges THS (Rs.) (4)	Capitalised Energy Charges THS (Rs.) (5)	Total Capitalised Cost THS (Rs.) (6)	Cost of pump sets THS (Rs.) (7)	Annual Energy Charges THS (Rs.) (8)					
1	291	199	211	1608	2099	244	266	2025	543	DI	K9	Yes
2	439	170	180	1369	1977	200	218	1661	445	DI	K9	No
3	584	165	175	1335	2084	190	208	1580	424	DI	K9	No
4	766	165	175	1335	2266	190	208	1580	424	DI	K9	No
5	970	165	175	1335	2470	190	208	1580	424	DI	K9	No
6	594	170	180	1369	2132	195	213	1620	434	CI	LA	No
7	800	170	180	1369	2338	190	208	1580	424	CI	LA	No
8	1032	165	175	1335	2532	190	208	1580	424	CI	LA	No
9	644	165	175	1335	2144	195	213	1620	434	CI	A	No
10	644	170	180	1369	2182	195	213	1620	434	CI	A	No
11	871	165	175	1335	2371	190	208	1580	424	CI	A	No

**TABLE - 3 shows that the most economical size of MAIN is :**

Pipe Size in mm	150
Pipe Material	DI
Pipe Class	K9
Capitalised Cost Rs.	2422000

## CHAPTER - XII

### DESIGN AND SELECTION OF PUMPS

- 12.0 The 440 volt & 11 KV (HT) electric line is available in the area. Hence, provision has been made for electrically operated pumping machinery operating on 400 / 440 volts, 50 c/s A.C. power supply. Exact capacity and types of pumps & motors may be determined during the execution of the scheme taking into consideration the actual yield of tube well, its verticality and other allied factors.

It is proposed to provide submersible pumps capable of yielding the required discharge at a design head given as below. Submersible pumps have additional advantages of a lower capital cost and protection against over heating under prolonged operation.

It is proposed to provide submersible pumps capable of yielding the required discharge at a design head to CWR in Zone - II, Zone - III & Zone - IV and to OHR in Zone - V.

Centrifugal pumps are proposed to provide required lift of water from CWR to OHR in Zone - II, Zone - III & Zone - IV.

All Pumps are designed for 15 years i.e. for water demand of the year 2038.

The design calculation is given in the following pages.



## DESIGN AND SELECTION OF PUMP SET FOR ZONE - II

<b>Purpose :</b>	To deliver water from TW to CWR - II
------------------	--------------------------------------

### Design Discharge Calculation

Design Discharge (2023)	0.64	MLD
Design Pumping hours	12	hrs
Duty of Pump	14.81	lps
Say	15	lps

### Pumping Head Calculation

Static Head	21	m	(Ref. Chapter-XI)
Frictional Loss of 150 mm dia Rising main	9.41	m	(Ref. Chapter-XI)
Head losses at Bends, Valves etc. (10% of frictional loss)	0.941	m	
Total Pumping Head Required	31.351	m	
Say	32	m	

### Energy Required for Pump set

Discharge	15	lps	
Head	32	m	
Efficiency of Pump	70	%	
Pump power Required (BHP)	9.14286	HP	
Efficiency of Motor	85	%	
Power input to Motor	10.7563	HP	
Say	8.0242	KW	
	9	KW or	12 HP

**Final Rating of Pump set :** 15 lps x 32 m

**No. of Pump proposed :** 4 Nos.  
(1 no. for each tube well + 1 no. stand by)

**Type of Pump :** KSB make Submersible pump with  
12 HP / 9 KW motor.



### DESIGN AND SELECTION OF PUMP SET FOR ZONE - III

<b>Purpose :</b>	<b>To deliver water from TW to CWR - III</b>
------------------	--

#### Design Discharge Calculation

Design Discharge (2023)	0.59	MLD
Design Pumping hours	12	hrs
Duty of Pump	13.66	lps
Say	14	lps

#### Pumping Head Calculation

Static Head	21	m	(Ref. Chapter-XI)
Frictional Loss of 150 mm dia Rising main	3.25	m	(Ref. Chapter-XI)
Head losses at Bends, Valves etc. (10% of frictional loss)	0.325	m	
Total Pumping Head Required	24.575	m	
Say	25	m	

#### Energy Required for Pump set

Discharge	14	lps	
Head	25	m	
Efficiency of Pump	70	%	
Pump power Required (BHP)	6.66667	HP	
Efficiency of Motor	85	%	
Power input to Motor	7.84314	HP	
	5.85098	KW	
Say	6	KW or	8

**Final Rating of Pump set : 14 lps x 25 m**

**No. of Pump proposed : 4 Nos.**  
(1 no. for each tube well + 1 no. stand by)

**Type of Pump :** KSB make Submersible pump with  
8 HP / 6 KW motor.

## DESIGN AND SELECTION OF PUMP SET FOR ZONE - IV

<b>Purpose :</b>	<b>To deliver water from TW to CWR - IV</b>
------------------	---

### Design Discharge Calculation

Design Discharge (2023)	0.72	MLD
Design Pumping hours	12	hrs
Duty of Pump	16.67	lps
Say	17	lps

### Pumping Head Calculation

Static Head	21	m	(Ref. Chapter-XI)
Frictional Loss of 150 mm dia Rising main	4.28	m	(Ref. Chapter-XI)
Head losses at Bends, Valves etc. (10% of frictional loss)	0.428	m	
Total Pumping Head Required	25.708	m	
Say	26	m	

### Energy Required for Pump set

Discharge	17	lps	
Head	26	m	
Efficiency of Pump	70	%	
Pump power Required (BHP)	8.41905	HP	
Efficiency of Motor	85	%	
Power input to Motor	9.90476	HP	
	7.38895	KW	
Say	7.5	KW or	10 HP

**Final Rating of Pump set :** 17 lps x 26 m

**No. of Pump proposed :** 4 Nos.  
(1 no. for each tube well + 1 no. stand by)

**Type of Pump :** KSB make Submersible pump with  
10 HP / 7.5 KW motor.

## DESIGN AND SELECTION OF PUMP SET FOR ZONE - II

<b>Purpose :</b>	<b>To deliver water from CWR - II to OHR - II</b>
------------------	---

### Design Discharge Calculation

Design Discharge (2023)	1.92	MLD
Design Pumping hours	12	hrs
Duty of Pump	44.44	lps
Say	45	lps

### Pumping Head Calculation

Static Head	31	m	(Ref. Chapter-XI)
Frictional Loss of 250 mm dia Rising main	0.15	m	(Ref. Chapter-XI)
Head losses at Bends, Valves etc. (10% of frictional loss)	0.015	m	
Total Pumping Head Required	31.165	m	
Say	32	m	

### Energy Required for Pump set

Discharge	45	lps	
Head	32	m	
Efficiency of Pump	70	%	
Pump power Required (BHP)	27.4286	HP	
Efficiency of Motor	85	%	
Power input to Motor	32.2689	HP	
Say	25	KW or	34 HP

**Final Rating of Pump set : 45 lps x 32 m**

**No. of Pump proposed : 2 Nos.**  
(1 no. working + 1 no. stand by)

**Type of Pump : Horizontal Split Case Centrifugal Pump**  
**34 HP / 25 KW motor.**



## DESIGN AND SELECTION OF PUMP SET FOR ZONE - III

<b>Purpose :</b>	<b>To deliver water from CWR - III to OHR - III</b>
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### Design Discharge Calculation

Design Discharge (2023)	1.37	MLD
Design Pumping hours	12	hrs
Duty of Pump	31.71	lps
Say	32	lps

### Pumping Head Calculation

Static Head	31	m	(Ref. Chapter-XI)
Frictional Loss of 200 mm dia Rising main	0.24	m	(Ref. Chapter-XI)
Head losses at Bends, Valves etc. (10% of frictional loss)	0.024	m	
Total Pumping Head Required	31.264	m	
Say	32	m	

### Energy Required for Pump set

Discharge	32	lps	
Head	32	m	
Efficiency of Pump	70	%	
Pump power Required (BHP)	19.5048	HP	
Efficiency of Motor	85	%	
Power input to Motor	22.9468	HP	
	17.1183	KW	
Say	18	KW or	<b>24</b> HP

**Final Rating of Pump set :** 32 lps x 32 m

**No. of Pump proposed :** 2 Nos.  
(1 no. working + 1 no. stand by)

**Type of Pump :** Horizontal Split Case Centrifugal Pump  
24 HP / 18 KW motor.

## DESIGN AND SELECTION OF PUMP SET FOR ZONE - IV

<b>Purpose :</b>	<b>To deliver water from CWR - IV to OHR - IV</b>
------------------	---

### Design Discharge Calculation

Design Discharge (2023)	2.17	MLD
Design Pumping hours	12	hrs
Duty of Pump	50.23	lps
Say	51	lps

### Pumping Head Calculation

Static Head	31	m	(Ref. Chapter-XI)
Frictional Loss of 250 mm dia Rising main	0.19	m	(Ref. Chapter-XI)
Head losses at Bends, Valves etc. (10% of frictional loss)	0.019	m	
Total Pumping Head Required	31.209	m	
Say	32	m	

### Energy Required for Pump set

Discharge	51	lps	
Head	32	m	
Efficiency of Pump	70	%	
Pump power Required (BHP)	31.0857	HP	
Efficiency of Motor	85	%	
Power input to Motor	36.5714	HP	
	27.2823	KW	
Say	28	KW or	<b>38</b> HP

**Final Rating of Pump set : 51 lps x 32 m**

**No. of Pump proposed : 2 Nos.**  
(1 no. working + 1 no. stand by)

**Type of Pump : Horizontal Split Case Centrifugal Pump**  
**38 HP / 28 KW motor.**

## DESIGN AND SELECTION OF PUMP SET FOR ZONE - V

<b>Purpose :</b>	<b>To deliver water from TW to OHR</b>
------------------	--

### Design Discharge Calculation

Design Discharge (2023)	0.54	MLD
Design Pumping hours	12	hrs
Duty of Pump	12.5	lps
Say	13	lps

### Pumping Head Calculation

Static Head	39	m	(Ref. Chapter-XI)
Frictional Loss of 200 mm dia Rising main	1.06	m	(Ref. Chapter-XI)
Head losses at Bends, Valves etc. (10% of frictional loss)	0.106	m	
Total Pumping Head Required	40.166	m	
Say	41	m	

### Energy Required for Pump set

Discharge	13	lps	
Head	41	m	
Efficiency of Pump	70	%	
Pump power Required (BHP)	10.1524	HP	
Efficiency of Motor	85	%	
Power input to Motor	11.944	HP	
Say	8.91021	KW	
	9	KW or	12
			HP

**Final Rating of Pump set : 13 lps x 41 m**

**No. of Pump proposed : 2 Nos.**  
(1 no. working TW + 1 no. stand by TW)

**Type of Pump : KSB make Submersible pump with  
12 HP / 9 KW motor.**



## CHAPTER - XIII

### DESIGN OF DISTRIBUTION SYSTEM

- 13.0 It is already mentioned that for equitable distribution of water with minimum terminal pressure of 7 m, synchronization with the existing distribution system for effective utilization of existing infrastructure and considering economic point of view, the entire command area has been divided into 5 (five) zones. Most of the existing distribution pipes are AC pipes and are kept as existing in distribution design. Considering heavy vehicular traffic, life of the pipe and easy maintenance DI K<sub>7</sub> class pipes are recommended for distribution system.

The distribution system is designed for a period of 30 years. Design of distribution system has been done with the help of World Bank / UNDP financed computer program 'LOOP' (Version 4.0), and using Hazen William's formula taking C value as 140 for DI K<sub>7</sub> CML pipes. For existing AC and CI pipes, C value has been taken as 140 and 100 as per CPHEEO Manual. The parallel pipes wherever necessary is provided alongwith existing pipes.

The supply of water is to be made within 8 (eight) hours with a daily demand rate of 70 lpcd. Peak factor for design of distribution system has been considered as 3 (three) and the minimum terminal head at the furthest end as 7.0 meter. No provision of stand post has been made in the estimate. Existing stand post will be utilized. If additional stand post is necessary, it will be provided by the local authority. Distribution lines are to be operated section wise, for which valves have to be provided at a suitable location.

Details of hydraulic design for distribution network are enclosed.

L O O P

Version 4.0

Looped Water Distribution Network Design Program

LOOP: Looped Water Distribution Design Program - (C) The World Bank

## Echoing Input Variables

```

-----
Title of the Project           : ARAMBAGH W/S SCHEME ZONE I
Name of the User              : C SEC
Number of Pipes               : 58
Number of Nodes               : 44
Type of Pipe Materials Used   : DI/CI/AC/
Number of Commercial Dia per Material : 6/3/1/
Peak Design Factor            : 3
Newton-Raphson Stopping Criterion lps : .001
Minimum Pressure              m   : 7
Maximum Pressure              m   : 40
Design Hydraulic Gradient m in km : 10
Simulate or Design?          (S/D) : S
No. of Res. Nodes with Fixed HGL : 1
No. of Res. Nodes with Variable HGL :
No. of Booster Pumps         :
No. of Pressure Reducing Valves :
No. of Check Valves          :
Type of Formula               : Hazen's

```

## Pipe Data

```

-----
Pipe No.   From Node   To Node   Length m   Diameter mm   Hazen's Const   Pipe Material (E/P)   Status
-----
101  101  102    50.00   300.0   140.00000   DI
102  135  103   100.00   300.0   100.00000   CI   E
103  103  104   120.00   300.0   100.00000   CI   E
104  104  105   300.00   100.0   140.00000   DI
105  104  128    60.00   300.0   100.00000   CI   E
106  128  129   150.00   100.0   140.00000   DI
107  128  130   100.00   300.0   140.00000   DI   E
108  130  131   240.00   100.0   140.00000   DI
109  130  106    60.00   300.0   100.00000   CI   E
110  106  107   150.00    80.0   140.00000   AC   E
111  106  108   120.00   300.0   100.00000   CI   E
112  108  134   100.00   100.0   140.00000   DI
113  108  109   300.00   300.0   100.00000   CI   E
114  109  110   120.00   300.0   100.00000   CI   E
115  110  113   240.00    80.0   140.00000   AC   E
116  108  113   540.00    80.0   140.00000   AC   E
117  141  116    60.00   200.0   100.00000   CI   E
118  110  114    50.00   300.0   100.00000   CI   E
119  114  115   100.00   300.0   100.00000   CI   E
120  115  116   360.00    80.0   140.00000   AC   E
121  115  117   100.00   300.0   100.00000   CI   E
122  116  117   360.00   200.0   100.00000   CI   E

```



## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
123	117	118	270.00	100.0	140.00000	DI	
124	118	119	420.00	100.0	140.00000	DI	
125	119	120	300.00	100.0	140.00000	DI	
126	119	121	1000.00	100.0	140.00000	DI	
127	104	127	270.00	80.0	140.00000	AC	E
128	127	131	50.00	80.0	140.00000	AC	E
129	131	111	60.00	80.0	140.00000	AC	E
130	106	111	240.00	80.0	140.00000	AC	E
131	111	109	210.00	80.0	140.00000	AC	E
132	111	112	180.00	80.0	140.00000	AC	E
133	112	114	270.00	80.0	140.00000	AC	E
134	127	126	100.00	100.0	140.00000	DI	
135	126	132	100.00	100.0	140.00000	DI	
136	132	112	60.00	100.0	140.00000	DI	
137	132	133	200.00	100.0	140.00000	DI	
138	126	125	500.00	100.0	140.00000	DI	
139	118	122	540.00	100.0	140.00000	DI	
140	122	123	500.00	100.0	140.00000	DI	
141	124	118	300.00	150.0	100.00000	CI	E
142	124	139	360.00	200.0	100.00000	CI	E
143	139	122	240.00	100.0	140.00000	DI	
144	139	140	500.00	200.0	100.00000	CI	E
145	139	140	240.00	100.0	140.00000	DI	
146	113	141	400.00	100.0	140.00000	DI	
147	102	135	200.00	300.0	100.00000	CI	E
148	102	136	50.00	100.0	140.00000	DI	
149	135	137	420.00	100.0	140.00000	DI	
150	137	142	420.00	150.0	100.00000	CI	E
151	142	138	240.00	100.0	140.00000	DI	
152	142	125	500.00	150.0	100.00000	CI	E
153	125	124	270.00	150.0	100.00000	CI	E
154	103	138	400.00	100.0	140.00000	DI	
155	117	124	300.00	200.0	100.00000	CI	E
156	141	143	500.00	200.0	100.00000	CI	E
157	116	144	200.00	100.0	140.00000	DI	
158	116	118	200.00	100.0	140.00000	DI	

## Node Data

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
101	3.00	0.000	0.00	7.00	40.00
102	3.00	-0.498	0.00	7.00	40.00
103	3.00	-0.498	0.00	7.00	40.00
104	3.00	-0.498	0.00	7.00	40.00
105	3.00	-0.498	0.00	7.00	40.00
106	3.00	-0.498	0.00	7.00	40.00
107	3.00	-0.498	0.00	7.00	40.00
108	3.00	-0.498	0.00	7.00	40.00
109	3.00	-0.498	0.00	7.00	40.00
110	3.00	-0.498	0.00	7.00	40.00
111	3.00	-0.498	0.00	7.00	40.00
112	3.00	-0.498	0.00	7.00	40.00
113	3.00	-0.498	0.00	7.00	40.00
114	3.00	-0.498	0.00	7.00	40.00
115	3.00	-0.498	0.00	7.00	40.00
116	3.00	-0.498	0.00	7.00	40.00
117	3.00	-0.498	0.00	7.00	40.00
118	3.00	-0.498	0.00	7.00	40.00
119	3.00	-0.498	0.00	7.00	40.00
120	3.00	-0.498	0.00	7.00	40.00
121	3.00	-0.498	0.00	7.00	40.00
122	3.00	-0.498	0.00	7.00	40.00
123	3.00	-0.498	0.00	7.00	40.00
124	3.00	-0.498	0.00	7.00	40.00
125	3.00	-0.498	0.00	7.00	40.00
126	3.00	-0.498	0.00	7.00	40.00
127	3.00	-0.498	0.00	7.00	40.00
128	3.00	-0.498	0.00	7.00	40.00
129	3.00	-0.498	0.00	7.00	40.00
130	3.00	-0.498	0.00	7.00	40.00
131	3.00	-0.498	0.00	7.00	40.00
132	3.00	-0.498	0.00	7.00	40.00
133	3.00	-0.498	0.00	7.00	40.00
134	3.00	-0.498	0.00	7.00	40.00
135	3.00	-0.498	0.00	7.00	40.00
136	3.00	-0.498	0.00	7.00	40.00
137	3.00	-0.498	0.00	7.00	40.00
138	3.00	-0.498	0.00	7.00	40.00
139	3.00	-0.498	0.00	7.00	40.00
140	3.00	-0.498	0.00	7.00	40.00
141	3.00	-0.498	0.00	7.00	40.00
142	3.00	-0.498	0.00	7.00	40.00
143	3.00	-0.498	0.00	7.00	40.00
144	3.00	-0.498	0.00	7.00	40.00

## Fixed Head Reservoir Data

Source Node	Head m	Ref Res? (R)
101	12.76	R

## Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length	Allow Press m	Pipe Material
100.0	140.00000	820.00	120.00	DI
150.0	140.00000	1185.00	120.00	DI
200.0	140.00000	1728.00	120.00	DI
250.0	140.00000	2328.00	120.00	DI
300.0	140.00000	3001.00	120.00	DI
350.0	140.00000	3784.00	120.00	DI
150.0	100.00000	1356.00	120.00	CI
200.0	100.00000	1979.00	120.00	CI
300.0	100.00000	3439.00	120.00	CI
80.0	140.00000	247.00	40.00	AC

## Looped Water Distribution Network Design Output

BandWidth	=	6
Number of Loops	=	15
Newton Raphson Iterations	=	9

## Pipe Details

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
101	101	102	64.242	300.0	0.12	2.47	50.00	0.91
102	135	103	55.527	300.0	0.35	3.52	100.00	0.79



## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m )	HL/1000m (m )	Length (m )	Velocity (m/s )
103	103	104	50.423	300.0	0.35	2.94	120.00	0.71
104	104	105	1.494	100.0	0.15	0.49	300.00	0.19
105	104	128	44.951	300.0	0.14	2.38	60.00	0.64
106	128	129	1.494	100.0	0.07	0.49	150.00	0.19
107	128	130	41.963	300.0	0.11	1.12	100.00	0.59
108	130	131	3.727	100.0	0.64	2.67	240.00	0.47
109	130	106	36.742	300.0	0.10	1.64	60.00	0.52
110	106	107	1.494	80.0	0.22	1.46	150.00	0.30
111	106	108	31.849	300.0	0.15	1.26	120.00	0.45
112	108	134	1.494	100.0	0.05	0.49	100.00	0.19
113	108	109	27.579	300.0	0.29	0.96	300.00	0.39
114	109	110	25.228	300.0	0.10	0.82	120.00	0.36
115	110	113	1.122	80.0	0.21	0.86	240.00	0.22
116	108	113	1.281	80.0	0.59	1.10	540.00	0.25
117	141	116	-2.079	200.0	-0.00	-0.06	60.00	-0.07
118	110	114	22.613	300.0	0.03	0.67	50.00	0.32
119	114	115	19.872	300.0	0.05	0.52	100.00	0.28
120	115	116	0.875	80.0	0.20	0.54	360.00	0.17
121	115	117	17.502	300.0	0.04	0.41	100.00	0.25
122	116	117	-6.116	200.0	-0.15	-0.43	360.00	-0.19
123	117	118	2.364	100.0	0.31	1.15	270.00	0.30
124	118	119	4.482	100.0	1.58	3.76	420.00	0.57
125	119	120	1.494	100.0	0.15	0.49	300.00	0.19
126	119	121	1.494	100.0	0.49	0.49	1000.00	0.19
127	104	127	2.483	80.0	1.01	3.74	270.00	0.49
128	127	131	-1.886	80.0	-0.11	-2.24	50.00	-0.38
129	131	111	0.347	80.0	0.01	0.10	60.00	0.07
130	106	111	1.905	80.0	0.55	2.29	240.00	0.38
131	111	109	-0.857	80.0	-0.11	-0.52	210.00	-0.17
132	111	112	1.616	80.0	0.30	1.69	180.00	0.32
133	112	114	-1.247	80.0	-0.28	-1.04	270.00	-0.25
134	127	126	2.875	100.0	0.17	1.65	100.00	0.37
135	126	132	1.619	100.0	0.06	0.57	100.00	0.21
136	132	112	-1.369	100.0	-0.03	-0.42	60.00	-0.17
137	132	133	1.494	100.0	0.10	0.49	200.00	0.19
138	126	125	-0.238	100.0	-0.01	-0.02	500.00	-0.03
139	118	122	1.120	100.0	0.16	0.29	540.00	0.14
140	122	123	1.494	100.0	0.25	0.49	500.00	0.19
141	124	118	2.807	150.0	0.12	0.41	300.00	0.16
142	124	139	4.856	200.0	0.10	0.28	360.00	0.15
143	139	122	1.868	100.0	0.18	0.74	240.00	0.24
144	139	140	1.118	200.0	0.01	0.02	500.00	0.04
145	139	140	0.376	100.0	0.01	0.04	240.00	0.05
146	113	141	0.909	100.0	0.08	0.20	400.00	0.12
147	102	135	61.254	300.0	0.84	4.22	200.00	0.87

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
148	102	136	1.494	100.0	0.02	0.49	50.00	0.19
149	135	137	4.233	100.0	1.42	3.38	420.00	0.54
150	137	142	2.739	150.0	0.16	0.39	420.00	0.15
151	142	138	-2.117	100.0	-0.23	-0.94	240.00	-0.27
152	142	125	3.361	150.0	0.29	0.57	500.00	0.19
153	125	124	1.629	150.0	0.04	0.15	270.00	0.09
154	103	138	3.611	100.0	1.01	2.52	400.00	0.46
155	117	124	7.528	200.0	0.19	0.63	300.00	0.24
156	141	143	1.494	200.0	0.02	0.03	500.00	0.05
157	116	144	1.494	100.0	0.10	0.49	200.00	0.19
158	116	118	1.925	100.0	0.16	0.79	200.00	0.24

Note: Negative value indicates the flow in reverse direction in that Pipe

## Pipe Pressure Details

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m)	Allow Press (m)	Status (E/P)
101	101	102	300.0	140.00000	DI	12.76	120.00	
102	135	103	300.0	100.00000	CI	11.79	120.00	E
103	103	104	300.0	100.00000	CI	11.44	120.00	E
104	104	105	100.0	140.00000	DI	11.09	120.00	
105	104	128	300.0	100.00000	CI	11.09	120.00	E
106	128	129	100.0	140.00000	DI	10.94	120.00	
107	128	130	300.0	140.00000	DI	10.94	120.00	E
108	130	131	100.0	140.00000	DI	10.83	120.00	
109	130	106	300.0	100.00000	CI	10.83	120.00	E
110	106	107	80.0	140.00000	AC	10.73	40.00	E
111	106	108	300.0	100.00000	CI	10.73	120.00	E
112	108	134	100.0	140.00000	DI	10.58	120.00	
113	108	109	300.0	100.00000	CI	10.58	120.00	E
114	109	110	300.0	100.00000	CI	10.29	120.00	E
115	110	113	80.0	140.00000	AC	10.20	40.00	E
116	108	113	80.0	140.00000	AC	10.58	40.00	E
117	141	116	200.0	100.00000	CI	9.92	120.00	E
118	110	114	300.0	100.00000	CI	10.20	120.00	E
119	114	115	300.0	100.00000	CI	10.16	120.00	E
120	115	116	80.0	140.00000	AC	10.11	40.00	E
121	115	117	300.0	100.00000	CI	10.11	120.00	E
122	116	117	200.0	100.00000	CI	10.07	120.00	E

## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
123	117	118	100.0	140.00000	DI	10.07	120.00	
124	118	119	100.0	140.00000	DI	9.76	120.00	
125	119	120	100.0	140.00000	DI	8.18	120.00	
126	119	121	100.0	140.00000	DI	8.18	120.00	
127	104	127	80.0	140.00000	AC	11.09	40.00	E
128	127	131	80.0	140.00000	AC	10.19	40.00	E
129	131	111	80.0	140.00000	AC	10.19	40.00	E
130	106	111	80.0	140.00000	AC	10.73	40.00	E
131	111	109	80.0	140.00000	AC	10.29	40.00	E
132	111	112	80.0	140.00000	AC	10.18	40.00	E
133	112	114	80.0	140.00000	AC	10.16	40.00	E
134	127	126	100.0	140.00000	DI	10.08	120.00	
135	126	132	100.0	140.00000	DI	9.91	120.00	
136	132	112	100.0	140.00000	DI	9.88	120.00	
137	132	133	100.0	140.00000	DI	9.86	120.00	
138	126	125	100.0	140.00000	DI	9.92	120.00	
139	118	122	100.0	140.00000	DI	9.76	120.00	
140	122	123	100.0	140.00000	DI	9.60	120.00	
141	124	118	150.0	100.00000	CI	9.88	120.00	E
142	124	139	200.0	100.00000	CI	9.88	120.00	E
143	139	122	100.0	140.00000	DI	9.78	120.00	
144	139	140	200.0	100.00000	CI	9.78	120.00	E
145	139	140	100.0	140.00000	DI	9.78	120.00	
146	113	141	100.0	140.00000	DI	9.99	120.00	
147	102	135	300.0	100.00000	CI	12.64	120.00	E
148	102	136	100.0	140.00000	DI	12.64	120.00	
149	135	137	100.0	140.00000	DI	11.79	120.00	
150	137	142	150.0	100.00000	CI	10.37	120.00	E
151	142	138	100.0	140.00000	DI	10.43	120.00	
152	142	125	150.0	100.00000	CI	10.21	120.00	E
153	125	124	150.0	100.00000	CI	9.92	120.00	E
154	103	138	100.0	140.00000	DI	11.44	120.00	
155	117	124	200.0	100.00000	CI	10.07	120.00	E
156	141	143	200.0	100.00000	CI	9.91	120.00	E
157	116	144	100.0	140.00000	DI	9.92	120.00	
158	116	118	100.0	140.00000	DI	9.92	120.00	



## Node Details

Node No.	Flow (lps)	Elev. (m )	H G L (m )	Pressure (m )
101 S	64.242	0.00	12.76	12.76
102	-1.494	0.00	12.64	12.64
103	-1.494	0.00	11.44	11.44
104	-1.494	0.00	11.09	11.09
105	-1.494	0.00	10.94	10.94
106	-1.494	0.00	10.73	10.73
107	-1.494	0.00	10.52	10.52
108	-1.494	0.00	10.58	10.58
109	-1.494	0.00	10.29	10.29
110	-1.494	0.00	10.20	10.20
111	-1.494	0.00	10.18	10.18
112	-1.494	0.00	9.88	9.88
113	-1.494	0.00	9.99	9.99
114	-1.494	0.00	10.16	10.16
115	-1.494	0.00	10.11	10.11
116	-1.494	0.00	9.92	9.92
117	-1.494	0.00	10.07	10.07
118	-1.494	0.00	9.76	9.76
119	-1.494	0.00	8.18	8.18
120	-1.494	0.00	8.03	8.03
121	-1.494	0.00	7.69	7.69
122	-1.494	0.00	9.60	9.60
123	-1.494	0.00	9.36	9.36
124	-1.494	0.00	9.88	9.88
125	-1.494	0.00	9.92	9.92
126	-1.494	0.00	9.91	9.91
127	-1.494	0.00	10.08	10.08
128	-1.494	0.00	10.94	10.94
129	-1.494	0.00	10.87	10.87
130	-1.494	0.00	10.83	10.83
131	-1.494	0.00	10.19	10.19
132	-1.494	0.00	9.86	9.86
133	-1.494	0.00	9.76	9.76
134	-1.494	0.00	10.53	10.53
135	-1.494	0.00	11.79	11.79
136	-1.494	0.00	12.61	12.61
137	-1.494	0.00	10.37	10.37
138	-1.494	0.00	10.43	10.43
139	-1.494	0.00	9.78	9.78
140	-1.494	0.00	9.77	9.77
141	-1.494	0.00	9.91	9.91
142	-1.494	0.00	10.21	10.21
143	-1.494	0.00	9.90	9.90
144	-1.494	0.00	9.82	9.82

## Pipe Cost Summary

Diameter (mm)	Pipe Material	Length (m )	Cost (1000 Rs )	Cum. Cost (1000 Rs )
100.0	DI	7170.00	5879.40	5879.40
300.0	DI	50.00	150.05	6029.45

## Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Pipe Material	Length (m )	Cost (1000 Rs )	Cum. Cost (1000 Rs )
101	300.0	DI	50.00	150.05	150.05
104	100.0	DI	300.00	246.00	396.05
106	100.0	DI	150.00	123.00	519.05
108	100.0	DI	240.00	196.80	715.85
112	100.0	DI	100.00	82.00	797.85
123	100.0	DI	270.00	221.40	1019.25
124	100.0	DI	420.00	344.40	1363.65
125	100.0	DI	300.00	246.00	1609.65
126	100.0	DI	1000.00	820.00	2429.65
134	100.0	DI	100.00	82.00	2511.65
135	100.0	DI	100.00	82.00	2593.65
136	100.0	DI	60.00	49.20	2642.85
137	100.0	DI	200.00	164.00	2806.85
138	100.0	DI	500.00	410.00	3216.85
139	100.0	DI	540.00	442.80	3659.65
140	100.0	DI	500.00	410.00	4069.65
143	100.0	DI	240.00	196.80	4266.45
145	100.0	DI	240.00	196.80	4463.25
146	100.0	DI	400.00	328.00	4791.25
148	100.0	DI	50.00	41.00	4832.25
149	100.0	DI	420.00	344.40	5176.65
151	100.0	DI	240.00	196.80	5373.45
154	100.0	DI	400.00	328.00	5701.45
157	100.0	DI	200.00	164.00	5865.45
158	100.0	DI	200.00	164.00	6029.45

L O O P

Version 4.0

Looped Water Distribution Network Design Program

LOOP: Looped Water Distribution Design Program - (C) The World Bank



## Echoing Input Variables

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Title of the Project      : ARAMBAGH WATER SUPPLY SCHEME ZONE
II
Name of the User         : C SEC
Number of Pipes          : 167
Number of Nodes         : 117
Type of Pipe Materials Used : DI/CI/AC/
Number of Commercial Dia per Material : 6/2/2/
Peak Design Factor       : 3
Newton-Raphson Stopping Criterion lps : .001
Minimum Pressure         m : 7
Maximum Pressure        m : 40
Design Hydraulic Gradient m in km : 10
Simulate or Design?     (S/D) : S
No. of Res. Nodes with Fixed HGL : 1
No. of Res. Nodes with Variable HGL : 0
No. of Booster Pumps    : 0
No. of Pressure Reducing Valves : 0
No. of Check Valves     : 0
Type of Formula         : Hazen's

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## Pipe Data

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Pipe  From  To  Length  Diameter  Hazen's  Pipe  Status
No.  Node  Node  m        mm        Const   Material (E/P)
-----
201  201  202   50.00   300.0    140.00000  DI
202  202  203   60.00   100.0    140.00000  AC      E
332  202  203   60.00   200.0    140.00000  DI
203  211  204  150.00   100.0    140.00000  DI
204  204  205  160.00   100.0    140.00000  DI
205  204  206  150.00   100.0    140.00000  DI
206  206  207  100.00   100.0    140.00000  DI
207  206  208  150.00   100.0    140.00000  DI
208  208  209  100.00   100.0    140.00000  DI
209  208  210  150.00   100.0    140.00000  DI
210  203  211   60.00   100.0    140.00000  AC      E
333  203  211   60.00   150.0    140.00000  DI
211  211  212  100.00   100.0    140.00000  DI
212  212  213  200.00   100.0    140.00000  DI
213  212  214  100.00   100.0    140.00000  DI
214  211  215  100.00   100.0    140.00000  AC      E
334  211  215  100.00   150.0    140.00000  DI
215  215  216   50.00   100.0    140.00000  DI
216  216  217   50.00   100.0    140.00000  DI
217  216  218   50.00   100.0    140.00000  DI
218  218  219   50.00   100.0    140.00000  DI
219  218  220   50.00   100.0    140.00000  DI

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## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
220	215	221	120.00	100.0	140.00000	AC	E
335	215	221	120.00	150.0	140.00000	DI	
221	221	222	100.00	100.0	140.00000	DI	
222	221	223	60.00	100.0	140.00000	AC	E
336	221	223	60.00	150.0	140.00000	DI	
223	223	210	600.00	100.0	140.00000	AC	E
224	223	226	180.00	80.0	140.00000	AC	E
337	223	226	180.00	150.0	140.00000	DI	
225	226	227	400.00	100.0	140.00000	DI	
226	226	228	60.00	80.0	140.00000	AC	E
338	226	228	60.00	150.0	140.00000	DI	
227	228	229	120.00	80.0	140.00000	AC	E
339	228	229	120.00	100.0	140.00000	DI	
228	229	230	100.00	100.0	140.00000	DI	
229	229	231	180.00	80.0	140.00000	AC	E
340	229	231	180.00	100.0	140.00000	DI	
230	231	232	300.00	100.0	140.00000	DI	
231	231	233	300.00	80.0	140.00000	AC	E
341	231	233	300.00	100.0	140.00000	DI	
232	233	234	300.00	100.0	140.00000	DI	
233	233	235	180.00	80.0	140.00000	AC	E
342	233	235	180.00	100.0	140.00000	DI	
234	235	239	120.00	100.0	140.00000	DI	
235	235	236	200.00	100.0	140.00000	DI	
236	236	237	100.00	100.0	140.00000	DI	
237	236	238	100.00	100.0	140.00000	DI	
238	228	251	240.00	100.0	140.00000	DI	
239	223	224	100.00	100.0	140.00000	DI	
240	224	225	150.00	100.0	140.00000	DI	
241	224	248	50.00	100.0	140.00000	DI	
242	203	242	720.00	100.0	140.00000	DI	
243	202	240	60.00	300.0	140.00000	DI	
244	240	244	150.00	150.0	140.00000	DI	
245	240	241	300.00	250.0	140.00000	DI	
246	241	242	120.00	100.0	140.00000	DI	
247	242	243	60.00	100.0	140.00000	DI	
248	241	244	240.00	80.0	140.00000	AC	E
249	244	245	200.00	100.0	140.00000	DI	
250	244	220	180.00	80.0	140.00000	AC	E
363	244	220	180.00	100.0	140.00000	DI	
251	220	246	120.00	80.0	140.00000	AC	E
364	220	246	120.00	100.0	140.00000	DI	
252	246	247	100.00	100.0	140.00000	DI	
253	246	248	150.00	80.0	140.00000	AC	E
365	246	248	150.00	100.0	140.00000	DI	

## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
254	248	249	100.00	80.0	140.00000	AC	E
366	248	249	100.00	100.0	140.00000	DI	
255	249	250	200.00	100.0	140.00000	DI	
256	249	251	180.00	80.0	140.00000	AC	E
367	249	251	180.00	100.0	140.00000	DI	
257	251	252	420.00	80.0	140.00000	AC	E
344	251	252	420.00	150.0	140.00000	DI	
258	252	253	50.00	100.0	140.00000	DI	
259	252	254	180.00	80.0	140.00000	AC	E
345	252	254	180.00	100.0	140.00000	DI	
260	254	255	100.00	100.0	140.00000	DI	
261	254	256	180.00	80.0	140.00000	AC	E
346	254	256	180.00	100.0	140.00000	DI	
262	256	257	1000.00	100.0	140.00000	DI	
263	256	258	180.00	80.0	140.00000	AC	E
347	256	258	180.00	100.0	140.00000	DI	
264	258	259	1000.00	100.0	140.00000	DI	
265	258	260	180.00	80.0	140.00000	AC	E
348	258	260	180.00	100.0	140.00000	DI	
266	260	261	60.00	100.0	140.00000	DI	
267	261	262	100.00	100.0	140.00000	DI	
268	261	263	60.00	100.0	140.00000	DI	
269	263	264	250.00	100.0	140.00000	DI	
270	263	265	60.00	100.0	140.00000	DI	
271	265	266	150.00	100.0	140.00000	DI	
272	265	267	120.00	100.0	140.00000	DI	
273	267	268	150.00	100.0	140.00000	DI	
274	260	269	300.00	80.0	140.00000	AC	E
349	260	269	300.00	100.0	140.00000	DI	
275	269	270	150.00	100.0	140.00000	DI	
276	269	271	180.00	100.0	140.00000	DI	
277	271	272	150.00	100.0	140.00000	DI	
278	271	273	150.00	100.0	140.00000	DI	
279	271	274	150.00	100.0	140.00000	DI	
280	274	275	150.00	100.0	140.00000	DI	
281	274	276	180.00	100.0	140.00000	DI	
282	269	277	120.00	80.0	140.00000	AC	E
350	269	277	120.00	100.0	140.00000	DI	
283	277	278	150.00	100.0	140.00000	DI	
284	277	279	120.00	80.0	140.00000	AC	E
351	277	279	120.00	100.0	140.00000	DI	
285	279	280	200.00	100.0	140.00000	DI	
286	279	281	180.00	80.0	140.00000	AC	E
352	279	281	180.00	100.0	140.00000	DI	
287	281	282	200.00	100.0	140.00000	DI	

## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
288	281	283	180.00	80.0	140.00000	AC	E
353	281	283	180.00	100.0	140.00000	DI	
289	283	284	100.00	100.0	140.00000	DI	
290	283	285	120.00	80.0	140.00000	AC	E
354	283	285	120.00	150.0	140.00000	DI	
291	285	286	300.00	100.0	140.00000	DI	
292	285	287	120.00	80.0	140.00000	AC	E
355	285	287	120.00	150.0	140.00000	DI	
293	287	288	200.00	100.0	140.00000	DI	
294	287	289	120.00	80.0	140.00000	AC	E
343	287	289	120.00	150.0	140.00000	DI	
295	289	290	100.00	100.0	140.00000	DI	
296	289	291	120.00	80.0	140.00000	AC	E
356	289	291	120.00	150.0	140.00000	DI	
297	241	292	420.00	150.0	100.00000	CI	E
357	241	292	420.00	200.0	140.00000	DI	
298	292	291	480.00	150.0	100.00000	CI	E
358	292	291	480.00	150.0	140.00000	DI	
299	292	294	840.00	100.0	140.00000	AC	E
300	291	293	330.00	200.0	100.00000	CI	E
301	293	294	270.00	200.0	100.00000	CI	E
302	291	295	240.00	150.0	100.00000	CI	E
359	291	295	240.00	100.0	140.00000	DI	
303	295	296	120.00	80.0	140.00000	AC	E
304	296	297	60.00	100.0	140.00000	DI	
305	296	298	120.00	100.0	140.00000	DI	
306	295	299	330.00	150.0	100.00000	CI	E
360	295	299	330.00	150.0	140.00000	DI	
307	299	300	200.00	100.0	140.00000	DI	
308	299	301	60.00	150.0	100.00000	CI	E
361	299	301	60.00	100.0	140.00000	DI	
309	301	316	450.00	150.0	100.00000	CI	E
362	301	316	450.00	100.0	140.00000	DI	
310	301	302	120.00	150.0	100.00000	CI	E
311	302	303	100.00	100.0	140.00000	DI	
312	302	304	180.00	150.0	100.00000	CI	E
313	304	305	120.00	150.0	100.00000	CI	E
314	305	306	270.00	100.0	140.00000	DI	
315	304	306	150.00	80.0	140.00000	AC	E
316	306	293	600.00	100.0	140.00000	DI	
317	305	307	60.00	150.0	100.00000	CI	E
318	307	308	300.00	150.0	100.00000	CI	E
319	294	308	360.00	100.0	140.00000	DI	
320	308	309	240.00	100.0	140.00000	DI	
321	307	310	180.00	80.0	140.00000	AC	E



## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
322	310	309	420.00	80.0	140.00000	AC	E
323	310	311	120.00	80.0	140.00000	AC	E
324	311	312	360.00	80.0	140.00000	AC	E
325	311	313	150.00	100.0	140.00000	DI	
326	312	313	100.00	80.0	140.00000	AC	E
327	313	314	540.00	80.0	140.00000	AC	E
328	309	314	120.00	100.0	140.00000	DI	
329	315	317	280.00	200.0	100.00000	CI	E
330	312	315	240.00	80.0	140.00000	AC	E
331	315	316	600.00	200.0	100.00000	CI	E

## Node Data

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
201	3.00	0.000	0.00	7.00	40.00
202	3.00	-0.220	0.00	7.00	40.00
203	3.00	-0.220	0.00	7.00	40.00
204	3.00	-0.220	0.00	7.00	40.00
205	3.00	-0.220	0.00	7.00	40.00
206	3.00	-0.220	0.00	7.00	40.00
207	3.00	-0.220	0.00	7.00	40.00
208	3.00	-0.220	0.00	7.00	40.00
209	3.00	-0.220	0.00	7.00	40.00
210	3.00	-0.220	0.00	7.00	40.00
211	3.00	-0.220	0.00	7.00	40.00
212	3.00	-0.220	0.00	7.00	40.00
213	3.00	-0.220	0.00	7.00	40.00
214	3.00	-0.220	0.00	7.00	40.00
215	3.00	-0.220	0.00	7.00	40.00
216	3.00	-0.220	0.00	7.00	40.00
217	3.00	-0.220	0.00	7.00	40.00
218	3.00	-0.220	0.00	7.00	40.00
219	3.00	-0.220	0.00	7.00	40.00
220	3.00	-0.220	0.00	7.00	40.00
221	3.00	-0.220	0.00	7.00	40.00
222	3.00	-0.220	0.00	7.00	40.00
223	3.00	-0.220	0.00	7.00	40.00
224	3.00	-0.220	0.00	7.00	40.00
225	3.00	-0.220	0.00	7.00	40.00

## Node Data cont'd

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
226	3.00	-0.220	0.00	7.00	40.00
227	3.00	-0.220	0.00	7.00	40.00
228	3.00	-0.220	0.00	7.00	40.00
229	3.00	-0.220	0.00	7.00	40.00
230	3.00	-0.220	0.00	7.00	40.00
231	3.00	-0.220	0.00	7.00	40.00
232	3.00	-0.220	0.00	7.00	40.00
233	3.00	-0.220	0.00	7.00	40.00
234	3.00	-0.220	0.00	7.00	40.00
235	3.00	-0.220	0.00	7.00	40.00
236	3.00	-0.220	0.00	7.00	40.00
237	3.00	-0.220	0.00	7.00	40.00
238	3.00	-0.220	0.00	7.00	40.00
239	3.00	-0.220	0.00	7.00	40.00
240	3.00	-0.220	0.00	7.00	40.00
241	3.00	-0.220	0.00	7.00	40.00
242	3.00	-0.220	0.00	7.00	40.00
243	3.00	-0.220	0.00	7.00	40.00
244	3.00	-0.220	0.00	7.00	40.00
245	3.00	-0.220	0.00	7.00	40.00
246	3.00	-0.220	0.00	7.00	40.00
247	3.00	-0.220	0.00	7.00	40.00
248	3.00	-0.220	0.00	7.00	40.00
249	3.00	-0.220	0.00	7.00	40.00
250	3.00	-0.220	0.00	7.00	40.00
251	3.00	-0.220	0.00	7.00	40.00
252	3.00	-0.220	0.00	7.00	40.00
253	3.00	-0.220	0.00	7.00	40.00
254	3.00	-0.220	0.00	7.00	40.00
255	3.00	-0.220	0.00	7.00	40.00
256	3.00	-0.220	0.00	7.00	40.00
257	3.00	-0.220	0.00	7.00	40.00
258	3.00	-0.220	0.00	7.00	40.00
259	3.00	-0.220	0.00	7.00	40.00
260	3.00	-0.220	0.00	7.00	40.00
261	3.00	-0.220	0.00	7.00	40.00
262	3.00	-0.220	0.00	7.00	40.00
263	3.00	-0.220	0.00	7.00	40.00
264	3.00	-0.220	0.00	7.00	40.00
265	3.00	-0.220	0.00	7.00	40.00
266	3.00	-0.220	0.00	7.00	40.00
267	3.00	-0.220	0.00	7.00	40.00
268	3.00	-0.220	0.00	7.00	40.00
269	3.00	-0.220	0.00	7.00	40.00
270	3.00	-0.220	0.00	7.00	40.00

## Node Data cont'd

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
271	3.00	-0.220	0.00	7.00	40.00
272	3.00	-0.220	0.00	7.00	40.00
273	3.00	-0.220	0.00	7.00	40.00
274	3.00	-0.220	0.00	7.00	40.00
275	3.00	-0.220	0.00	7.00	40.00
276	3.00	-0.220	0.00	7.00	40.00
277	3.00	-0.220	0.00	7.00	40.00
278	3.00	-0.220	0.00	7.00	40.00
279	3.00	-0.220	0.00	7.00	40.00
280	3.00	-0.220	0.00	7.00	40.00
281	3.00	-0.220	0.00	7.00	40.00
282	3.00	-0.220	0.00	7.00	40.00
283	3.00	-0.220	0.00	7.00	40.00
284	3.00	-0.220	0.00	7.00	40.00
285	3.00	-0.220	0.00	7.00	40.00
286	3.00	-0.220	0.00	7.00	40.00
287	3.00	-0.220	0.00	7.00	40.00
288	3.00	-0.220	0.00	7.00	40.00
289	3.00	-0.220	0.00	7.00	40.00
290	3.00	-0.220	0.00	7.00	40.00
291	3.00	-0.220	0.00	7.00	40.00
292	3.00	-0.220	0.00	7.00	40.00
293	3.00	-0.220	0.00	7.00	40.00
294	3.00	-0.220	0.00	7.00	40.00
295	3.00	-0.220	0.00	7.00	40.00
296	3.00	-0.220	0.00	7.00	40.00
297	3.00	-0.220	0.00	7.00	40.00
298	3.00	-0.220	0.00	7.00	40.00
299	3.00	-0.220	0.00	7.00	40.00
300	3.00	-0.220	0.00	7.00	40.00
301	3.00	-0.220	0.00	7.00	40.00
302	3.00	-0.220	0.00	7.00	40.00
303	3.00	-0.220	0.00	7.00	40.00
304	3.00	-0.220	0.00	7.00	40.00
305	3.00	-0.220	0.00	7.00	40.00
306	3.00	-0.220	0.00	7.00	40.00
307	3.00	-0.220	0.00	7.00	40.00
308	3.00	-0.220	0.00	7.00	40.00
309	3.00	-0.220	0.00	7.00	40.00
310	3.00	-0.220	0.00	7.00	40.00
311	3.00	-0.220	0.00	7.00	40.00
312	3.00	-0.220	0.00	7.00	40.00
313	3.00	-0.220	0.00	7.00	40.00
314	3.00	-0.220	0.00	7.00	40.00
315	3.00	-0.220	0.00	7.00	40.00

## Node Data cont'd

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
316	3.00	-0.220	0.00	7.00	40.00
317	3.00	-0.220	0.00	7.00	40.00

## Fixed Head Reservoir Data

Source Node	Head m	Ref Res? (R)
201	16.50	R

## Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length	Allow Press m	Pipe Material
100.0	140.00000	820.00	140.00	DI
150.0	140.00000	1185.00	140.00	DI
200.0	140.00000	1728.00	140.00	DI
250.0	140.00000	2328.00	140.00	DI
300.0	140.00000	3001.00	140.00	DI
350.0	140.00000	3784.00	140.00	DI
150.0	100.00000	1356.00	120.00	CI
200.0	100.00000	1979.00	120.00	CI
80.0	140.00000	247.00	40.00	AC
100.0	140.00000	301.00	40.00	AC

## Looped Water Distribution Network Design Output

BandWidth	=	19
Number of Loops	=	51
Newton Raphson Iterations	=	7



## Pipe Details

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
201	201	202	76.560	300.0	0.17	3.42	50.00	1.08
202	202	203	4.494	100.0	0.23	3.78	60.00	0.57
332	202	203	27.819	200.0	0.23	3.78	60.00	0.89
203	211	204	5.083	100.0	0.71	4.75	150.00	0.65
204	204	205	0.660	100.0	0.02	0.11	160.00	0.08
205	204	206	3.763	100.0	0.41	2.72	150.00	0.48
206	206	207	0.660	100.0	0.01	0.11	100.00	0.08
207	206	208	2.443	100.0	0.18	1.22	150.00	0.31
208	208	209	0.660	100.0	0.01	0.11	100.00	0.08
209	208	210	1.123	100.0	0.04	0.29	150.00	0.14
210	203	211	7.730	100.0	0.62	10.32	60.00	0.98
333	203	211	22.455	150.0	0.62	10.32	60.00	1.27
211	211	212	1.980	100.0	0.08	0.83	100.00	0.25
212	212	213	0.660	100.0	0.02	0.11	200.00	0.08
213	212	214	0.660	100.0	0.01	0.11	100.00	0.08
214	211	215	5.752	100.0	0.60	5.97	100.00	0.73
334	211	215	16.710	150.0	0.60	5.97	100.00	0.95
215	215	216	2.429	100.0	0.06	1.21	50.00	0.31
216	216	217	0.660	100.0	0.01	0.11	50.00	0.08
217	216	218	1.109	100.0	0.01	0.28	50.00	0.14
218	218	219	0.660	100.0	0.01	0.11	50.00	0.08
219	218	220	-0.211	100.0	-0.00	-0.01	50.00	-0.03
220	215	221	4.961	100.0	0.54	4.54	120.00	0.63
335	215	221	14.412	150.0	0.54	4.54	120.00	0.82
221	221	222	0.660	100.0	0.01	0.11	100.00	0.08
222	221	223	4.623	100.0	0.24	3.98	60.00	0.59
336	221	223	13.430	150.0	0.24	3.98	60.00	0.76
223	223	210	-0.463	100.0	-0.03	-0.06	600.00	-0.06
224	223	226	2.229	80.0	0.55	3.06	180.00	0.44
337	223	226	11.646	150.0	0.55	3.06	180.00	0.66
225	226	227	0.660	100.0	0.04	0.11	400.00	0.08
226	226	228	2.017	80.0	0.15	2.54	60.00	0.40
338	226	228	10.538	150.0	0.15	2.54	60.00	0.60
227	228	229	2.594	80.0	0.49	4.05	120.00	0.52
339	228	229	4.666	100.0	0.49	4.05	120.00	0.59
228	229	230	0.660	100.0	0.01	0.11	100.00	0.08
229	229	231	2.123	80.0	0.50	2.79	180.00	0.42
340	229	231	3.817	100.0	0.50	2.79	180.00	0.49
230	231	232	0.660	100.0	0.03	0.11	300.00	0.08
231	231	233	1.651	80.0	0.53	1.75	300.00	0.33
341	231	233	2.969	100.0	0.53	1.75	300.00	0.38
232	233	234	0.660	100.0	0.03	0.11	300.00	0.08
233	233	235	1.179	80.0	0.17	0.94	180.00	0.23
342	233	235	2.121	100.0	0.17	0.94	180.00	0.27
234	235	239	0.660	100.0	0.01	0.11	120.00	0.08

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m )	HL/1000m (m )	Length (m )	Velocity (m/s )
235	235	236	1.980	100.0	0.17	0.83	200.00	0.25
236	236	237	0.660	100.0	0.01	0.11	100.00	0.08
237	236	238	0.660	100.0	0.01	0.11	100.00	0.08
238	228	251	4.636	100.0	0.96	4.00	240.00	0.59
239	223	224	3.981	100.0	0.30	3.02	100.00	0.51
240	224	225	0.660	100.0	0.02	0.11	150.00	0.08
241	224	248	2.661	100.0	0.07	1.43	50.00	0.34
242	203	242	1.467	100.0	0.34	0.48	720.00	0.19
243	202	240	43.587	300.0	0.07	1.21	60.00	0.62
244	240	244	10.858	150.0	0.40	2.69	150.00	0.61
245	240	241	32.069	250.0	0.50	1.66	300.00	0.65
246	241	242	-0.147	100.0	-0.00	-0.01	120.00	-0.02
247	242	243	0.660	100.0	0.01	0.11	60.00	0.08
248	241	244	-0.737	80.0	-0.09	-0.39	240.00	-0.15
249	244	245	0.660	100.0	0.02	0.11	200.00	0.08
250	244	220	3.145	80.0	1.04	5.79	180.00	0.63
363	244	220	5.656	100.0	1.04	5.79	180.00	0.72
251	220	246	2.834	80.0	0.57	4.77	120.00	0.56
364	220	246	5.096	100.0	0.57	4.77	120.00	0.65
252	246	247	0.660	100.0	0.01	0.11	100.00	0.08
253	246	248	2.362	80.0	0.51	3.41	150.00	0.47
365	246	248	4.248	100.0	0.51	3.41	150.00	0.54
254	248	249	3.077	80.0	0.56	5.56	100.00	0.61
366	248	249	5.534	100.0	0.56	5.56	100.00	0.70
255	249	250	0.660	100.0	0.02	0.11	200.00	0.08
256	249	251	2.605	80.0	0.74	4.08	180.00	0.52
367	249	251	4.685	100.0	0.74	4.08	180.00	0.60
257	251	252	1.810	80.0	0.87	2.08	420.00	0.36
344	251	252	9.456	150.0	0.87	2.08	420.00	0.54
258	252	253	0.660	100.0	0.01	0.11	50.00	0.08
259	252	254	3.554	80.0	1.31	7.26	180.00	0.71
345	252	254	6.392	100.0	1.31	7.26	180.00	0.81
260	254	255	0.660	100.0	0.01	0.11	100.00	0.08
261	254	256	3.083	80.0	1.00	5.58	180.00	0.61
346	254	256	5.544	100.0	1.00	5.58	180.00	0.71
262	256	257	0.660	100.0	0.11	0.11	1000.00	0.08
263	256	258	2.611	80.0	0.74	4.10	180.00	0.52
347	256	258	4.696	100.0	0.74	4.10	180.00	0.60
264	258	259	0.660	100.0	0.11	0.11	1000.00	0.08
265	258	260	2.139	80.0	0.51	2.84	180.00	0.43
348	258	260	3.847	100.0	0.51	2.84	180.00	0.49
266	260	261	5.280	100.0	0.31	5.09	60.00	0.67
267	261	262	0.660	100.0	0.01	0.11	100.00	0.08
268	261	263	3.960	100.0	0.18	2.99	60.00	0.50
269	263	264	0.660	100.0	0.03	0.11	250.00	0.08

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m )	HL/1000m (m )	Length (m )	Velocity (m/s )
270	263	265	2.640	100.0	0.08	1.41	60.00	0.34
271	265	266	0.660	100.0	0.02	0.11	150.00	0.08
272	265	267	1.320	100.0	0.05	0.39	120.00	0.17
273	267	268	0.660	100.0	0.02	0.11	150.00	0.08
274	260	269	0.017	80.0	0.00	0.00	300.00	0.00
349	260	269	0.030	100.0	0.00	0.00	300.00	0.00
275	269	270	0.660	100.0	0.02	0.11	150.00	0.08
276	269	271	3.960	100.0	0.54	2.99	180.00	0.50
277	271	272	0.660	100.0	0.02	0.11	150.00	0.08
278	271	273	0.660	100.0	0.02	0.11	150.00	0.08
279	271	274	1.980	100.0	0.12	0.83	150.00	0.25
280	274	275	0.660	100.0	0.02	0.11	150.00	0.08
281	274	276	0.660	100.0	0.02	0.11	180.00	0.08
282	269	277	-1.870	80.0	-0.27	-2.21	120.00	-0.37
350	269	277	-3.363	100.0	-0.27	-2.21	120.00	-0.43
283	277	278	0.660	100.0	0.02	0.11	150.00	0.08
284	277	279	-2.342	80.0	-0.40	-3.35	120.00	-0.47
351	277	279	-4.211	100.0	-0.40	-3.35	120.00	-0.54
285	279	280	0.660	100.0	0.02	0.11	200.00	0.08
286	279	281	-2.814	80.0	-0.85	-4.71	180.00	-0.56
352	279	281	-5.060	100.0	-0.85	-4.71	180.00	-0.64
287	281	282	0.660	100.0	0.02	0.11	200.00	0.08
288	281	283	-3.285	80.0	-1.13	-6.27	180.00	-0.65
353	281	283	-5.908	100.0	-1.13	-6.27	180.00	-0.75
289	283	284	0.660	100.0	0.01	0.11	100.00	0.08
290	283	285	-1.689	80.0	-0.22	-1.83	120.00	-0.34
354	283	285	-8.824	150.0	-0.22	-1.83	120.00	-0.50
291	285	286	0.660	100.0	0.03	0.11	300.00	0.08
292	285	287	-1.901	80.0	-0.27	-2.28	120.00	-0.38
355	285	287	-9.932	150.0	-0.27	-2.28	120.00	-0.56
293	287	288	0.660	100.0	0.02	0.11	200.00	0.08
294	287	289	-2.113	80.0	-0.33	-2.77	120.00	-0.42
343	287	289	-11.040	150.0	-0.33	-2.77	120.00	-0.62
295	289	290	0.660	100.0	0.01	0.11	100.00	0.08
296	289	291	-2.325	80.0	-0.40	-3.31	120.00	-0.46
356	289	291	-12.148	150.0	-0.40	-3.31	120.00	-0.69
297	241	292	8.107	150.0	1.23	2.92	420.00	0.46
357	241	292	24.186	200.0	1.23	2.92	420.00	0.77
298	292	291	11.468	150.0	2.66	5.55	480.00	0.65
358	292	291	16.056	150.0	2.66	5.55	480.00	0.91
299	292	294	4.109	100.0	2.69	3.20	840.00	0.52
300	291	293	2.603	200.0	0.03	0.09	330.00	0.08
301	293	294	-0.326	200.0	-0.00	-0.00	270.00	-0.01
302	291	295	6.605	150.0	0.48	2.00	240.00	0.37
359	291	295	3.183	100.0	0.48	2.00	240.00	0.41



## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
303	295	296	1.980	80.0	0.29	2.46	120.00	0.39
304	296	297	0.660	100.0	0.01	0.11	60.00	0.08
305	296	298	0.660	100.0	0.01	0.11	120.00	0.08
306	295	299	2.978	150.0	0.15	0.46	330.00	0.17
360	295	299	4.170	150.0	0.15	0.46	330.00	0.24
307	299	300	0.660	100.0	0.02	0.11	200.00	0.08
308	299	301	3.933	150.0	0.05	0.76	60.00	0.22
361	299	301	1.895	100.0	0.05	0.76	60.00	0.24
309	301	316	1.962	150.0	0.09	0.21	450.00	0.11
362	301	316	0.946	100.0	0.09	0.21	450.00	0.12
310	301	302	2.260	150.0	0.03	0.27	120.00	0.13
311	302	303	0.660	100.0	0.01	0.11	100.00	0.08
312	302	304	0.940	150.0	0.01	0.05	180.00	0.05
313	304	305	0.951	150.0	0.01	0.06	120.00	0.05
314	305	306	-0.939	100.0	-0.06	-0.21	270.00	-0.12
315	304	306	-0.670	80.0	-0.05	-0.33	150.00	-0.13
316	306	293	-2.269	100.0	-0.64	-1.07	600.00	-0.29
317	305	307	1.229	150.0	0.01	0.09	60.00	0.07
318	307	308	-0.641	150.0	-0.01	-0.03	300.00	-0.04
319	294	308	3.123	100.0	0.69	1.93	360.00	0.40
320	308	309	1.822	100.0	0.17	0.71	240.00	0.23
321	307	310	1.211	80.0	0.18	0.99	180.00	0.24
322	310	309	-0.203	80.0	-0.02	-0.04	420.00	-0.04
323	310	311	0.754	80.0	0.05	0.41	120.00	0.15
324	311	312	-0.074	80.0	-0.00	-0.01	360.00	-0.01
325	311	313	0.168	100.0	0.00	0.01	150.00	0.02
326	312	313	0.193	80.0	0.00	0.03	100.00	0.04
327	313	314	-0.299	80.0	-0.04	-0.07	540.00	-0.06
328	309	314	0.959	100.0	0.03	0.22	120.00	0.12
329	315	317	0.660	200.0	0.00	0.01	280.00	0.02
330	312	315	-0.927	80.0	-0.14	-0.60	240.00	-0.18
331	315	316	-2.247	200.0	-0.04	-0.07	600.00	-0.07

Note: Negative value indicates the flow in reverse direction in that Pipe



## Pipe Pressure Details

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
201	201	202	300.0	140.00000	DI	16.50	140.00	
202	202	203	100.0	140.00000	AC	16.33	40.00	E
332	202	203	200.0	140.00000	DI	16.33	140.00	
203	211	204	100.0	140.00000	DI	15.48	140.00	
204	204	205	100.0	140.00000	DI	14.77	140.00	
205	204	206	100.0	140.00000	DI	14.77	140.00	
206	206	207	100.0	140.00000	DI	14.36	140.00	
207	206	208	100.0	140.00000	DI	14.36	140.00	
208	208	209	100.0	140.00000	DI	14.18	140.00	
209	208	210	100.0	140.00000	DI	14.18	140.00	
210	203	211	100.0	140.00000	AC	16.10	40.00	E
333	203	211	150.0	140.00000	DI	16.10	140.00	
211	211	212	100.0	140.00000	DI	15.48	140.00	
212	212	213	100.0	140.00000	DI	15.40	140.00	
213	212	214	100.0	140.00000	DI	15.40	140.00	
214	211	215	100.0	140.00000	AC	15.48	40.00	E
334	211	215	150.0	140.00000	DI	15.48	140.00	
215	215	216	100.0	140.00000	DI	14.89	140.00	
216	216	217	100.0	140.00000	DI	14.83	140.00	
217	216	218	100.0	140.00000	DI	14.83	140.00	
218	218	219	100.0	140.00000	DI	14.81	140.00	
219	218	220	100.0	140.00000	DI	14.81	140.00	
220	215	221	100.0	140.00000	AC	14.89	40.00	E
335	215	221	150.0	140.00000	DI	14.89	140.00	
221	221	222	100.0	140.00000	DI	14.34	140.00	
222	221	223	100.0	140.00000	AC	14.34	40.00	E
336	221	223	150.0	140.00000	DI	14.34	140.00	
223	223	210	100.0	140.00000	AC	14.14	40.00	E
224	223	226	80.0	140.00000	AC	14.10	40.00	E
337	223	226	150.0	140.00000	DI	14.10	140.00	
225	226	227	100.0	140.00000	DI	13.55	140.00	
226	226	228	80.0	140.00000	AC	13.55	40.00	E
338	226	228	150.0	140.00000	DI	13.55	140.00	
227	228	229	80.0	140.00000	AC	13.40	40.00	E
339	228	229	100.0	140.00000	DI	13.40	140.00	
228	229	230	100.0	140.00000	DI	12.91	140.00	
229	229	231	80.0	140.00000	AC	12.91	40.00	E
340	229	231	100.0	140.00000	DI	12.91	140.00	
230	231	232	100.0	140.00000	DI	12.41	140.00	
231	231	233	80.0	140.00000	AC	12.41	40.00	E
341	231	233	100.0	140.00000	DI	12.41	140.00	
232	233	234	100.0	140.00000	DI	11.88	140.00	
233	233	235	80.0	140.00000	AC	11.88	40.00	E
342	233	235	100.0	140.00000	DI	11.88	140.00	
234	235	239	100.0	140.00000	DI	11.71	140.00	

## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
235	235	236	100.0	140.00000	DI	11.71	140.00	
236	236	237	100.0	140.00000	DI	11.55	140.00	
237	236	238	100.0	140.00000	DI	11.55	140.00	
238	228	251	100.0	140.00000	DI	13.40	140.00	
239	223	224	100.0	140.00000	DI	14.10	140.00	
240	224	225	100.0	140.00000	DI	13.80	140.00	
241	224	248	100.0	140.00000	DI	13.80	140.00	
242	203	242	100.0	140.00000	DI	16.10	140.00	
243	202	240	300.0	140.00000	DI	16.33	140.00	
244	240	244	150.0	140.00000	DI	16.26	140.00	
245	240	241	250.0	140.00000	DI	16.26	140.00	
246	241	242	100.0	140.00000	DI	15.76	140.00	
247	242	243	100.0	140.00000	DI	15.76	140.00	
248	241	244	80.0	140.00000	AC	15.85	40.00	E
249	244	245	100.0	140.00000	DI	15.85	140.00	
250	244	220	80.0	140.00000	AC	15.85	40.00	E
363	244	220	100.0	140.00000	DI	15.85	140.00	
251	220	246	80.0	140.00000	AC	14.81	40.00	E
364	220	246	100.0	140.00000	DI	14.81	140.00	
252	246	247	100.0	140.00000	DI	14.24	140.00	
253	246	248	80.0	140.00000	AC	14.24	40.00	E
365	246	248	100.0	140.00000	DI	14.24	140.00	
254	248	249	80.0	140.00000	AC	13.73	40.00	E
366	248	249	100.0	140.00000	DI	13.73	140.00	
255	249	250	100.0	140.00000	DI	13.17	140.00	
256	249	251	80.0	140.00000	AC	13.17	40.00	E
367	249	251	100.0	140.00000	DI	13.17	140.00	
257	251	252	80.0	140.00000	AC	12.44	40.00	E
344	251	252	150.0	140.00000	DI	12.44	140.00	
258	252	253	100.0	140.00000	DI	11.56	140.00	
259	252	254	80.0	140.00000	AC	11.56	40.00	E
345	252	254	100.0	140.00000	DI	11.56	140.00	
260	254	255	100.0	140.00000	DI	10.26	140.00	
261	254	256	80.0	140.00000	AC	10.26	40.00	E
346	254	256	100.0	140.00000	DI	10.26	140.00	
262	256	257	100.0	140.00000	DI	9.25	140.00	
263	256	258	80.0	140.00000	AC	9.25	40.00	E
347	256	258	100.0	140.00000	DI	9.25	140.00	
264	258	259	100.0	140.00000	DI	8.52	140.00	
265	258	260	80.0	140.00000	AC	8.52	40.00	E
348	258	260	100.0	140.00000	DI	8.52	140.00	
266	260	261	100.0	140.00000	DI	8.00	140.00	
267	261	262	100.0	140.00000	DI	7.70	140.00	
268	261	263	100.0	140.00000	DI	7.70	140.00	
269	263	264	100.0	140.00000	DI	7.52	140.00	

## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
270	263	265	100.0	140.00000	DI	7.52	140.00	
271	265	266	100.0	140.00000	DI	7.44	140.00	
272	265	267	100.0	140.00000	DI	7.44	140.00	
273	267	268	100.0	140.00000	DI	7.39	140.00	
274	260	269	80.0	140.00000	AC	8.00	40.00	E
349	260	269	100.0	140.00000	DI	8.00	140.00	
275	269	270	100.0	140.00000	DI	8.00	140.00	
276	269	271	100.0	140.00000	DI	8.00	140.00	
277	271	272	100.0	140.00000	DI	7.47	140.00	
278	271	273	100.0	140.00000	DI	7.47	140.00	
279	271	274	100.0	140.00000	DI	7.47	140.00	
280	274	275	100.0	140.00000	DI	7.34	140.00	
281	274	276	100.0	140.00000	DI	7.34	140.00	
282	269	277	80.0	140.00000	AC	8.27	40.00	E
350	269	277	100.0	140.00000	DI	8.27	140.00	
283	277	278	100.0	140.00000	DI	8.27	140.00	
284	277	279	80.0	140.00000	AC	8.67	40.00	E
351	277	279	100.0	140.00000	DI	8.67	140.00	
285	279	280	100.0	140.00000	DI	8.67	140.00	
286	279	281	80.0	140.00000	AC	9.52	40.00	E
352	279	281	100.0	140.00000	DI	9.52	140.00	
287	281	282	100.0	140.00000	DI	9.52	140.00	
288	281	283	80.0	140.00000	AC	10.65	40.00	E
353	281	283	100.0	140.00000	DI	10.65	140.00	
289	283	284	100.0	140.00000	DI	10.65	140.00	
290	283	285	80.0	140.00000	AC	10.87	40.00	E
354	283	285	150.0	140.00000	DI	10.87	140.00	
291	285	286	100.0	140.00000	DI	10.87	140.00	
292	285	287	80.0	140.00000	AC	11.14	40.00	E
355	285	287	150.0	140.00000	DI	11.14	140.00	
293	287	288	100.0	140.00000	DI	11.14	140.00	
294	287	289	80.0	140.00000	AC	11.47	40.00	E
343	287	289	150.0	140.00000	DI	11.47	140.00	
295	289	290	100.0	140.00000	DI	11.47	140.00	
296	289	291	80.0	140.00000	AC	11.87	40.00	E
356	289	291	150.0	140.00000	DI	11.87	140.00	
297	241	292	150.0	100.00000	CI	15.76	120.00	E
357	241	292	200.0	140.00000	DI	15.76	140.00	
298	292	291	150.0	100.00000	CI	14.53	120.00	E
358	292	291	150.0	140.00000	DI	14.53	140.00	
299	292	294	100.0	140.00000	AC	14.53	40.00	E
300	291	293	200.0	100.00000	CI	11.87	120.00	E
301	293	294	200.0	100.00000	CI	11.84	120.00	E
302	291	295	150.0	100.00000	CI	11.87	120.00	E
359	291	295	100.0	140.00000	DI	11.87	140.00	



## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
303	295	296	80.0	140.00000	AC	11.39	40.00	E
304	296	297	100.0	140.00000	DI	11.10	140.00	
305	296	298	100.0	140.00000	DI	11.10	140.00	
306	295	299	150.0	100.00000	CI	11.39	120.00	E
360	295	299	150.0	140.00000	DI	11.39	140.00	
307	299	300	100.0	140.00000	DI	11.24	140.00	
308	299	301	150.0	100.00000	CI	11.24	120.00	E
361	299	301	100.0	140.00000	DI	11.24	140.00	
309	301	316	150.0	100.00000	CI	11.20	120.00	E
362	301	316	100.0	140.00000	DI	11.20	140.00	
310	301	302	150.0	100.00000	CI	11.20	120.00	E
311	302	303	100.0	140.00000	DI	11.16	140.00	
312	302	304	150.0	100.00000	CI	11.16	120.00	E
313	304	305	150.0	100.00000	CI	11.15	120.00	E
314	305	306	100.0	140.00000	DI	11.20	140.00	
315	304	306	80.0	140.00000	AC	11.20	40.00	E
316	306	293	100.0	140.00000	DI	11.84	140.00	
317	305	307	150.0	100.00000	CI	11.15	120.00	E
318	307	308	150.0	100.00000	CI	11.15	120.00	E
319	294	308	100.0	140.00000	DI	11.84	140.00	
320	308	309	100.0	140.00000	DI	11.15	140.00	
321	307	310	80.0	140.00000	AC	11.14	40.00	E
322	310	309	80.0	140.00000	AC	10.98	40.00	E
323	310	311	80.0	140.00000	AC	10.96	40.00	E
324	311	312	80.0	140.00000	AC	10.92	40.00	E
325	311	313	100.0	140.00000	DI	10.91	140.00	
326	312	313	80.0	140.00000	AC	10.92	40.00	E
327	313	314	80.0	140.00000	AC	10.95	40.00	E
328	309	314	100.0	140.00000	DI	10.98	140.00	
329	315	317	200.0	100.00000	CI	11.06	120.00	E
330	312	315	80.0	140.00000	AC	11.06	40.00	E
331	315	316	200.0	100.00000	CI	11.10	120.00	E

## Node Details

Node No.	Flow (lps)	Elev. (m )	H G L (m )	Pressure (m )
201 S	76.560	0.00	16.50	16.50
202	-0.660	0.00	16.33	16.33
203	-0.660	0.00	16.10	16.10



## Node Details cont'd

Node No.	Flow (lps)	Elev. (m)	H G L (m)	Pressure (m)
204	-0.660	0.00	14.77	14.77
205	-0.660	0.00	14.75	14.75
206	-0.660	0.00	14.36	14.36
207	-0.660	0.00	14.35	14.35
208	-0.660	0.00	14.18	14.18
209	-0.660	0.00	14.17	14.17
210	-0.660	0.00	14.14	14.14
211	-0.660	0.00	15.48	15.48
212	-0.660	0.00	15.40	15.40
213	-0.660	0.00	15.38	15.38
214	-0.660	0.00	15.39	15.39
215	-0.660	0.00	14.89	14.89
216	-0.660	0.00	14.83	14.83
217	-0.660	0.00	14.82	14.82
218	-0.660	0.00	14.81	14.81
219	-0.660	0.00	14.81	14.81
220	-0.660	0.00	14.81	14.81
221	-0.660	0.00	14.34	14.34
222	-0.660	0.00	14.33	14.33
223	-0.660	0.00	14.10	14.10
224	-0.660	0.00	13.80	13.80
225	-0.660	0.00	13.78	13.78
226	-0.660	0.00	13.55	13.55
227	-0.660	0.00	13.51	13.51
228	-0.660	0.00	13.40	13.40
229	-0.660	0.00	12.91	12.91
230	-0.660	0.00	12.90	12.90
231	-0.660	0.00	12.41	12.41
232	-0.660	0.00	12.38	12.38
233	-0.660	0.00	11.88	11.88
234	-0.660	0.00	11.85	11.85
235	-0.660	0.00	11.71	11.71
236	-0.660	0.00	11.55	11.55
237	-0.660	0.00	11.54	11.54
238	-0.660	0.00	11.54	11.54
239	-0.660	0.00	11.70	11.70
240	-0.660	0.00	16.26	16.26
241	-0.660	0.00	15.76	15.76
242	-0.660	0.00	15.76	15.76
243	-0.660	0.00	15.75	15.75
244	-0.660	0.00	15.85	15.85
245	-0.660	0.00	15.83	15.83
246	-0.660	0.00	14.24	14.24
247	-0.660	0.00	14.23	14.23
248	-0.660	0.00	13.73	13.73

## Node Details cont'd

Node No.	Flow (lps)	Elev. (m )	H G L (m )	Pressure (m )
249	-0.660	0.00	13.17	13.17
250	-0.660	0.00	13.15	13.15
251	-0.660	0.00	12.44	12.44
252	-0.660	0.00	11.56	11.56
253	-0.660	0.00	11.56	11.56
254	-0.660	0.00	10.26	10.26
255	-0.660	0.00	10.25	10.25
256	-0.660	0.00	9.25	9.25
257	-0.660	0.00	9.14	9.14
258	-0.660	0.00	8.52	8.52
259	-0.660	0.00	8.41	8.41
260	-0.660	0.00	8.00	8.00
261	-0.660	0.00	7.70	7.70
262	-0.660	0.00	7.69	7.69
263	-0.660	0.00	7.52	7.52
264	-0.660	0.00	7.49	7.49
265	-0.660	0.00	7.44	7.44
266	-0.660	0.00	7.42	7.42
267	-0.660	0.00	7.39	7.39
268	-0.660	0.00	7.37	7.37
269	-0.660	0.00	8.00	8.00
270	-0.660	0.00	7.99	7.99
271	-0.660	0.00	7.47	7.47
272	-0.660	0.00	7.45	7.45
273	-0.660	0.00	7.45	7.45
274	-0.660	0.00	7.34	7.34
275	-0.660	0.00	7.33	7.33
276	-0.660	0.00	7.32	7.32
277	-0.660	0.00	8.27	8.27
278	-0.660	0.00	8.25	8.25
279	-0.660	0.00	8.67	8.67
280	-0.660	0.00	8.65	8.65
281	-0.660	0.00	9.52	9.52
282	-0.660	0.00	9.50	9.50
283	-0.660	0.00	10.65	10.65
284	-0.660	0.00	10.64	10.64
285	-0.660	0.00	10.87	10.87
286	-0.660	0.00	10.84	10.84
287	-0.660	0.00	11.14	11.14
288	-0.660	0.00	11.12	11.12
289	-0.660	0.00	11.47	11.47
290	-0.660	0.00	11.46	11.46
291	-0.660	0.00	11.87	11.87
292	-0.660	0.00	14.53	14.53
293	-0.660	0.00	11.84	11.84

## Node Details cont'd

Node No.	Flow (lps)	Elev. (m)	H G L (m)	Pressure (m)
294	-0.660	0.00	11.84	11.84
295	-0.660	0.00	11.39	11.39
296	-0.660	0.00	11.10	11.10
297	-0.660	0.00	11.09	11.09
298	-0.660	0.00	11.08	11.08
299	-0.660	0.00	11.24	11.24
300	-0.660	0.00	11.22	11.22
301	-0.660	0.00	11.20	11.20
302	-0.660	0.00	11.16	11.16
303	-0.660	0.00	11.15	11.15
304	-0.660	0.00	11.15	11.15
305	-0.660	0.00	11.15	11.15
306	-0.660	0.00	11.20	11.20
307	-0.660	0.00	11.14	11.14
308	-0.660	0.00	11.15	11.15
309	-0.660	0.00	10.98	10.98
310	-0.660	0.00	10.96	10.96
311	-0.660	0.00	10.91	10.91
312	-0.660	0.00	10.92	10.92
313	-0.660	0.00	10.91	10.91
314	-0.660	0.00	10.95	10.95
315	-0.660	0.00	11.06	11.06
316	-0.660	0.00	11.10	11.10
317	-0.660	0.00	11.06	11.06

## Pipe Cost Summary

Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
100.0	DI	16830.00	13800.60	13800.60
150.0	DI	2440.00	2891.40	16692.00
200.0	DI	480.00	829.44	17521.44
250.0	DI	300.00	698.40	18219.84
300.0	DI	110.00	330.11	18549.95

## Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
201	300.0	DI	50.00	150.05	150.05
332	200.0	DI	60.00	103.68	253.73
203	100.0	DI	150.00	123.00	376.73
204	100.0	DI	160.00	131.20	507.93
205	100.0	DI	150.00	123.00	630.93
206	100.0	DI	100.00	82.00	712.93
207	100.0	DI	150.00	123.00	835.93
208	100.0	DI	100.00	82.00	917.93
209	100.0	DI	150.00	123.00	1040.93
333	150.0	DI	60.00	71.10	1112.03
211	100.0	DI	100.00	82.00	1194.03
212	100.0	DI	200.00	164.00	1358.03
213	100.0	DI	100.00	82.00	1440.03
334	150.0	DI	100.00	118.50	1558.53
215	100.0	DI	50.00	41.00	1599.53
216	100.0	DI	50.00	41.00	1640.53
217	100.0	DI	50.00	41.00	1681.53
218	100.0	DI	50.00	41.00	1722.53
219	100.0	DI	50.00	41.00	1763.53
335	150.0	DI	120.00	142.20	1905.73
221	100.0	DI	100.00	82.00	1987.73
336	150.0	DI	60.00	71.10	2058.83
337	150.0	DI	180.00	213.30	2272.13
225	100.0	DI	400.00	328.00	2600.13
338	150.0	DI	60.00	71.10	2671.23
339	100.0	DI	120.00	98.40	2769.63
228	100.0	DI	100.00	82.00	2851.63
340	100.0	DI	180.00	147.60	2999.23
230	100.0	DI	300.00	246.00	3245.23
341	100.0	DI	300.00	246.00	3491.23
232	100.0	DI	300.00	246.00	3737.23
342	100.0	DI	180.00	147.60	3884.83
234	100.0	DI	120.00	98.40	3983.23
235	100.0	DI	200.00	164.00	4147.23
236	100.0	DI	100.00	82.00	4229.23
237	100.0	DI	100.00	82.00	4311.23
238	100.0	DI	240.00	196.80	4508.03
239	100.0	DI	100.00	82.00	4590.03
240	100.0	DI	150.00	123.00	4713.03
241	100.0	DI	50.00	41.00	4754.03
242	100.0	DI	720.00	590.40	5344.43
243	300.0	DI	60.00	180.06	5524.49
244	150.0	DI	150.00	177.75	5702.24
245	250.0	DI	300.00	698.40	6400.64
246	100.0	DI	120.00	98.40	6499.04



## Pipe-wise Cost Summary cont'd

Pipe No	Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
247	100.0	DI	60.00	49.20	6548.24
249	100.0	DI	200.00	164.00	6712.24
363	100.0	DI	180.00	147.60	6859.84
364	100.0	DI	120.00	98.40	6958.24
252	100.0	DI	100.00	82.00	7040.24
365	100.0	DI	150.00	123.00	7163.24
366	100.0	DI	100.00	82.00	7245.24
255	100.0	DI	200.00	164.00	7409.24
367	100.0	DI	180.00	147.60	7556.84
344	150.0	DI	420.00	497.70	8054.54
258	100.0	DI	50.00	41.00	8095.54
345	100.0	DI	180.00	147.60	8243.14
260	100.0	DI	100.00	82.00	8325.14
346	100.0	DI	180.00	147.60	8472.74
262	100.0	DI	1000.00	820.00	9292.74
347	100.0	DI	180.00	147.60	9440.34
264	100.0	DI	1000.00	820.00	10260.34
348	100.0	DI	180.00	147.60	10407.94
266	100.0	DI	60.00	49.20	10457.14
267	100.0	DI	100.00	82.00	10539.14
268	100.0	DI	60.00	49.20	10588.34
269	100.0	DI	250.00	205.00	10793.34
270	100.0	DI	60.00	49.20	10842.54
271	100.0	DI	150.00	123.00	10965.54
272	100.0	DI	120.00	98.40	11063.94
273	100.0	DI	150.00	123.00	11186.94
349	100.0	DI	300.00	246.00	11432.94
275	100.0	DI	150.00	123.00	11555.94
276	100.0	DI	180.00	147.60	11703.54
277	100.0	DI	150.00	123.00	11826.54
278	100.0	DI	150.00	123.00	11949.54
279	100.0	DI	150.00	123.00	12072.54
280	100.0	DI	150.00	123.00	12195.54
281	100.0	DI	180.00	147.60	12343.14
350	100.0	DI	120.00	98.40	12441.54
283	100.0	DI	150.00	123.00	12564.54
351	100.0	DI	120.00	98.40	12662.94
285	100.0	DI	200.00	164.00	12826.94
352	100.0	DI	180.00	147.60	12974.54
287	100.0	DI	200.00	164.00	13138.54
353	100.0	DI	180.00	147.60	13286.14
289	100.0	DI	100.00	82.00	13368.14
354	150.0	DI	120.00	142.20	13510.34
291	100.0	DI	300.00	246.00	13756.34
355	150.0	DI	120.00	142.20	13898.54

## Pipe-wise Cost Summary cont'd

Pipe No	Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
293	100.0	DI	200.00	164.00	14062.54
343	150.0	DI	120.00	142.20	14204.74
295	100.0	DI	100.00	82.00	14286.74
356	150.0	DI	120.00	142.20	14428.94
357	200.0	DI	420.00	725.76	15154.70
358	150.0	DI	480.00	568.80	15723.50
359	100.0	DI	240.00	196.80	15920.30
304	100.0	DI	60.00	49.20	15969.50
305	100.0	DI	120.00	98.40	16067.90
360	150.0	DI	330.00	391.05	16458.95
307	100.0	DI	200.00	164.00	16622.95
361	100.0	DI	60.00	49.20	16672.15
362	100.0	DI	450.00	369.00	17041.15
311	100.0	DI	100.00	82.00	17123.15
314	100.0	DI	270.00	221.40	17344.55
316	100.0	DI	600.00	492.00	17836.55
319	100.0	DI	360.00	295.20	18131.75
320	100.0	DI	240.00	196.80	18328.55
325	100.0	DI	150.00	123.00	18451.55
328	100.0	DI	120.00	98.40	18549.95

L O O P

Version 4.0

Looped Water Distribution Network Design Program

LOOP: Looped Water Distribution Design Program - (C) The World Bank

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## Echoing Input Variables

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Title of the Project           : ARAMBAGH W/S SCHEME ZONE III
Name of the User              : C SEC
Number of Pipes               : 106
Number of Nodes               : 79
Type of Pipe Materials Used   : DI/CI/AC/
Number of Commercial Dia per Material : 6/3/1/
Peak Design Factor            : 3
Newton-Raphson Stopping Criterion lps : .001
Minimum Pressure              m : 7
Maximum Pressure              m : 40
Design Hydraulic Gradient m in km : 10
Simulate or Design?          (S/D) : S
No. of Res. Nodes with Fixed HGL : 1
No. of Res. Nodes with Variable HGL : 0
No. of Booster Pumps         : 0
No. of Pressure Reducing Valves : 0
No. of Check Valves          : 0
Type of Formula               : Hazen's

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## Pipe Data

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material (E/P)	Status
301	301	302	60.00	300.0	100.00000	DI	
302	302	303	300.00	150.0	100.00000	CI	E
399	302	303	300.00	150.0	100.00000	DI	
303	303	304	300.00	100.0	100.00000	DI	
304	303	305	120.00	150.0	100.00000	CI	E
400	303	305	120.00	150.0	100.00000	DI	
305	305	306	200.00	100.0	100.00000	DI	
306	305	307	300.00	150.0	100.00000	CI	E
401	305	307	300.00	150.0	100.00000	DI	
307	307	308	300.00	100.0	100.00000	DI	
308	307	309	100.00	150.0	100.00000	CI	E
402	307	309	100.00	150.0	100.00000	DI	
309	309	310	180.00	150.0	100.00000	CI	E
310	310	311	400.00	100.0	100.00000	DI	
311	310	312	120.00	150.0	100.00000	CI	E
312	312	313	800.00	150.0	100.00000	CI	E
313	309	314	120.00	100.0	100.00000	CI	E
403	309	314	120.00	100.0	100.00000	DI	
314	314	315	200.00	100.0	100.00000	DI	
315	314	316	100.00	100.0	100.00000	CI	E
404	314	316	100.00	100.0	100.00000	DI	
316	316	317	400.00	100.0	100.00000	DI	



## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
317	316	318	200.00	100.0	100.00000	CI	E
405	316	318	200.00	100.0	100.00000	DI	
318	318	319	400.00	100.0	100.00000	DI	
319	318	320	300.00	100.0	100.00000	CI	E
406	318	320	300.00	100.0	100.00000	DI	
320	320	321	400.00	100.0	100.00000	DI	
321	320	322	150.00	100.0	100.00000	CI	E
407	320	322	150.00	100.0	100.00000	DI	
322	322	323	300.00	100.0	100.00000	DI	
323	322	324	120.00	100.0	100.00000	CI	E
408	322	324	120.00	100.0	100.00000	DI	
324	324	325	300.00	100.0	100.00000	DI	
325	324	326	200.00	100.0	100.00000	CI	E
409	324	326	200.00	100.0	100.00000	DI	
326	326	327	150.00	100.0	100.00000	CI	E
327	327	328	200.00	100.0	100.00000	DI	
328	327	329	100.00	100.0	100.00000	CI	E
329	326	330	1000.00	100.0	100.00000	DI	
330	366	312	1100.00	100.0	100.00000	DI	
331	302	366	300.00	150.0	100.00000	DI	
332	331	332	200.00	100.0	100.00000	DI	
333	331	333	120.00	150.0	100.00000	DI	
334	333	334	150.00	150.0	100.00000	DI	
335	333	334	300.00	100.0	100.00000	DI	
336	334	364	120.00	100.0	100.00000	DI	
337	335	336	400.00	100.0	100.00000	DI	
338	335	337	100.00	100.0	100.00000	DI	
339	337	338	300.00	100.0	100.00000	DI	
340	337	372	420.00	100.0	100.00000	DI	
341	302	340	60.00	150.0	100.00000	CI	E
410	302	340	60.00	200.0	100.00000	DI	
342	340	341	500.00	100.0	100.00000	DI	
343	340	342	120.00	150.0	100.00000	CI	E
411	340	342	120.00	200.0	100.00000	DI	
344	342	343	500.00	100.0	100.00000	DI	
345	342	378	800.00	150.0	100.00000	CI	E
412	342	378	800.00	200.0	100.00000	DI	
346	344	345	120.00	100.0	100.00000	DI	
347	345	379	300.00	100.0	100.00000	DI	
348	345	347	300.00	100.0	100.00000	DI	
349	344	360	420.00	150.0	100.00000	CI	E
413	344	360	420.00	100.0	100.00000	DI	
350	360	361	500.00	100.0	100.00000	DI	
351	360	362	120.00	200.0	100.00000	CI	E
352	362	363	1000.00	100.0	100.00000	DI	

## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
353	362	347	200.00	200.0	100.00000	CI	E
354	347	374	200.00	200.0	100.00000	CI	E
355	348	349	850.00	100.0	100.00000	DI	
356	349	350	120.00	200.0	100.00000	CI	E
357	350	351	600.00	100.0	100.00000	DI	
358	350	375	200.00	200.0	100.00000	CI	E
359	349	377	450.00	200.0	100.00000	CI	E
360	348	354	1000.00	100.0	100.00000	DI	
361	354	355	1500.00	100.0	100.00000	CI	E
362	354	353	300.00	100.0	100.00000	DI	
363	353	356	420.00	80.0	140.00000	AC	E
414	353	356	420.00	100.0	100.00000	DI	
364	356	357	500.00	100.0	100.00000	DI	
365	356	358	420.00	100.0	100.00000	DI	
366	358	359	1500.00	100.0	100.00000	DI	
369	364	365	150.00	100.0	100.00000	DI	
372	368	367	150.00	100.0	100.00000	DI	
373	369	368	120.00	100.0	100.00000	DI	
374	364	335	300.00	150.0	100.00000	DI	
376	372	339	850.00	100.0	100.00000	DI	
378	375	352	300.00	100.0	100.00000	DI	
379	378	369	550.00	100.0	100.00000	DI	
380	379	369	250.00	100.0	100.00000	DI	
381	379	346	120.00	100.0	100.00000	DI	
382	347	346	420.00	100.0	100.00000	DI	
383	346	370	300.00	100.0	100.00000	DI	
384	368	370	120.00	100.0	100.00000	DI	
385	368	371	120.00	100.0	100.00000	DI	
386	370	371	120.00	100.0	100.00000	DI	
387	371	373	200.00	100.0	100.00000	DI	
389	373	374	550.00	80.0	140.00000	AC	E
392	378	344	300.00	150.0	100.00000	CI	E
415	378	344	300.00	150.0	100.00000	DI	
393	374	348	250.00	200.0	100.00000	CI	E
394	348	376	420.00	200.0	100.00000	CI	E
395	376	377	120.00	200.0	100.00000	CI	E
396	377	353	270.00	80.0	140.00000	AC	E
397	376	354	420.00	100.0	100.00000	CI	E
398	366	331	120.00	150.0	100.00000	DI	

## Node Data

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
301	3.00	0.000	0.00	7.00	40.00
302	3.00	-0.233	0.00	7.00	40.00
303	3.00	-0.233	0.00	7.00	40.00
304	3.00	-0.233	0.00	7.00	40.00
305	3.00	-0.233	0.00	7.00	40.00
306	3.00	-0.233	0.00	7.00	40.00
307	3.00	-0.233	0.00	7.00	40.00
308	3.00	-0.233	0.00	7.00	40.00
309	3.00	-0.233	0.00	7.00	40.00
310	3.00	-0.233	0.00	7.00	40.00
311	3.00	-0.233	0.00	7.00	40.00
312	3.00	-0.233	0.00	7.00	40.00
313	3.00	-0.233	0.00	7.00	40.00
314	3.00	-0.233	0.00	7.00	40.00
315	3.00	-0.233	0.00	7.00	40.00
316	3.00	-0.233	0.00	7.00	40.00
317	3.00	-0.233	0.00	7.00	40.00
318	3.00	-0.233	0.00	7.00	40.00
319	3.00	-0.233	0.00	7.00	40.00
320	3.00	-0.233	0.00	7.00	40.00
321	3.00	-0.233	0.00	7.00	40.00
322	3.00	-0.233	0.00	7.00	40.00
323	3.00	-0.233	0.00	7.00	40.00
324	3.00	-0.233	0.00	7.00	40.00
325	3.00	-0.233	0.00	7.00	40.00
326	3.00	-0.233	0.00	7.00	40.00
327	3.00	-0.233	0.00	7.00	40.00
328	3.00	-0.233	0.00	7.00	40.00
329	3.00	-0.233	0.00	7.00	40.00
330	3.00	-0.233	0.00	7.00	40.00
331	3.00	-0.233	0.00	7.00	40.00
332	3.00	-0.233	0.00	7.00	40.00
333	3.00	-0.233	0.00	7.00	40.00
334	3.00	-0.233	0.00	7.00	40.00
335	3.00	-0.233	0.00	7.00	40.00
336	3.00	-0.233	0.00	7.00	40.00
337	3.00	-0.233	0.00	7.00	40.00
338	3.00	-0.233	0.00	7.00	40.00
339	3.00	-0.233	0.00	7.00	40.00
340	3.00	-0.233	0.00	7.00	40.00
341	3.00	-0.233	0.00	7.00	40.00
342	3.00	-0.233	0.00	7.00	40.00
343	3.00	-0.233	0.00	7.00	40.00
344	3.00	-0.233	0.00	7.00	40.00
345	3.00	-0.233	0.00	7.00	40.00

## Node Data cont'd

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
346	3.00	-0.233	0.00	7.00	40.00
347	3.00	-0.233	0.00	7.00	40.00
348	3.00	-0.233	0.00	7.00	40.00
349	3.00	-0.233	0.00	7.00	40.00
350	3.00	-0.233	0.00	7.00	40.00
351	3.00	-0.233	0.00	7.00	40.00
352	3.00	-0.233	0.00	7.00	40.00
353	3.00	-0.233	0.00	7.00	40.00
354	3.00	-0.233	0.00	7.00	40.00
355	3.00	-0.233	0.00	7.00	40.00
356	3.00	-0.233	0.00	7.00	40.00
357	3.00	-0.233	0.00	7.00	40.00
358	3.00	-0.233	0.00	7.00	40.00
359	3.00	-0.233	0.00	7.00	40.00
360	3.00	-0.233	0.00	7.00	40.00
361	3.00	-0.233	0.00	7.00	40.00
362	3.00	-0.233	0.00	7.00	40.00
363	3.00	-0.233	0.00	7.00	40.00
364	3.00	-0.233	0.00	7.00	40.00
365	3.00	-0.233	0.00	7.00	40.00
366	3.00	-0.233	0.00	7.00	40.00
367	3.00	-0.233	0.00	7.00	40.00
368	3.00	-0.233	0.00	7.00	40.00
369	3.00	-0.233	0.00	7.00	40.00
370	3.00	-0.233	0.00	7.00	40.00
371	3.00	-0.233	0.00	7.00	40.00
372	3.00	-0.233	0.00	7.00	40.00
373	3.00	-0.233	0.00	7.00	40.00
374	3.00	-0.233	0.00	7.00	40.00
375	3.00	-0.233	0.00	7.00	40.00
376	3.00	-0.233	0.00	7.00	40.00
377	3.00	-0.233	0.00	7.00	40.00
378	3.00	-0.233	0.00	7.00	40.00
379	3.00	-0.233	0.00	7.00	40.00



## Fixed Head Reservoir Data

Source Node	Head m	Ref Res? (R)
301	16.40	R

## Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length	Allow Press m	Pipe Material
100.0	100.00000	820.00	120.00	DI
150.0	100.00000	1185.00	120.00	DI
200.0	100.00000	1728.00	120.00	DI
250.0	100.00000	2328.00	120.00	DI
300.0	100.00000	3001.00	120.00	DI
350.0	100.00000	3784.00	120.00	DI
100.0	100.00000	902.00	120.00	CI
150.0	100.00000	1356.00	120.00	CI
200.0	100.00000	1979.00	120.00	CI
80.0	140.00000	247.00	40.00	AC

## Looped Water Distribution Network Design Output

BandWidth	=	5
Number of Loops	=	28
Newton Raphson Iterations	=	7

## Pipe Details

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m )	HL/1000m (m )	Length (m )	Velocity (m/s )
301	301	302	54.522	300.0	0.20	3.40	60.00	0.77
302	302	303	9.034	150.0	1.07	3.56	300.00	0.51

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
399	302	303	9.034	150.0	1.07	3.56	300.00	0.51
303	303	304	0.699	100.0	0.07	0.22	300.00	0.09
304	303	305	8.335	150.0	0.37	3.07	120.00	0.47
400	303	305	8.335	150.0	0.37	3.07	120.00	0.47
305	305	306	0.699	100.0	0.04	0.22	200.00	0.09
306	305	307	7.636	150.0	0.78	2.61	300.00	0.43
401	305	307	7.636	150.0	0.78	2.61	300.00	0.43
307	307	308	0.699	100.0	0.07	0.22	300.00	0.09
308	307	309	6.937	150.0	0.22	2.19	100.00	0.39
402	307	309	6.937	150.0	0.22	2.19	100.00	0.39
309	309	310	1.292	150.0	0.02	0.10	180.00	0.07
310	310	311	0.699	100.0	0.09	0.22	400.00	0.09
311	310	312	-0.106	150.0	-0.00	-0.00	120.00	-0.01
312	312	313	0.699	150.0	0.02	0.03	800.00	0.04
313	309	314	5.942	100.0	1.42	11.82	120.00	0.76
403	309	314	5.942	100.0	1.42	11.82	120.00	0.76
314	314	315	0.699	100.0	0.04	0.22	200.00	0.09
315	314	316	5.243	100.0	0.94	9.38	100.00	0.67
404	314	316	5.243	100.0	0.94	9.38	100.00	0.67
316	316	317	0.699	100.0	0.09	0.22	400.00	0.09
317	316	318	4.543	100.0	1.44	7.19	200.00	0.58
405	316	318	4.543	100.0	1.44	7.19	200.00	0.58
318	318	319	0.699	100.0	0.09	0.22	400.00	0.09
319	318	320	3.844	100.0	1.58	5.28	300.00	0.49
406	318	320	3.844	100.0	1.58	5.28	300.00	0.49
320	320	321	0.699	100.0	0.09	0.22	400.00	0.09
321	320	322	3.145	100.0	0.55	3.64	150.00	0.40
407	320	322	3.145	100.0	0.55	3.64	150.00	0.40
322	322	323	0.699	100.0	0.07	0.22	300.00	0.09
323	322	324	2.447	100.0	0.27	2.29	120.00	0.31
408	322	324	2.447	100.0	0.27	2.29	120.00	0.31
324	324	325	0.699	100.0	0.07	0.22	300.00	0.09
325	324	326	1.748	100.0	0.25	1.23	200.00	0.22
409	324	326	1.748	100.0	0.25	1.23	200.00	0.22
326	326	327	2.097	100.0	0.26	1.72	150.00	0.27
327	327	328	0.699	100.0	0.04	0.22	200.00	0.09
328	327	329	0.699	100.0	0.02	0.22	100.00	0.09
329	326	330	0.699	100.0	0.22	0.22	1000.00	0.09
330	366	312	1.504	100.0	1.02	0.93	1100.00	0.19
331	302	366	10.591	150.0	1.44	4.79	300.00	0.60
332	331	332	0.699	100.0	0.04	0.22	200.00	0.09
333	331	333	6.990	150.0	0.27	2.22	120.00	0.40
334	333	334	5.087	150.0	0.18	1.23	150.00	0.29
335	333	334	1.204	100.0	0.18	0.62	300.00	0.15
336	334	364	5.592	100.0	1.27	10.57	120.00	0.71

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
337	335	336	0.699	100.0	0.09	0.22	400.00	0.09
338	335	337	2.796	100.0	0.29	2.93	100.00	0.36
339	337	338	0.699	100.0	0.07	0.22	300.00	0.09
340	337	372	1.398	100.0	0.34	0.81	420.00	0.18
341	302	340	8.037	150.0	0.17	2.87	60.00	0.45
410	302	340	17.127	200.0	0.17	2.87	60.00	0.55
342	340	341	0.699	100.0	0.11	0.22	500.00	0.09
343	340	342	7.590	150.0	0.31	2.58	120.00	0.43
411	340	342	16.176	200.0	0.31	2.58	120.00	0.51
344	342	343	0.699	100.0	0.11	0.22	500.00	0.09
345	342	378	7.144	150.0	1.85	2.31	800.00	0.40
412	342	378	15.224	200.0	1.85	2.31	800.00	0.48
346	344	345	5.239	100.0	1.12	9.37	120.00	0.67
347	345	379	2.111	100.0	0.52	1.74	300.00	0.27
348	345	347	2.429	100.0	0.68	2.26	300.00	0.31
349	344	360	8.959	150.0	1.47	3.51	420.00	0.51
413	344	360	3.084	100.0	1.47	3.51	420.00	0.39
350	360	361	0.699	100.0	0.11	0.22	500.00	0.09
351	360	362	10.645	200.0	0.14	1.19	120.00	0.34
352	362	363	0.699	100.0	0.22	0.22	1000.00	0.09
353	362	347	9.247	200.0	0.18	0.92	200.00	0.29
354	347	374	11.017	200.0	0.25	1.27	200.00	0.35
355	348	349	0.954	100.0	0.34	0.40	850.00	0.12
356	349	350	2.796	200.0	0.01	0.10	120.00	0.09
357	350	351	0.699	100.0	0.13	0.22	600.00	0.09
358	350	375	1.398	200.0	0.01	0.03	200.00	0.04
359	349	377	-2.541	200.0	-0.04	-0.08	450.00	-0.08
360	348	354	1.293	100.0	0.70	0.70	1000.00	0.16
361	354	355	0.699	100.0	0.34	0.22	1500.00	0.09
362	354	353	1.496	100.0	0.28	0.92	300.00	0.19
363	353	356	1.224	80.0	0.42	1.01	420.00	0.24
414	353	356	1.572	100.0	0.42	1.01	420.00	0.20
364	356	357	0.699	100.0	0.11	0.22	500.00	0.09
365	356	358	1.398	100.0	0.34	0.81	420.00	0.18
366	358	359	0.699	100.0	0.34	0.22	1500.00	0.09
369	364	365	0.699	100.0	0.03	0.22	150.00	0.09
372	368	367	0.699	100.0	0.03	0.22	150.00	0.09
373	369	368	2.607	100.0	0.31	2.57	120.00	0.33
374	364	335	4.194	150.0	0.26	0.86	300.00	0.24
376	372	339	0.699	100.0	0.19	0.22	850.00	0.09
378	375	352	0.699	100.0	0.07	0.22	300.00	0.09
379	378	369	3.687	100.0	2.69	4.89	550.00	0.47
380	379	369	-0.381	100.0	-0.02	-0.07	250.00	-0.05
381	379	346	1.793	100.0	0.15	1.29	120.00	0.23
382	347	346	-0.040	100.0	-0.00	-0.00	420.00	-0.01



## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
383	346	370	1.055	100.0	0.14	0.48	300.00	0.13
384	368	370	0.373	100.0	0.01	0.07	120.00	0.05
385	368	371	0.836	100.0	0.04	0.31	120.00	0.11
386	370	371	0.729	100.0	0.03	0.24	120.00	0.09
387	371	373	0.866	100.0	0.07	0.33	200.00	0.11
389	373	374	0.167	80.0	0.01	0.03	550.00	0.03
392	378	344	8.991	150.0	1.06	3.53	300.00	0.51
415	378	344	8.991	150.0	1.06	3.53	300.00	0.51
393	374	348	10.485	200.0	0.29	1.16	250.00	0.33
394	348	376	7.539	200.0	0.26	0.63	420.00	0.24
395	376	377	5.239	200.0	0.04	0.32	120.00	0.17
396	377	353	1.999	80.0	0.68	2.50	270.00	0.40
397	376	354	1.601	100.0	0.44	1.04	420.00	0.20
398	366	331	8.388	150.0	0.37	3.11	120.00	0.47

Note: Negative value indicates the flow in reverse direction in that Pipe

## Pipe Pressure Details

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m)	Allow Press (m)	Status (E/P)
301	301	302	300.0	100.00000	DI	16.40	120.00	
302	302	303	150.0	100.00000	CI	16.20	120.00	E
399	302	303	150.0	100.00000	DI	16.20	120.00	
303	303	304	100.0	100.00000	DI	15.13	120.00	
304	303	305	150.0	100.00000	CI	15.13	120.00	E
400	303	305	150.0	100.00000	DI	15.13	120.00	
305	305	306	100.0	100.00000	DI	14.76	120.00	
306	305	307	150.0	100.00000	CI	14.76	120.00	E
401	305	307	150.0	100.00000	DI	14.76	120.00	
307	307	308	100.0	100.00000	DI	13.97	120.00	
308	307	309	150.0	100.00000	CI	13.97	120.00	E
402	307	309	150.0	100.00000	DI	13.97	120.00	
309	309	310	150.0	100.00000	CI	13.76	120.00	E
310	310	311	100.0	100.00000	DI	13.74	120.00	
311	310	312	150.0	100.00000	CI	13.74	120.00	E
312	312	313	150.0	100.00000	CI	13.74	120.00	E
313	309	314	100.0	100.00000	CI	13.76	120.00	E
403	309	314	100.0	100.00000	DI	13.76	120.00	
314	314	315	100.0	100.00000	DI	12.34	120.00	



## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
315	314	316	100.0	100.00000	CI	12.34	120.00	E
404	314	316	100.0	100.00000	DI	12.34	120.00	
316	316	317	100.0	100.00000	DI	11.40	120.00	
317	316	318	100.0	100.00000	CI	11.40	120.00	E
405	316	318	100.0	100.00000	DI	11.40	120.00	
318	318	319	100.0	100.00000	DI	9.96	120.00	
319	318	320	100.0	100.00000	CI	9.96	120.00	E
406	318	320	100.0	100.00000	DI	9.96	120.00	
320	320	321	100.0	100.00000	DI	8.38	120.00	
321	320	322	100.0	100.00000	CI	8.38	120.00	E
407	320	322	100.0	100.00000	DI	8.38	120.00	
322	322	323	100.0	100.00000	DI	7.83	120.00	
323	322	324	100.0	100.00000	CI	7.83	120.00	E
408	322	324	100.0	100.00000	DI	7.83	120.00	
324	324	325	100.0	100.00000	DI	7.56	120.00	
325	324	326	100.0	100.00000	CI	7.56	120.00	E
409	324	326	100.0	100.00000	DI	7.56	120.00	
326	326	327	100.0	100.00000	CI	7.31	120.00	E
327	327	328	100.0	100.00000	DI	7.05	120.00	
328	327	329	100.0	100.00000	CI	7.05	120.00	E
329	326	330	100.0	100.00000	DI	7.31	120.00	
330	366	312	100.0	100.00000	DI	14.76	120.00	
331	302	366	150.0	100.00000	DI	16.20	120.00	
332	331	332	100.0	100.00000	DI	14.39	120.00	
333	331	333	150.0	100.00000	DI	14.39	120.00	
334	333	334	150.0	100.00000	DI	14.12	120.00	
335	333	334	100.0	100.00000	DI	14.12	120.00	
336	334	364	100.0	100.00000	DI	13.94	120.00	
337	335	336	100.0	100.00000	DI	12.41	120.00	
338	335	337	100.0	100.00000	DI	12.41	120.00	
339	337	338	100.0	100.00000	DI	12.12	120.00	
340	337	372	100.0	100.00000	DI	12.12	120.00	
341	302	340	150.0	100.00000	CI	16.20	120.00	E
410	302	340	200.0	100.00000	DI	16.20	120.00	
342	340	341	100.0	100.00000	DI	16.02	120.00	
343	340	342	150.0	100.00000	CI	16.02	120.00	E
411	340	342	200.0	100.00000	DI	16.02	120.00	
344	342	343	100.0	100.00000	DI	15.71	120.00	
345	342	378	150.0	100.00000	CI	15.71	120.00	E
412	342	378	200.0	100.00000	DI	15.71	120.00	
346	344	345	100.0	100.00000	DI	12.81	120.00	
347	345	379	100.0	100.00000	DI	11.68	120.00	
348	345	347	100.0	100.00000	DI	11.68	120.00	
349	344	360	150.0	100.00000	CI	12.81	120.00	E
413	344	360	100.0	100.00000	DI	12.81	120.00	

## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
350	360	361	100.0	100.00000	DI	11.33	120.00	
351	360	362	200.0	100.00000	CI	11.33	120.00	E
352	362	363	100.0	100.00000	DI	11.19	120.00	
353	362	347	200.0	100.00000	CI	11.19	120.00	E
354	347	374	200.0	100.00000	CI	11.01	120.00	E
355	348	349	100.0	100.00000	DI	10.46	120.00	
356	349	350	200.0	100.00000	CI	10.12	120.00	E
357	350	351	100.0	100.00000	DI	10.11	120.00	
358	350	375	200.0	100.00000	CI	10.11	120.00	E
359	349	377	200.0	100.00000	CI	10.16	120.00	E
360	348	354	100.0	100.00000	DI	10.46	120.00	
361	354	355	100.0	100.00000	CI	9.76	120.00	E
362	354	353	100.0	100.00000	DI	9.76	120.00	
363	353	356	80.0	140.00000	AC	9.49	40.00	E
414	353	356	100.0	100.00000	DI	9.49	120.00	
364	356	357	100.0	100.00000	DI	9.06	120.00	
365	356	358	100.0	100.00000	DI	9.06	120.00	
366	358	359	100.0	100.00000	DI	8.72	120.00	
369	364	365	100.0	100.00000	DI	12.67	120.00	
372	368	367	100.0	100.00000	DI	10.87	120.00	
373	369	368	100.0	100.00000	DI	11.18	120.00	
374	364	335	150.0	100.00000	DI	12.67	120.00	
376	372	339	100.0	100.00000	DI	11.78	120.00	
378	375	352	100.0	100.00000	DI	10.11	120.00	
379	378	369	100.0	100.00000	DI	13.87	120.00	
380	379	369	100.0	100.00000	DI	11.18	120.00	
381	379	346	100.0	100.00000	DI	11.16	120.00	
382	347	346	100.0	100.00000	DI	11.01	120.00	
383	346	370	100.0	100.00000	DI	11.01	120.00	
384	368	370	100.0	100.00000	DI	10.87	120.00	
385	368	371	100.0	100.00000	DI	10.87	120.00	
386	370	371	100.0	100.00000	DI	10.86	120.00	
387	371	373	100.0	100.00000	DI	10.83	120.00	
389	373	374	80.0	140.00000	AC	10.77	40.00	E
392	378	344	150.0	100.00000	CI	13.87	120.00	E
415	378	344	150.0	100.00000	DI	13.87	120.00	
393	374	348	200.0	100.00000	CI	10.75	120.00	E
394	348	376	200.0	100.00000	CI	10.46	120.00	E
395	376	377	200.0	100.00000	CI	10.20	120.00	E
396	377	353	80.0	140.00000	AC	10.16	40.00	E
397	376	354	100.0	100.00000	CI	10.20	120.00	E
398	366	331	150.0	100.00000	DI	14.76	120.00	

## Node Details

Node No.	Flow (lps)	Elev. (m )	H G L (m )	Pressure (m )
301 S	54.522	0.00	16.40	16.40
302	-0.699	0.00	16.20	16.20
303	-0.699	0.00	15.13	15.13
304	-0.699	0.00	15.06	15.06
305	-0.699	0.00	14.76	14.76
306	-0.699	0.00	14.71	14.71
307	-0.699	0.00	13.97	13.97
308	-0.699	0.00	13.91	13.91
309	-0.699	0.00	13.76	13.76
310	-0.699	0.00	13.74	13.74
311	-0.699	0.00	13.65	13.65
312	-0.699	0.00	13.74	13.74
313	-0.699	0.00	13.71	13.71
314	-0.699	0.00	12.34	12.34
315	-0.699	0.00	12.29	12.29
316	-0.699	0.00	11.40	11.40
317	-0.699	0.00	11.31	11.31
318	-0.699	0.00	9.96	9.96
319	-0.699	0.00	9.87	9.87
320	-0.699	0.00	8.38	8.38
321	-0.699	0.00	8.29	8.29
322	-0.699	0.00	7.83	7.83
323	-0.699	0.00	7.76	7.76
324	-0.699	0.00	7.56	7.56
325	-0.699	0.00	7.49	7.49
326	-0.699	0.00	7.31	7.31
327	-0.699	0.00	7.05	7.05
328	-0.699	0.00	7.01	7.01
329	-0.699	0.00	7.03	7.03
330	-0.699	0.00	7.09	7.09
331	-0.699	0.00	14.39	14.39
332	-0.699	0.00	14.34	14.34
333	-0.699	0.00	14.12	14.12
334	-0.699	0.00	13.94	13.94
335	-0.699	0.00	12.41	12.41
336	-0.699	0.00	12.32	12.32
337	-0.699	0.00	12.12	12.12
338	-0.699	0.00	12.05	12.05
339	-0.699	0.00	11.59	11.59
340	-0.699	0.00	16.02	16.02
341	-0.699	0.00	15.91	15.91
342	-0.699	0.00	15.71	15.71
343	-0.699	0.00	15.60	15.60
344	-0.699	0.00	12.81	12.81
345	-0.699	0.00	11.68	11.68

## Node Details cont'd

Node No.	Flow (lps)	Elev. (m )	H G L (m )	Pressure (m )
346	-0.699	0.00	11.01	11.01
347	-0.699	0.00	11.01	11.01
348	-0.699	0.00	10.46	10.46
349	-0.699	0.00	10.12	10.12
350	-0.699	0.00	10.11	10.11
351	-0.699	0.00	9.98	9.98
352	-0.699	0.00	10.04	10.04
353	-0.699	0.00	9.49	9.49
354	-0.699	0.00	9.76	9.76
355	-0.699	0.00	9.42	9.42
356	-0.699	0.00	9.06	9.06
357	-0.699	0.00	8.95	8.95
358	-0.699	0.00	8.72	8.72
359	-0.699	0.00	8.39	8.39
360	-0.699	0.00	11.33	11.33
361	-0.699	0.00	11.22	11.22
362	-0.699	0.00	11.19	11.19
363	-0.699	0.00	10.97	10.97
364	-0.699	0.00	12.67	12.67
365	-0.699	0.00	12.64	12.64
366	-0.699	0.00	14.76	14.76
367	-0.699	0.00	10.84	10.84
368	-0.699	0.00	10.87	10.87
369	-0.699	0.00	11.18	11.18
370	-0.699	0.00	10.86	10.86
371	-0.699	0.00	10.83	10.83
372	-0.699	0.00	11.78	11.78
373	-0.699	0.00	10.77	10.77
374	-0.699	0.00	10.75	10.75
375	-0.699	0.00	10.11	10.11
376	-0.699	0.00	10.20	10.20
377	-0.699	0.00	10.16	10.16
378	-0.699	0.00	13.87	13.87
379	-0.699	0.00	11.16	11.16



## Pipe Cost Summary

Diameter (mm)	Pipe Material	Length (m )	Cost (1000 Rs )	Cum. Cost (1000 Rs )
100.0	DI	21530.00	17654.60	17654.60
150.0	DI	2110.00	2500.35	20154.95
200.0	DI	980.00	1693.44	21848.39
300.0	DI	60.00	180.06	22028.45

## Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Pipe Material	Length (m )	Cost (1000 Rs )	Cum. Cost (1000 Rs )
301	300.0	DI	60.00	180.06	180.06
399	150.0	DI	300.00	355.50	535.56
303	100.0	DI	300.00	246.00	781.56
400	150.0	DI	120.00	142.20	923.76
305	100.0	DI	200.00	164.00	1087.76
401	150.0	DI	300.00	355.50	1443.26
307	100.0	DI	300.00	246.00	1689.26
402	150.0	DI	100.00	118.50	1807.76
310	100.0	DI	400.00	328.00	2135.76
403	100.0	DI	120.00	98.40	2234.16
314	100.0	DI	200.00	164.00	2398.16
404	100.0	DI	100.00	82.00	2480.16
316	100.0	DI	400.00	328.00	2808.16
405	100.0	DI	200.00	164.00	2972.16
318	100.0	DI	400.00	328.00	3300.16
406	100.0	DI	300.00	246.00	3546.16
320	100.0	DI	400.00	328.00	3874.16
407	100.0	DI	150.00	123.00	3997.16
322	100.0	DI	300.00	246.00	4243.16
408	100.0	DI	120.00	98.40	4341.56
324	100.0	DI	300.00	246.00	4587.56
409	100.0	DI	200.00	164.00	4751.56
327	100.0	DI	200.00	164.00	4915.56
329	100.0	DI	1000.00	820.00	5735.56
330	100.0	DI	1100.00	902.00	6637.56
331	150.0	DI	300.00	355.50	6993.06
332	100.0	DI	200.00	164.00	7157.06
333	150.0	DI	120.00	142.20	7299.26
334	150.0	DI	150.00	177.75	7477.01
335	100.0	DI	300.00	246.00	7723.01
336	100.0	DI	120.00	98.40	7821.41

## Pipe-wise Cost Summary cont'd

Pipe No	Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
337	100.0	DI	400.00	328.00	8149.41
338	100.0	DI	100.00	82.00	8231.41
339	100.0	DI	300.00	246.00	8477.41
340	100.0	DI	420.00	344.40	8821.81
410	200.0	DI	60.00	103.68	8925.49
342	100.0	DI	500.00	410.00	9335.49
411	200.0	DI	120.00	207.36	9542.85
344	100.0	DI	500.00	410.00	9952.85
412	200.0	DI	800.00	1382.40	11335.25
346	100.0	DI	120.00	98.40	11433.65
347	100.0	DI	300.00	246.00	11679.65
348	100.0	DI	300.00	246.00	11925.65
413	100.0	DI	420.00	344.40	12270.05
350	100.0	DI	500.00	410.00	12680.05
352	100.0	DI	1000.00	820.00	13500.05
355	100.0	DI	850.00	697.00	14197.05
357	100.0	DI	600.00	492.00	14689.05
360	100.0	DI	1000.00	820.00	15509.05
362	100.0	DI	300.00	246.00	15755.05
414	100.0	DI	420.00	344.40	16099.45
364	100.0	DI	500.00	410.00	16509.45
365	100.0	DI	420.00	344.40	16853.85
366	100.0	DI	1500.00	1230.00	18083.85
369	100.0	DI	150.00	123.00	18206.85
372	100.0	DI	150.00	123.00	18329.85
373	100.0	DI	120.00	98.40	18428.25
374	150.0	DI	300.00	355.50	18783.75
376	100.0	DI	850.00	697.00	19480.75
378	100.0	DI	300.00	246.00	19726.75
379	100.0	DI	550.00	451.00	20177.75
380	100.0	DI	250.00	205.00	20382.75
381	100.0	DI	120.00	98.40	20481.15
382	100.0	DI	420.00	344.40	20825.55
383	100.0	DI	300.00	246.00	21071.55
384	100.0	DI	120.00	98.40	21169.95
385	100.0	DI	120.00	98.40	21268.35
386	100.0	DI	120.00	98.40	21366.75
387	100.0	DI	200.00	164.00	21530.75
415	150.0	DI	300.00	355.50	21886.25
398	150.0	DI	120.00	142.20	22028.45

L O O P

Version 4.0

Looped Water Distribution Network Design Program

LOOP: Looped Water Distribution Design Program - (C) The World Bank

## Echoing Input Variables

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Title of the Project          : ARAMBAGH W/S SCHEME ZONE IV
Name of the User             : C SEC
Number of Pipes              : 106
Number of Nodes              : 71
Type of Pipe Materials Used  : DI/CI/AC/
Number of Commercial Dia per Material : 6/3/2/
Peak Design Factor           : 3
Newton-Raphson Stopping Criterion lps : .001
Minimum Pressure             m : 7
Maximum Pressure             m : 40
Design Hydraulic Gradient m in km : 10
Simulate or Design?         (S/D) : S
No. of Res. Nodes with Fixed HGL : 1
No. of Res. Nodes with Variable HGL : 0
No. of Booster Pumps        : 0
No. of Pressure Reducing Valves : 0
No. of Check Valves         : 0
Type of Formula              : Hazen's

```

## Pipe Data

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material (E/P)	Status
401	401	449	60.00	350.0	140.00000	DI	
402	460	403	60.00	200.0	100.00000	CI	E
487	460	403	60.00	100.0	100.00000	CI	E
403	427	464	500.00	200.0	100.00000	CI	E
488	427	464	500.00	200.0	140.00000	DI	
404	471	405	300.00	150.0	140.00000	DI	
405	405	406	600.00	100.0	140.00000	DI	
406	472	407	200.00	150.0	100.00000	CI	E
407	406	408	100.00	80.0	140.00000	AC	E
408	408	409	120.00	80.0	140.00000	AC	E
409	410	408	100.00	80.0	140.00000	AC	E
410	405	410	300.00	150.0	140.00000	DI	
411	410	411	300.00	80.0	140.00000	AC	E
412	402	412	100.00	200.0	100.00000	CI	E
489	402	412	100.00	100.0	140.00000	DI	
413	412	413	250.00	100.0	140.00000	DI	
414	412	414	420.00	200.0	100.00000	CI	E
490	412	414	420.00	100.0	140.00000	DI	
415	414	415	350.00	100.0	140.00000	DI	
416	414	416	200.00	80.0	140.00000	AC	E
417	416	417	200.00	100.0	140.00000	DI	
418	415	417	220.00	100.0	140.00000	DI	



## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
419	417	418	200.00	100.0	140.00000	DI	
420	416	419	250.00	80.0	140.00000	AC	E
421	419	420	350.00	80.0	140.00000	AC	E
508	419	420	350.00	100.0	140.00000	DI	
422	420	421	300.00	100.0	140.00000	DI	
423	420	422	300.00	100.0	140.00000	DI	
424	419	423	800.00	100.0	140.00000	DI	
425	426	419	500.00	150.0	140.00000	DI	
426	414	424	360.00	200.0	100.00000	CI	E
491	414	424	360.00	150.0	140.00000	DI	
427	424	425	1000.00	100.0	140.00000	DI	
428	424	426	250.00	200.0	100.00000	CI	E
492	424	426	250.00	150.0	140.00000	DI	
429	426	454	120.00	200.0	100.00000	CI	E
493	426	454	120.00	150.0	140.00000	DI	
430	427	428	600.00	80.0	140.00000	AC	E
494	427	428	600.00	100.0	140.00000	DI	
431	428	429	360.00	80.0	140.00000	AC	E
495	428	429	360.00	100.0	140.00000	DI	
432	429	430	200.00	100.0	140.00000	DI	
433	428	431	100.00	80.0	140.00000	AC	E
434	431	432	300.00	80.0	140.00000	AC	E
435	431	433	420.00	80.0	140.00000	AC	E
436	427	434	270.00	200.0	100.00000	CI	E
496	427	434	270.00	200.0	140.00000	DI	
437	453	435	350.00	100.0	100.00000	CI	E
509	453	435	350.00	100.0	140.00000	DI	
438	457	436	250.00	100.0	100.00000	CI	E
439	435	436	700.00	100.0	140.00000	DI	
440	436	437	850.00	100.0	100.00000	CI	E
441	434	438	720.00	100.0	140.00000	AC	E
497	434	438	720.00	300.0	140.00000	DI	
442	450	439	300.00	100.0	140.00000	DI	
443	470	440	550.00	100.0	140.00000	AC	E
498	470	440	550.00	100.0	140.00000	DI	
444	440	441	350.00	100.0	140.00000	DI	
445	440	442	120.00	80.0	140.00000	AC	E
499	440	442	120.00	100.0	140.00000	DI	
446	442	443	60.00	80.0	140.00000	AC	E
500	442	443	60.00	100.0	140.00000	DI	
447	443	444	200.00	100.0	140.00000	DI	
448	443	445	250.00	80.0	140.00000	AC	E
449	445	446	1000.00	100.0	140.00000	DI	
450	445	447	250.00	80.0	140.00000	AC	E
451	448	445	300.00	100.0	140.00000	DI	

## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material (E/P)	Status
452	442	448	300.00	100.0	140.00000	DI	
453	402	460	60.00	200.0	100.00000	CI	E
501	402	460	60.00	100.0	140.00000	DI	
454	403	462	120.00	100.0	140.00000	DI	
455	403	471	120.00	150.0	100.00000	CI	E
502	403	471	120.00	100.0	140.00000	DI	
456	406	472	200.00	80.0	140.00000	AC	E
503	406	472	200.00	100.0	140.00000	DI	
457	402	459	700.00	100.0	140.00000	DI	
458	460	461	400.00	100.0	140.00000	DI	
459	462	463	300.00	100.0	140.00000	DI	
460	471	472	420.00	150.0	100.00000	CI	E
504	471	472	420.00	100.0	140.00000	DI	
464	427	455	850.00	100.0	140.00000	DI	
465	455	454	300.00	100.0	140.00000	DI	
466	455	456	3000.00	100.0	100.00000	CI	E
467	449	438	50.00	100.0	140.00000	AC	E
505	449	438	50.00	300.0	140.00000	DI	
468	449	470	60.00	80.0	140.00000	AC	E
506	449	470	60.00	150.0	140.00000	DI	
469	470	465	300.00	100.0	140.00000	DI	
470	438	450	120.00	150.0	140.00000	DI	
471	450	451	120.00	150.0	140.00000	DI	
472	451	452	360.00	100.0	140.00000	DI	
473	451	453	350.00	150.0	140.00000	DI	
474	434	452	250.00	100.0	100.00000	CI	E
475	452	453	200.00	100.0	100.00000	CI	E
476	435	457	500.00	100.0	100.00000	CI	E
477	457	458	420.00	100.0	140.00000	DI	
478	451	465	240.00	100.0	140.00000	DI	
479	454	464	600.00	200.0	100.00000	CI	E
507	454	464	600.00	200.0	140.00000	DI	
480	465	441	420.00	100.0	140.00000	DI	
481	441	466	200.00	100.0	140.00000	DI	
482	466	448	200.00	100.0	140.00000	DI	
483	466	467	240.00	100.0	140.00000	DI	
484	467	447	120.00	100.0	140.00000	DI	
485	447	469	480.00	100.0	140.00000	DI	
486	467	468	420.00	100.0	140.00000	DI	

## Node Data

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
401	3.00	0.000	0.00	7.00	40.00
402	3.00	-0.412	0.00	7.00	40.00
403	3.00	-0.412	0.00	7.00	40.00
405	3.00	-0.412	0.00	7.00	40.00
406	3.00	-0.412	0.00	7.00	40.00
407	3.00	-0.412	0.00	7.00	40.00
408	3.00	-0.412	0.00	7.00	40.00
409	3.00	-0.412	0.00	7.00	40.00
410	3.00	-0.412	0.00	7.00	40.00
411	3.00	-0.412	0.00	7.00	40.00
412	3.00	-0.412	0.00	7.00	40.00
413	3.00	-0.412	0.00	7.00	40.00
414	3.00	-0.412	0.00	7.00	40.00
415	3.00	-0.412	0.00	7.00	40.00
416	3.00	-0.412	0.00	7.00	40.00
417	3.00	-0.412	0.00	7.00	40.00
418	3.00	-0.412	0.00	7.00	40.00
419	3.00	-0.412	0.00	7.00	40.00
420	3.00	-0.412	0.00	7.00	40.00
421	3.00	-0.412	0.00	7.00	40.00
422	3.00	-0.412	0.00	7.00	40.00
423	3.00	-0.412	0.00	7.00	40.00
424	3.00	-0.412	0.00	7.00	40.00
425	3.00	-0.412	0.00	7.00	40.00
426	3.00	-0.412	0.00	7.00	40.00
427	3.00	-0.412	0.00	7.00	40.00
428	3.00	-0.412	0.00	7.00	40.00
429	3.00	-0.412	0.00	7.00	40.00
430	3.00	-0.412	0.00	7.00	40.00
431	3.00	-0.412	0.00	7.00	40.00
432	3.00	-0.412	0.00	7.00	40.00
433	3.00	-0.412	0.00	7.00	40.00
434	3.00	-0.412	0.00	7.00	40.00
435	3.00	-0.412	0.00	7.00	40.00
436	3.00	-0.412	0.00	7.00	40.00
437	3.00	-0.412	0.00	7.00	40.00
438	3.00	-0.412	0.00	7.00	40.00
439	3.00	-0.412	0.00	7.00	40.00
440	3.00	-0.412	0.00	7.00	40.00
441	3.00	-0.412	0.00	7.00	40.00
442	3.00	-0.412	0.00	7.00	40.00
443	3.00	-0.412	0.00	7.00	40.00
444	3.00	-0.412	0.00	7.00	40.00
445	3.00	-0.412	0.00	7.00	40.00
446	3.00	-0.412	0.00	7.00	40.00

## Node Data cont'd

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
447	3.00	-0.412	0.00	7.00	40.00
448	3.00	-0.412	0.00	7.00	40.00
449	3.00	-0.412	0.00	7.00	40.00
450	3.00	-0.412	0.00	7.00	40.00
451	3.00	-0.412	0.00	7.00	40.00
452	3.00	-0.412	0.00	7.00	40.00
453	3.00	-0.412	0.00	7.00	40.00
454	3.00	-0.412	0.00	7.00	40.00
455	3.00	-0.412	0.00	7.00	40.00
456	3.00	-0.412	0.00	7.00	40.00
457	3.00	-0.412	0.00	7.00	40.00
458	3.00	-0.412	0.00	7.00	40.00
459	3.00	-0.412	0.00	7.00	40.00
460	3.00	-0.412	0.00	7.00	40.00
461	3.00	-0.412	0.00	7.00	40.00
462	3.00	-0.412	0.00	7.00	40.00
463	3.00	-0.412	0.00	7.00	40.00
464	3.00	-0.412	0.00	7.00	40.00
465	3.00	-0.412	0.00	7.00	40.00
466	3.00	-0.412	0.00	7.00	40.00
467	3.00	-0.412	0.00	7.00	40.00
468	3.00	-0.412	0.00	7.00	40.00
469	3.00	-0.412	0.00	7.00	40.00
470	3.00	-0.412	0.00	7.00	40.00
471	3.00	-0.412	0.00	7.00	40.00
472	3.00	-0.412	0.00	7.00	40.00

## Fixed Head Reservoir Data

Source Node	Head m	Ref Res? (R)
401	17.50	R



## Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length	Allow Press m	Pipe Material
100.0	140.00000	820.00	120.00	DI
150.0	140.00000	1185.00	120.00	DI
200.0	140.00000	1728.00	120.00	DI
250.0	140.00000	2328.00	120.00	DI
300.0	140.00000	3001.00	120.00	DI
350.0	140.00000	3784.00	120.00	DI
100.0	100.00000	902.00	120.00	CI
150.0	100.00000	1356.00	120.00	CI
200.0	100.00000	1979.00	120.00	CI
80.0	140.00000	247.00	40.00	AC
100.0	140.00000	301.00	40.00	AC

## Looped Water Distribution Network Design OutPut

Bandwidth	=	4
Number of Loops	=	36
Newton Raphson Iterations	=	8

## Pipe Details

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
401	401	449	86.520	350.0	0.12	2.02	60.00	0.90
402	460	403	12.769	200.0	0.10	1.67	60.00	0.41
487	460	403	2.063	100.0	0.10	1.67	60.00	0.26
403	427	464	16.340	200.0	1.32	2.63	500.00	0.52
488	427	464	22.877	200.0	1.32	2.63	500.00	0.73
404	471	405	5.390	150.0	0.22	0.73	300.00	0.30
405	405	406	0.600	100.0	0.05	0.09	600.00	0.08
406	472	407	1.236	150.0	0.02	0.09	200.00	0.07
407	406	408	1.390	80.0	0.13	1.28	100.00	0.28
408	408	409	1.236	80.0	0.12	1.03	120.00	0.25
409	410	408	1.082	80.0	0.08	0.80	100.00	0.22
410	405	410	3.554	150.0	0.10	0.34	300.00	0.20

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
411	410	411	1.236	80.0	0.31	1.03	300.00	0.25
412	402	412	-16.128	200.0	-0.26	-2.57	100.00	-0.51
489	402	412	-3.648	100.0	-0.26	-2.57	100.00	-0.46
413	412	413	1.236	100.0	0.09	0.35	250.00	0.16
414	412	414	-18.144	200.0	-1.34	-3.19	420.00	-0.58
490	412	414	-4.104	100.0	-1.34	-3.19	420.00	-0.52
415	414	415	1.776	100.0	0.24	0.68	350.00	0.23
416	414	416	0.816	80.0	0.10	0.48	200.00	0.16
417	416	417	1.932	100.0	0.16	0.79	200.00	0.25
418	415	417	0.540	100.0	0.02	0.07	220.00	0.07
419	417	418	1.236	100.0	0.07	0.35	200.00	0.16
420	416	419	-2.352	80.0	-0.84	-3.38	250.00	-0.47
421	419	420	1.325	80.0	0.41	1.17	350.00	0.26
508	419	420	2.383	100.0	0.41	1.17	350.00	0.30
422	420	421	1.236	100.0	0.10	0.35	300.00	0.16
423	420	422	1.236	100.0	0.10	0.35	300.00	0.16
424	419	423	1.236	100.0	0.28	0.35	800.00	0.16
425	426	419	8.532	150.0	0.86	1.72	500.00	0.48
426	414	424	-15.737	200.0	-0.88	-2.45	360.00	-0.50
491	414	424	-10.339	150.0	-0.88	-2.45	360.00	-0.58
427	424	425	1.236	100.0	0.35	0.35	1000.00	0.16
428	424	426	-17.229	200.0	-0.73	-2.90	250.00	-0.55
492	424	426	-11.319	150.0	-0.73	-2.90	250.00	-0.64
429	426	454	-23.124	200.0	-0.60	-5.01	120.00	-0.74
493	426	454	-15.192	150.0	-0.60	-5.01	120.00	-0.86
430	427	428	2.650	80.0	2.53	4.21	600.00	0.53
494	427	428	4.766	100.0	2.53	4.21	600.00	0.61
431	428	429	0.883	80.0	0.20	0.55	360.00	0.18
495	428	429	1.589	100.0	0.20	0.55	360.00	0.20
432	429	430	1.236	100.0	0.07	0.35	200.00	0.16
433	428	431	3.708	80.0	0.79	7.85	100.00	0.74
434	431	432	1.236	80.0	0.31	1.03	300.00	0.25
435	431	433	1.236	80.0	0.43	1.03	420.00	0.25
436	427	434	-21.630	200.0	-1.19	-4.42	270.00	-0.69
496	427	434	-30.282	200.0	-1.19	-4.42	270.00	-0.96
437	453	435	2.575	100.0	0.88	2.51	350.00	0.33
509	453	435	3.605	100.0	0.88	2.51	350.00	0.46
438	457	436	-0.188	100.0	-0.00	-0.02	250.00	-0.02
439	435	436	2.660	100.0	1.00	1.43	700.00	0.34
440	436	437	1.236	100.0	0.55	0.65	850.00	0.16
441	434	438	-2.820	100.0	-1.15	-1.59	720.00	-0.36
497	434	438	-50.701	300.0	-1.15	-1.59	720.00	-0.72
442	450	439	1.236	100.0	0.10	0.35	300.00	0.16
443	470	440	5.443	100.0	2.96	5.39	550.00	0.69
498	470	440	5.443	100.0	2.96	5.39	550.00	0.69

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
444	440	441	1.213	100.0	0.12	0.33	350.00	0.15
445	440	442	3.015	80.0	0.64	5.35	120.00	0.60
499	440	442	5.422	100.0	0.64	5.35	120.00	0.69
446	442	443	1.586	80.0	0.10	1.63	60.00	0.32
500	442	443	2.852	100.0	0.10	1.63	60.00	0.36
447	443	444	1.236	100.0	0.07	0.35	200.00	0.16
448	443	445	1.966	80.0	0.61	2.42	250.00	0.39
449	445	446	1.236	100.0	0.35	0.35	1000.00	0.16
450	445	447	1.451	80.0	0.35	1.38	250.00	0.29
451	448	445	1.957	100.0	0.24	0.81	300.00	0.25
452	442	448	2.763	100.0	0.46	1.54	300.00	0.35
453	402	460	14.112	200.0	0.12	2.01	60.00	0.45
501	402	460	3.192	100.0	0.12	2.01	60.00	0.41
454	403	462	2.472	100.0	0.15	1.25	120.00	0.31
455	403	471	7.506	150.0	0.30	2.53	120.00	0.42
502	403	471	3.618	100.0	0.30	2.53	120.00	0.46
456	406	472	-0.724	80.0	-0.08	-0.38	200.00	-0.14
503	406	472	-1.302	100.0	-0.08	-0.38	200.00	-0.17
457	402	459	1.236	100.0	0.24	0.35	700.00	0.16
458	460	461	1.236	100.0	0.14	0.35	400.00	0.16
459	462	463	1.236	100.0	0.10	0.35	300.00	0.16
460	471	472	3.035	150.0	0.20	0.47	420.00	0.17
504	471	472	1.463	100.0	0.20	0.47	420.00	0.19
464	427	455	4.043	100.0	2.64	3.11	850.00	0.51
465	455	454	1.571	100.0	0.16	0.54	300.00	0.20
466	455	456	1.236	100.0	1.94	0.65	3000.00	0.16
467	449	438	3.631	100.0	0.13	2.55	50.00	0.46
505	449	438	65.297	300.0	0.13	2.55	50.00	0.92
468	449	470	2.628	80.0	0.25	4.15	60.00	0.52
506	449	470	13.728	150.0	0.25	4.15	60.00	0.78
469	470	465	4.233	100.0	1.02	3.38	300.00	0.54
470	438	450	14.171	150.0	0.53	4.40	120.00	0.80
471	450	451	11.699	150.0	0.37	3.09	120.00	0.66
472	451	452	1.866	100.0	0.27	0.74	360.00	0.24
473	451	453	6.413	150.0	0.35	1.01	350.00	0.36
474	434	452	0.373	100.0	0.02	0.07	250.00	0.05
475	452	453	1.003	100.0	0.09	0.44	200.00	0.13
476	435	457	2.284	100.0	1.01	2.01	500.00	0.29
477	457	458	1.236	100.0	0.15	0.35	420.00	0.16
478	451	465	2.184	100.0	0.24	0.99	240.00	0.28
479	454	464	-15.825	200.0	-1.49	-2.48	600.00	-0.50
507	454	464	-22.156	200.0	-1.49	-2.48	600.00	-0.71
480	465	441	5.182	100.0	2.07	4.92	420.00	0.66
481	441	466	5.159	100.0	0.98	4.88	200.00	0.66
482	466	448	0.430	100.0	0.01	0.05	200.00	0.05

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
483	466	467	3.493	100.0	0.57	2.37	240.00	0.44
484	467	447	1.021	100.0	0.03	0.24	120.00	0.13
485	447	469	1.236	100.0	0.17	0.35	480.00	0.16
486	467	468	1.236	100.0	0.15	0.35	420.00	0.16

Note: Negative value indicates the flow in reverse direction in that Pipe

## Pipe Pressure Details

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m)	Allow Press (m)	Status (E/P)
401	401	449	350.0	140.00000	DI	17.50	120.00	
402	460	403	200.0	100.00000	CI	8.18	120.00	E
487	460	403	100.0	100.00000	CI	8.18	120.00	E
403	427	464	200.0	100.00000	CI	14.91	120.00	E
488	427	464	200.0	140.00000	DI	14.91	120.00	
404	471	405	150.0	140.00000	DI	7.77	120.00	
405	405	406	100.0	140.00000	DI	7.55	120.00	
406	472	407	150.0	100.00000	CI	7.57	120.00	E
407	406	408	80.0	140.00000	AC	7.50	40.00	E
408	408	409	80.0	140.00000	AC	7.37	40.00	E
409	410	408	80.0	140.00000	AC	7.45	40.00	E
410	405	410	150.0	140.00000	DI	7.55	120.00	
411	410	411	80.0	140.00000	AC	7.45	40.00	E
412	402	412	200.0	100.00000	CI	8.55	120.00	E
489	402	412	100.0	140.00000	DI	8.55	120.00	
413	412	413	100.0	140.00000	DI	8.55	120.00	
414	412	414	200.0	100.00000	CI	9.90	120.00	E
490	412	414	100.0	140.00000	DI	9.90	120.00	
415	414	415	100.0	140.00000	DI	9.90	120.00	
416	414	416	80.0	140.00000	AC	9.90	40.00	E
417	416	417	100.0	140.00000	DI	9.80	120.00	
418	415	417	100.0	140.00000	DI	9.66	120.00	
419	417	418	100.0	140.00000	DI	9.64	120.00	
420	416	419	80.0	140.00000	AC	10.64	40.00	E
421	419	420	80.0	140.00000	AC	10.64	40.00	E
508	419	420	100.0	140.00000	DI	10.64	120.00	
422	420	421	100.0	140.00000	DI	10.24	120.00	
423	420	422	100.0	140.00000	DI	10.24	120.00	
424	419	423	100.0	140.00000	DI	10.64	120.00	



## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
425	426	419	150.0	140.00000	DI	11.50	120.00	
426	414	424	200.0	100.00000	CI	10.78	120.00	E
491	414	424	150.0	140.00000	DI	10.78	120.00	
427	424	425	100.0	140.00000	DI	10.78	120.00	
428	424	426	200.0	100.00000	CI	11.50	120.00	E
492	424	426	150.0	140.00000	DI	11.50	120.00	
429	426	454	200.0	100.00000	CI	12.11	120.00	E
493	426	454	150.0	140.00000	DI	12.11	120.00	
430	427	428	80.0	140.00000	AC	14.91	40.00	E
494	427	428	100.0	140.00000	DI	14.91	120.00	
431	428	429	80.0	140.00000	AC	12.38	40.00	E
495	428	429	100.0	140.00000	DI	12.38	120.00	
432	429	430	100.0	140.00000	DI	12.18	120.00	
433	428	431	80.0	140.00000	AC	12.38	40.00	E
434	431	432	80.0	140.00000	AC	11.60	40.00	E
435	431	433	80.0	140.00000	AC	11.60	40.00	E
436	427	434	200.0	100.00000	CI	16.10	120.00	E
496	427	434	200.0	140.00000	DI	16.10	120.00	
437	453	435	100.0	100.00000	CI	16.00	120.00	E
509	453	435	100.0	140.00000	DI	16.00	120.00	
438	457	436	100.0	100.00000	CI	14.12	120.00	E
439	435	436	100.0	140.00000	DI	15.12	120.00	
440	436	437	100.0	100.00000	CI	14.12	120.00	E
441	434	438	100.0	140.00000	AC	17.25	40.00	E
497	434	438	300.0	140.00000	DI	17.25	120.00	
442	450	439	100.0	140.00000	DI	16.72	120.00	
443	470	440	100.0	140.00000	AC	17.13	40.00	E
498	470	440	100.0	140.00000	DI	17.13	120.00	
444	440	441	100.0	140.00000	DI	14.16	120.00	
445	440	442	80.0	140.00000	AC	14.16	40.00	E
499	440	442	100.0	140.00000	DI	14.16	120.00	
446	442	443	80.0	140.00000	AC	13.52	40.00	E
500	442	443	100.0	140.00000	DI	13.52	120.00	
447	443	444	100.0	140.00000	DI	13.42	120.00	
448	443	445	80.0	140.00000	AC	13.42	40.00	E
449	445	446	100.0	140.00000	DI	12.82	120.00	
450	445	447	80.0	140.00000	AC	12.82	40.00	E
451	448	445	100.0	140.00000	DI	13.06	120.00	
452	442	448	100.0	140.00000	DI	13.52	120.00	
453	402	460	200.0	100.00000	CI	8.30	120.00	E
501	402	460	100.0	140.00000	DI	8.30	120.00	
454	403	462	100.0	140.00000	DI	8.08	120.00	
455	403	471	150.0	100.00000	CI	8.08	120.00	E
502	403	471	100.0	140.00000	DI	8.08	120.00	
456	406	472	80.0	140.00000	AC	7.57	40.00	E

## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
503	406	472	100.0	140.00000	DI	7.57	120.00	
457	402	459	100.0	140.00000	DI	8.30	120.00	
458	460	461	100.0	140.00000	DI	8.18	120.00	
459	462	463	100.0	140.00000	DI	7.93	120.00	
460	471	472	150.0	100.00000	CI	7.77	120.00	E
504	471	472	100.0	140.00000	DI	7.77	120.00	
464	427	455	100.0	140.00000	DI	14.91	120.00	
465	455	454	100.0	140.00000	DI	12.27	120.00	
466	455	456	100.0	100.00000	CI	12.27	120.00	E
467	449	438	100.0	140.00000	AC	17.38	40.00	E
505	449	438	300.0	140.00000	DI	17.38	120.00	
468	449	470	80.0	140.00000	AC	17.38	40.00	E
506	449	470	150.0	140.00000	DI	17.38	120.00	
469	470	465	100.0	140.00000	DI	17.13	120.00	
470	438	450	150.0	140.00000	DI	17.25	120.00	
471	450	451	150.0	140.00000	DI	16.72	120.00	
472	451	452	100.0	140.00000	DI	16.35	120.00	
473	451	453	150.0	140.00000	DI	16.35	120.00	
474	434	452	100.0	100.00000	CI	16.10	120.00	E
475	452	453	100.0	100.00000	CI	16.09	120.00	E
476	435	457	100.0	100.00000	CI	15.12	120.00	E
477	457	458	100.0	140.00000	DI	14.11	120.00	
478	451	465	100.0	140.00000	DI	16.35	120.00	
479	454	464	200.0	100.00000	CI	13.59	120.00	E
507	454	464	200.0	140.00000	DI	13.59	120.00	
480	465	441	100.0	140.00000	DI	16.11	120.00	
481	441	466	100.0	140.00000	DI	14.05	120.00	
482	466	448	100.0	140.00000	DI	13.07	120.00	
483	466	467	100.0	140.00000	DI	13.07	120.00	
484	467	447	100.0	140.00000	DI	12.50	120.00	
485	447	469	100.0	140.00000	DI	12.47	120.00	
486	467	468	100.0	140.00000	DI	12.50	120.00	

## Node Details

Node No.	Flow (lps)	Elev. (m )	H G L (m )	Pressure (m )
401 S	86.520	0.00	17.50	17.50
402	-1.236	0.00	8.30	8.30
403	-1.236	0.00	8.08	8.08

## Node Details cont'd

Node No.	Flow (lps)	Elev. (m )	H G L (m )	Pressure (m )
405	-1.236	0.00	7.55	7.55
406	-1.236	0.00	7.50	7.50
407	-1.236	0.00	7.56	7.56
408	-1.236	0.00	7.37	7.37
409	-1.236	0.00	7.25	7.25
410	-1.236	0.00	7.45	7.45
411	-1.236	0.00	7.14	7.14
412	-1.236	0.00	8.55	8.55
413	-1.236	0.00	8.47	8.47
414	-1.236	0.00	9.90	9.90
415	-1.236	0.00	9.66	9.66
416	-1.236	0.00	9.80	9.80
417	-1.236	0.00	9.64	9.64
418	-1.236	0.00	9.57	9.57
419	-1.236	0.00	10.64	10.64
420	-1.236	0.00	10.24	10.24
421	-1.236	0.00	10.13	10.13
422	-1.236	0.00	10.13	10.13
423	-1.236	0.00	10.37	10.37
424	-1.236	0.00	10.78	10.78
425	-1.236	0.00	10.43	10.43
426	-1.236	0.00	11.50	11.50
427	-1.236	0.00	14.91	14.91
428	-1.236	0.00	12.38	12.38
429	-1.236	0.00	12.18	12.18
430	-1.236	0.00	12.11	12.11
431	-1.236	0.00	11.60	11.60
432	-1.236	0.00	11.29	11.29
433	-1.236	0.00	11.16	11.16
434	-1.236	0.00	16.10	16.10
435	-1.236	0.00	15.12	15.12
436	-1.236	0.00	14.12	14.12
437	-1.236	0.00	13.57	13.57
438	-1.236	0.00	17.25	17.25
439	-1.236	0.00	16.62	16.62
440	-1.236	0.00	14.16	14.16
441	-1.236	0.00	14.05	14.05
442	-1.236	0.00	13.52	13.52
443	-1.236	0.00	13.42	13.42
444	-1.236	0.00	13.36	13.36
445	-1.236	0.00	12.82	12.82
446	-1.236	0.00	12.47	12.47
447	-1.236	0.00	12.47	12.47
448	-1.236	0.00	13.06	13.06
449	-1.236	0.00	17.38	17.38

## Node Details cont'd

Node No.	Flow (lps)	Elev. (m)	H G L (m)	Pressure (m)
450	-1.236	0.00	16.72	16.72
451	-1.236	0.00	16.35	16.35
452	-1.236	0.00	16.09	16.09
453	-1.236	0.00	16.00	16.00
454	-1.236	0.00	12.11	12.11
455	-1.236	0.00	12.27	12.27
456	-1.236	0.00	10.33	10.33
457	-1.236	0.00	14.11	14.11
458	-1.236	0.00	13.97	13.97
459	-1.236	0.00	8.05	8.05
460	-1.236	0.00	8.18	8.18
461	-1.236	0.00	8.04	8.04
462	-1.236	0.00	7.93	7.93
463	-1.236	0.00	7.82	7.82
464	-1.236	0.00	13.59	13.59
465	-1.236	0.00	16.11	16.11
466	-1.236	0.00	13.07	13.07
467	-1.236	0.00	12.50	12.50
468	-1.236	0.00	12.36	12.36
469	-1.236	0.00	12.31	12.31
470	-1.236	0.00	17.13	17.13
471	-1.236	0.00	7.77	7.77
472	-1.236	0.00	7.57	7.57

## Pipe Cost Summary

Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
100.0	DI	17350.00	14227.00	14227.00
150.0	DI	2480.00	2938.80	17165.80
200.0	DI	1370.00	2367.36	19533.16
300.0	DI	770.00	2310.77	21843.93
350.0	DI	60.00	227.04	22070.97



## Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
401	350.0	DI	60.00	227.04	227.04
488	200.0	DI	500.00	864.00	1091.04
404	150.0	DI	300.00	355.50	1446.54
405	100.0	DI	600.00	492.00	1938.54
410	150.0	DI	300.00	355.50	2294.04
489	100.0	DI	100.00	82.00	2376.04
413	100.0	DI	250.00	205.00	2581.04
490	100.0	DI	420.00	344.40	2925.44
415	100.0	DI	350.00	287.00	3212.44
417	100.0	DI	200.00	164.00	3376.44
418	100.0	DI	220.00	180.40	3556.84
419	100.0	DI	200.00	164.00	3720.84
508	100.0	DI	350.00	287.00	4007.84
422	100.0	DI	300.00	246.00	4253.84
423	100.0	DI	300.00	246.00	4499.84
424	100.0	DI	800.00	656.00	5155.84
425	150.0	DI	500.00	592.50	5748.34
491	150.0	DI	360.00	426.60	6174.94
427	100.0	DI	1000.00	820.00	6994.94
492	150.0	DI	250.00	296.25	7291.19
493	150.0	DI	120.00	142.20	7433.39
494	100.0	DI	600.00	492.00	7925.39
495	100.0	DI	360.00	295.20	8220.59
432	100.0	DI	200.00	164.00	8384.59
496	200.0	DI	270.00	466.56	8851.15
509	100.0	DI	350.00	287.00	9138.15
439	100.0	DI	700.00	574.00	9712.15
497	300.0	DI	720.00	2160.72	11872.87
442	100.0	DI	300.00	246.00	12118.87
498	100.0	DI	550.00	451.00	12569.87
444	100.0	DI	350.00	287.00	12856.87
499	100.0	DI	120.00	98.40	12955.27
500	100.0	DI	60.00	49.20	13004.47
447	100.0	DI	200.00	164.00	13168.47
449	100.0	DI	1000.00	820.00	13988.47
451	100.0	DI	300.00	246.00	14234.47
452	100.0	DI	300.00	246.00	14480.47
501	100.0	DI	60.00	49.20	14529.67
454	100.0	DI	120.00	98.40	14628.07
502	100.0	DI	120.00	98.40	14726.47
503	100.0	DI	200.00	164.00	14890.47
457	100.0	DI	700.00	574.00	15464.47
458	100.0	DI	400.00	328.00	15792.47
459	100.0	DI	300.00	246.00	16038.47
504	100.0	DI	420.00	344.40	16382.87

## Pipe-wise Cost Summary cont'd

Pipe No	Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
464	100.0	DI	850.00	697.00	17079.87
465	100.0	DI	300.00	246.00	17325.87
505	300.0	DI	50.00	150.05	17475.92
506	150.0	DI	60.00	71.10	17547.02
469	100.0	DI	300.00	246.00	17793.02
470	150.0	DI	120.00	142.20	17935.22
471	150.0	DI	120.00	142.20	18077.42
472	100.0	DI	360.00	295.20	18372.62
473	150.0	DI	350.00	414.75	18787.37
477	100.0	DI	420.00	344.40	19131.77
478	100.0	DI	240.00	196.80	19328.57
507	200.0	DI	600.00	1036.80	20365.37
480	100.0	DI	420.00	344.40	20709.77
481	100.0	DI	200.00	164.00	20873.77
482	100.0	DI	200.00	164.00	21037.77
483	100.0	DI	240.00	196.80	21234.57
484	100.0	DI	120.00	98.40	21332.97
485	100.0	DI	480.00	393.60	21726.57
486	100.0	DI	420.00	344.40	22070.97

L O O P

Version 4.0

Looped Water Distribution Network Design Program

LOOP: Looped Water Distribution Design Program - (C) The World Bank

Echoing Input Variables

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Title of the Project : ARAMBAGH W/S SCHEME ZONE V  
 Name of the User : C SEC  
 Number of Pipes : 29  
 Number of Nodes : 25  
 Type of Pipe Materials Used : DI/AC/  
 Number of Commercial Dia per Material : 5/3/  
 Peak Design Factor : 3  
 Newton-Raphson Stopping Criterion lps : .001  
 Minimum Pressure m : 7  
 Maximum Pressure m : 40  
 Design Hydraulic Gradient m in km : 10  
 Simulate or Design? (S/D) : S  
 No. of Res. Nodes with Fixed HGL : 1  
 No. of Res. Nodes with Variable HGL : 0  
 No. of Booster Pumps : 0  
 No. of Pressure Reducing Valves : 0  
 No. of Check Valves : 0  
 Type of Formula : Hazen's

Pipe Data

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Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material (E/P)	Status
501	501	503	60.00	150.0	140.00000	DI	
502	503	502	120.00	150.0	140.00000	AC	E
503	503	504	360.00	150.0	140.00000	AC	E
504	504	505	150.00	100.0	140.00000	DI	
505	504	506	360.00	80.0	140.00000	AC	E
506	506	507	300.00	100.0	140.00000	DI	
507	503	508	420.00	80.0	140.00000	AC	E
529	503	508	420.00	100.0	140.00000	DI	
508	508	509	200.00	100.0	140.00000	DI	
509	508	510	200.00	100.0	140.00000	DI	
510	503	511	400.00	80.0	140.00000	AC	E
511	506	511	420.00	100.0	140.00000	DI	
512	502	513	120.00	150.0	140.00000	AC	E
513	513	514	200.00	100.0	140.00000	DI	
514	513	515	180.00	150.0	140.00000	AC	E
515	511	515	700.00	100.0	140.00000	DI	
516	515	512	240.00	150.0	140.00000	AC	E
517	517	516	420.00	100.0	140.00000	DI	
518	518	517	300.00	100.0	140.00000	DI	
519	516	519	600.00	100.0	140.00000	AC	E
520	519	520	240.00	100.0	140.00000	AC	E
521	519	521	300.00	100.0	140.00000	DI	



## Pipe Data cont'd

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Pipe Material	Status (E/P)
522	512	518	240.00	150.0	140.00000	AC	E
523	518	516	180.00	150.0	140.00000	AC	E
524	512	523	240.00	100.0	140.00000	DI	
525	523	524	120.00	100.0	140.00000	DI	
526	523	518	240.00	100.0	140.00000	DI	
527	518	525	240.00	100.0	140.00000	DI	
528	516	522	300.00	100.0	140.00000	DI	

## Node Data

Node No.	Peak	Flow lps	Elevation m	Min Press m	Max Press m
501	3.00	0.000	0.00	7.00	40.00
502	3.00	-0.299	0.00	7.00	40.00
503	3.00	-0.299	0.00	7.00	40.00
504	3.00	-0.299	0.00	7.00	40.00
505	3.00	-0.299	0.00	7.00	40.00
506	3.00	-0.299	0.00	7.00	40.00
507	3.00	-0.299	0.00	7.00	40.00
508	3.00	-0.299	0.00	7.00	40.00
509	3.00	-0.299	0.00	7.00	40.00
510	3.00	-0.299	0.00	7.00	40.00
511	3.00	-0.299	0.00	7.00	40.00
512	3.00	-0.299	0.00	7.00	40.00
513	3.00	-0.299	0.00	7.00	40.00
514	3.00	-0.299	0.00	7.00	40.00
515	3.00	-0.299	0.00	7.00	40.00
516	3.00	-0.299	0.00	7.00	40.00
517	3.00	-0.299	0.00	7.00	40.00
518	3.00	-0.299	0.00	7.00	40.00
519	3.00	-0.299	0.00	7.00	40.00
520	3.00	-0.299	0.00	7.00	40.00
521	3.00	-0.299	0.00	7.00	40.00
522	3.00	-0.299	0.00	7.00	40.00
523	3.00	-0.299	0.00	7.00	40.00
524	3.00	-0.299	0.00	7.00	40.00
525	3.00	-0.299	0.00	7.00	40.00

## Fixed Head Reservoir Data

Source Node	Head m	Ref Res? (R)
501	11.00	R

## Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length	Allow Press m	Pipe Material
100.0	140.00000	820.00	120.00	DI
150.0	140.00000	1185.00	120.00	DI
200.0	140.00000	1728.00	120.00	DI
250.0	140.00000	2328.00	120.00	DI
300.0	140.00000	3001.00	120.00	DI
80.0	140.00000	247.00	40.00	AC
100.0	140.00000	301.00	40.00	AC
150.0	140.00000	464.00	40.00	AC

## Looped Water Distribution Network Design Output

BandWidth	=	2
Number of Loops	=	5
Newton Raphson Iterations	=	6

## Pipe Details

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
501	501	503	21.528	150.0	0.57	9.55	60.00	1.22
502	503	502	12.321	150.0	0.41	3.40	120.00	0.70
503	503	504	3.683	150.0	0.13	0.36	360.00	0.21
504	504	505	0.897	100.0	0.03	0.19	150.00	0.11

## Pipe Details cont'd

Pipe No.	From Node	To Node	Flow (lps)	Dia (mm)	HL (m)	HL/1000m (m)	Length (m)	Velocity (m/s)
505	504	506	1.889	80.0	0.81	2.25	360.00	0.38
506	506	507	0.897	100.0	0.06	0.19	300.00	0.11
507	503	508	0.962	80.0	0.27	0.64	420.00	0.19
529	503	508	1.729	100.0	0.27	0.64	420.00	0.22
508	508	509	0.897	100.0	0.04	0.19	200.00	0.11
509	508	510	0.897	100.0	0.04	0.19	200.00	0.11
510	503	511	1.936	80.0	0.94	2.36	400.00	0.39
511	506	511	0.095	100.0	0.00	0.00	420.00	0.01
512	502	513	11.424	150.0	0.35	2.95	120.00	0.65
513	513	514	0.897	100.0	0.04	0.19	200.00	0.11
514	513	515	9.630	150.0	0.39	2.15	180.00	0.54
515	511	515	1.134	100.0	0.21	0.30	700.00	0.14
516	515	512	9.867	150.0	0.54	2.25	240.00	0.56
517	517	516	0.192	100.0	0.00	0.01	420.00	0.02
518	518	517	1.089	100.0	0.08	0.27	300.00	0.14
519	516	519	2.691	100.0	0.88	1.46	600.00	0.34
520	519	520	0.897	100.0	0.05	0.19	240.00	0.11
521	519	521	0.897	100.0	0.06	0.19	300.00	0.11
522	512	518	6.719	150.0	0.27	1.11	240.00	0.38
523	518	516	4.293	150.0	0.09	0.48	180.00	0.24
524	512	523	2.251	100.0	0.25	1.05	240.00	0.29
525	523	524	0.897	100.0	0.02	0.19	120.00	0.11
526	523	518	0.457	100.0	0.01	0.05	240.00	0.06
527	518	525	0.897	100.0	0.05	0.19	240.00	0.11
528	516	522	0.897	100.0	0.06	0.19	300.00	0.11

Note: Negative value indicates the flow in reverse direction in that Pipe

## Pipe Pressure Details

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m)	Allow Press (m)	Status (E/P)
501	501	503	150.0	140.00000	DI	11.00	120.00	
502	503	502	150.0	140.00000	AC	10.43	40.00	E
503	503	504	150.0	140.00000	AC	10.43	40.00	E
504	504	505	100.0	140.00000	DI	10.30	120.00	
505	504	506	80.0	140.00000	AC	10.30	40.00	E
506	506	507	100.0	140.00000	DI	9.49	120.00	
507	503	508	80.0	140.00000	AC	10.43	40.00	E
529	503	508	100.0	140.00000	DI	10.43	120.00	

## Pipe Pressure Details cont'd

Pipe No.	From Node	To Node	Dia (mm)	Hazen's Const	Pipe Material	Max Press (m )	Allow Press (m )	Status (E/P)
508	508	509	100.0	140.00000	DI	10.16	120.00	
509	508	510	100.0	140.00000	DI	10.16	120.00	
510	503	511	80.0	140.00000	AC	10.43	40.00	E
511	506	511	100.0	140.00000	DI	9.49	120.00	
512	502	513	150.0	140.00000	AC	10.02	40.00	E
513	513	514	100.0	140.00000	DI	9.67	120.00	
514	513	515	150.0	140.00000	AC	9.67	40.00	E
515	511	515	100.0	140.00000	DI	9.48	120.00	
516	515	512	150.0	140.00000	AC	9.28	40.00	E
517	517	516	100.0	140.00000	DI	8.39	120.00	
518	518	517	100.0	140.00000	DI	8.47	120.00	
519	516	519	100.0	140.00000	AC	8.39	40.00	E
520	519	520	100.0	140.00000	AC	7.51	40.00	E
521	519	521	100.0	140.00000	DI	7.51	120.00	
522	512	518	150.0	140.00000	AC	8.74	40.00	E
523	518	516	150.0	140.00000	AC	8.47	40.00	E
524	512	523	100.0	140.00000	DI	8.74	120.00	
525	523	524	100.0	140.00000	DI	8.49	120.00	
526	523	518	100.0	140.00000	DI	8.49	120.00	
527	518	525	100.0	140.00000	DI	8.47	120.00	
528	516	522	100.0	140.00000	DI	8.39	120.00	

## Node Details

Node No.	Flow (lps)	Elev. (m )	H G L (m )	Pressure (m )
501 S	21.528	0.00	11.00	11.00
502	-0.897	0.00	10.02	10.02
503	-0.897	0.00	10.43	10.43
504	-0.897	0.00	10.30	10.30
505	-0.897	0.00	10.27	10.27
506	-0.897	0.00	9.49	9.49
507	-0.897	0.00	9.43	9.43
508	-0.897	0.00	10.16	10.16
509	-0.897	0.00	10.12	10.12
510	-0.897	0.00	10.12	10.12
511	-0.897	0.00	9.48	9.48
512	-0.897	0.00	8.74	8.74
513	-0.897	0.00	9.67	9.67
514	-0.897	0.00	9.63	9.63



## Node Details cont'd

Node No.	Flow (lps)	Elev. (m)	H G L (m)	Pressure (m)
515	-0.897	0.00	9.28	9.28
516	-0.897	0.00	8.39	8.39
517	-0.897	0.00	8.39	8.39
518	-0.897	0.00	8.47	8.47
519	-0.897	0.00	7.51	7.51
520	-0.897	0.00	7.46	7.46
521	-0.897	0.00	7.45	7.45
522	-0.897	0.00	8.33	8.33
523	-0.897	0.00	8.49	8.49
524	-0.897	0.00	8.46	8.46
525	-0.897	0.00	8.43	8.43

## Pipe Cost Summary

Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
100.0	DI	4750.00	3895.00	3895.00
150.0	DI	60.00	71.10	3966.10

## Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
501	150.0	DI	60.00	71.10	71.10
504	100.0	DI	150.00	123.00	194.10
506	100.0	DI	300.00	246.00	440.10
529	100.0	DI	420.00	344.40	784.50
508	100.0	DI	200.00	164.00	948.50
509	100.0	DI	200.00	164.00	1112.50
511	100.0	DI	420.00	344.40	1456.90
513	100.0	DI	200.00	164.00	1620.90
515	100.0	DI	700.00	574.00	2194.90
517	100.0	DI	420.00	344.40	2539.30
518	100.0	DI	300.00	246.00	2785.30
521	100.0	DI	300.00	246.00	3031.30

## Pipe-wise Cost Summary cont'd

Pipe No	Diameter (mm)	Pipe Material	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
524	100.0	DI	240.00	196.80	3228.10
525	100.0	DI	120.00	98.40	3326.50
526	100.0	DI	240.00	196.80	3523.30
527	100.0	DI	240.00	196.80	3720.10
528	100.0	DI	300.00	246.00	3966.10

CHAPTER - XIV

DETAILED ESTIMATION OF COST  
AND  
ABSTRACT OF ESTIMATED CAPITAL COSTS

Abstract of Estimated Capital Cost for five Zones :-

ZONE - I	Rs. 62.61 lakh
ZONE - II	Rs. 311.20 lakh
ZONE - III	Rs. 300.42 lakh
ZONE - IV	Rs. 330.25 lakh
ZONE - V	Rs. 85.05 lakh
<b>TOTAL</b>	<b>Rs. 1089.52 lakh</b>
Add contingencies @3%	Rs. 32.69 lakh
<b>TOTAL PROJECT COST</b>	<b>Rs. 1122.21 lakh</b>
Add incentives @5%	Rs. 56.11 lakh
<b>ABSTRACT OF COST</b>	<b>Rs. 1178.32 lakh</b>

(Rupees eleven crore seventy eight lakh and thirty two thousand only)

Zone-wise detailed cost estimate has been annexed in the following pages.

**SUMMARY OF CAPITAL COST ESTIMATE FOR ZONE - I COVERING WARD NO. 3, 4, 5 & 14**

SL. NO.	ITEM	QTY.	RATE (Rs)	UNIT	AMOUNT (CIVIL) (Rs)	AMOUNT (MECH.) (Rs)
1	Cost of renovation of existing RCC Elevated Reservoir of Capacity - 450 cum, staging height - 16.76 m	450	410.00	cum	184500.00	
2	Laying of Distribution System including all type of specials, valves, etc. all complete. Based on actual Estimate as given in Page 202.	1	6076524.00	Each	6076524.00	
<b>TOTAL =</b>					<b>6261024.00</b>	<b>0.00</b>

**GRAND TOTAL = Rs. 6261024.00**

**Say 62.61 Lakh**



**SUMMARY OF CAPITAL COST ESTIMATE FOR ZONE - II COVERING WARD NO. 1, 2 & 13**

SL NO	ITEM	QTY.	RATE (Rs)	UNIT	AMOUNT (CIVIL) (Rs)	AMOUNT (MECH.) (Rs)
1	Cost of Construction of 3.0 mtr x 2.4 mtr Chlorine Room	1	72000.00	Each	72000.00	
2	Supply and installation of Chlorinator in Chlorine room	1	58000.00	Each		58000.00
3	Supply & installation of electrically operated pumping machinaries a) Submersible pump of rating 19 lps x 37 m with 16 HP/12 KW motor b) Horizontal split case Centrifugal pump of rating 45 lps x 32 m with 34 HP/25 KW motor	4 2	150000.00 350000.00	Each Each		600000.00 700000.00
4	Construction of RCC Elevated Reservoir of Capacity - 500 cum, staging height - 20 m including pipe connection.	500000	7.50	Litre	3750000.00	
5	Laying of D.I pipe (Class K-9) Rising Main including cost of material. a) Tube well to CWR: 150 mm dia b) CWR to OHR: 250 mm dia	4020 50	1464.00 2554.00	Meter Meter	5885280.00 127700.00	
6	Cost of Construction of RCC Clear Water Reservoir with high lift pump house including pipe connection.	80000	9.50	litre	760000.00	
7	Laying of Distribution System including all type of specials, valves, etc. all complete. Based on actual Estimate as given in Page 203.	1	18666800.00	Each	18666800.00	
8	Cost of permanent electrification.	1	500000.00	Each		500000.00
<b>TOTAL =</b>					<b>29261780.00</b>	<b>1858000.00</b>

**GRAND TOTAL = Rs. 31119780.00**

Say **311.20** Lakh

**SUMMARY OF CAPITAL COST ESTIMATE FOR ZONE - III COVERING WARD NO. 9, 10, 11 & 17**

SL NO	ITEM	QTY.	RATE (Rs)	UNIT	AMOUNT (CIVIL) (Rs)	AMOUNT (MECH.) (Rs)
1	Provision for 40 mm dia trial boring upto a depth of 200 m below GL with labour, materials etc. including pumping test & chemical analysis of water sample to ascertain probable quantity & quality of water.	1	20000.00	Each	20000.00	
2	Sinking of 300 mm x 200 mm dia 150 m deep tube well with 300 mm dia 35 m long housing pipe, 200 mm dia 85 m long well pipe and 200 mm dia 30 m long Fibre glass strainer all complete including cost of material. (ref. Page 201).	1	533275.00	Each	533275.00	
3	a) Cost of Construction of 3.6 mtr x 3.0 mtr Pump house	1	108000.00	Each	108000.00	
	b) Cost of Construction of 3.0 mtr x 2.4 mtr Chlorine Room	1	72000.00	Each	72000.00	
4	Supply and installation of Chlorinator in Chlorine room	1	58000.00	Each		58000.00
5	Supply & installation of electrically operated pumping machinaries					
	a) Submersible pump of rating 14 lps x 25 m with 8 HP/6 KW motor	4	150000.00	Each		600000.00
6	b) Horizontal split case Centrifugal pump of rating 32 lps x 32 m with 24 HP/18 KW motor	2	350000.00	Each		700000.00
	Construction of RCC Elevated Reservoir of Capacity - 350 cum, staging height - 20 m including pipe connection.	350000	8.20	Litre	2870000.00	

**SUMMARY OF CAPITAL COST ESTIMATE FOR ZONE - III COVERING WARD NO. 9, 10, 11 & 17**

SL NO	ITEM	QTY.	RATE (Rs)	UNIT	AMOUNT (CIVIL) (Rs)	AMOUNT (MECH.) (Rs)
7	Laying of D.I pipe (Class K-9) Rising Main including cost of material. a) Tube well to CWR: 150 mm dia b) CWR to OHR: 250 mm dia	830 50	1464.00 2554.00	Meter Meter	1215120.00 127700.00	
8	Cost of Construction of RCC Clear Water Reservoir with high lift pump house including pipe connection.	60000	9.50	litre	570000.00	
9	Laying of Distribution System including all type of specials, valves, etc. all complete. Based on actual Estimate as given in Page 204.	1	22167417.00	Each	22167417.00	
10	Cost of permanent electrification.	1	500000.00	Each		500000.00
11	Cost of power transmission line including service connection charges all complete	1	500000.00	per Instl		500000.00
<b>TOTAL =</b>					<b>27683512.00</b>	<b>2358000.00</b>

**GRAND TOTAL = Rs. 30041512.00**

**Say 300.42 Lakh**



**SUMMARY OF CAPITAL COST ESTIMATE FOR ZONE - IV COVERING WARD NO. 6, 7, 8, 15 & 16**

SL NO	ITEM	QTY.	RATE (Rs)	UNIT	AMOUNT (CIVIL) (Rs)	AMOUNT (MECH.) (Rs)
1	Provision for 40 mm dia trial boring upto a depth of 200 m below GL with labour, materials etc. including pumping test & chemical analysis of water sample to ascertain probable quantity & quality of water.	2	20000.00	Each	40000.00	
2	Sinking of 300 mm x 200 mm dia 150 m deep tube well with 300 mm dia 35 m long housing pipe, 200 mm dia 85 m long well pipe and 200 mm dia 30 m long Fibre glass strainer all complete including cost of material. (ref. Page 201).	2	533275.00	Each	1066550.00	
3	a) Cost of Construction of 3.6 mtr x 3.0 mtr Pump house b) Cost of Construction of 3.0 mtr x 2.4 mtr Chlorine Room	1 1	108000.00 72000.00	Each Each	108000.00 72000.00	
4	Supply and installation of Chlorinator in Chlorine room	1	58000.00	Each		58000.00
5	Supply & installation of electrically operated pumping machinaries a) Submersible pump of rating 17 lps x 26 m with 10 HP/7.5 KW motor b) Horizontal split case Centrifugal pump of rating 51 lps x 32 m with 38 HP/28 KW motor	4 2	150000.00 350000.00	Each Each		600000.00 700000.00
6	Construction of RCC Elevated Reservoir of Capacity - 550 cum, staging height - 20 m including pipe connection.	550000	7.50	Litre	4125000.00	



SUMMARY OF CAPITAL COST ESTIMATE FOR ZONE - IV COVERING WARD NO. 6, 7, 8, 15 & 16

SL NO	ITEM	QTY.	RATE (Rs)	UNIT	AMOUNT (CIVIL) (Rs)	AMOUNT (MECH.) (Rs)
7	Laying of D.I pipe (Class K-9) Rising Main including cost of material. a) Tube well to CWR: 150 mm dia b) CWR to OHR: 250 mm dia	1430 50	1464.00 2554.00	Meter Meter	2093520.00 127700.00	
8	Cost of Construction of RCC Clear Water Reservoir with high lift pump house including pipe connection.	90000	9.50	litre	855000.00	
9	Laying of Distribution System including all type of specials, valves, etc. all complete. Based on actual Estimate as given in Page 205.	1	22178988.00	Each	22178988.00	
10	Cost of permanent electrification.	1	500000.00	Each		500000.00
11	Cost of power transmission line including service connection charges all complete	1	500000.00	per Instl		500000.00

TOTAL = 30666758.00

GRAND TOTAL = Rs. 33024758.00

Say

330.25

Lakh

SUMMARY OF CAPITAL COST ESTIMATE FOR ZONE - V COVERING WARD NO. 12 & 18

SL NO	ITEM	QTY.	RATE (Rs)	UNIT	AMOUNT (CIVIL) (Rs)	AMOUNT (MECH.) (Rs)
1	Provision for 40 mm dia trial boring upto a depth of 200 m below GL with labour, materials etc. including pumping test & chemical analysis of water sample to ascertain probable quantity & quality of water.	2	20000.00	Each	40000.00	
2	Sinking of 300 mm x 200 mm dia 150 m deep tube well with 300 mm dia 35 m long housing pipe, 200 mm dia 85 m long well pipe and 200 mm dia 30 m long Fibre glass strainer all complete including cost of material. (ref. Page 201).	2	533275.00	Each	1066550.00	
3	a) Cost of Construction of 3.6 mtr x 3.0 mtr Pump house	1	108000.00	Each	108000.00	
	b) Cost of Construction of 3.0 mtr x 2.4 mtr Chlorine Room	1	72000.00	Each	72000.00	
4	Supply and installation of Chlorinator in Chlorine room	1	58000.00	Each		58000.00
5	Supply & installation of electrically operated pumping machinaries					
	a) Submersible pump of rating 13 lps x 41 m with 12 HP/9 KW motor	2	150000.00	Each		300000.00
6	Construction of RCC Elevated Reservoir of Capacity - 135 cum, staging height - 13.6 m including pipe connection.	135000	10.00	Litre	1350000.00	
7	Laying of D.I pipe (Class K-9) Rising Main including cost of material.					
	a) Tube well to OHR: 150 mm dia	350	1464.00	Meter	512400.00	

SUMMARY OF CAPITAL COST ESTIMATE FOR ZONE - V COVERING WARD NO. 12 & 18

SL NO	ITEM	QTY.	RATE (Rs)	UNIT	AMOUNT (CIVIL) (Rs)	AMOUNT (MECH.) (Rs)
8	Laying of Distribution System including all type of specials, valves, etc. all complete. Based on actual Estimate as given in Page 206.	1	3997624.00	Each	3997624.00	
9	Cost of permanent electrification.	1	500000.00	L.S.		500000.00
10	Cost of power transmission line including service connection charges all complete	1	500000.00	per Instl		500000.00
<b>TOTAL =</b>					<b>7146574.00</b>	<b>1358000.00</b>

**GRAND TOTAL = Rs. 8504574.00**

**Say**

**85.05**

**Lakh**

DETAILED ESTIMATE OF TUBE WELL (300 mm x 200 mm SIZE) FOR  
ARAMBAGH MUNICIPAL WATER SUPPLY SCHEME

Sl. No.	ITEMS	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
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**A) LABOUR CHARGES**

1)	Boring by drilling rig (475mm drill bit for direct & 559 mm drill bit for reverse). (Total 150 m boring depth)				
	a) Upto 120 m depth.	120	M	705.00	84600.00
	b) Above 120 m and up to 180 m depth.	30	M	800.00	24000.00
2)	Fitting, fixing, jointing by welding or otherwise, lowering etc.				
	a) Housing Pipe 300 mm dia.	35	M	145.00	5075.00
	b) Fibre Glass Strainer 200 mm dia.	30	M	166.00	4980.00
	c) Blank Pipe 200 mm dia.	85	M	92.00	7820.00
3)	Supplying and fitting (Bottom plug, reducer, cap, clamp, guide etc.)	3800.00	1 item	3800.00	3800.00
4)	Washed Gravel / Grit Shrouding	14	Cum	750.00	10500.00
5)	Cement Sealing to restrict entry of Arsenic contaminated water to the yielding aquifer	20000.00	1 item	20000.00	20000.00
6)	Surging / Development & Yield test	11000.00	1 item	11000.00	11000.00
7)	Transport of tubewell materials from departmental store.	5500.00	1 item	5500.00	5500.00
8)	Mobilisation and site clearance	7000.00	1 item	7000.00	7000.00
9)	Electrical logging in the bore hole	15000.00	1 item	15000.00	15000.00
10)	Chemical and Biological testing of water sample	5000.00	1 item	5000.00	5000.00
				<b>TOTAL (A) =</b>	<b>204275.00</b>

**B) COST OF MATERIALS**

1)	ERW pipes				
	a) 300 mm dia.	35	M	2700.00	94500.00
	b) 200 mm dia.	85	M	1700.00	144500.00
2)	Fibre Glass Strainer (7mm thk)				
	a) 200 mm dia.	30	M	3000.00	90000.00
				<b>TOTAL (B) =</b>	<b>329000.00</b>

<b>TOTAL COST OF CONSTRUCTION</b>	<b>TOTAL (A + B)</b>	<b>=</b>	<b>533275.00</b>
<b>Rupees five lakh thirty three thousand two hundred seventy five only</b>			



**DETAILED ESTIMATE FOR DISTRIBUTION SYSTEM FOR ARAMBAGH  
MUNICIPAL WATER SUPPLY SCHEME  
(ZONE - I)**

SI No	Items	Quantity	Unit	Rate (Rs.)	Amount (Rs.)
1	Supplying, laying, fitting, fixing and jointing with rubber gaskets DI (K7) pipe/Tyton pipe with all specials and valves upto an average depth so as to maintain throughout the length of pipe line an average cushion of one metre over the top of pipe including cutting trenches in any kind of soil, backfilling in layers, including testing and disinfection of pipeline all complete				
	a) 300 mm dia	50	Mtr.	3001.00	150050.00
	b) 100 mm dia	7170	Mtr.	820.00	5879400.00
2	Making flange joints with supply of rubber insertion, bolts, nuts etc. complete.				
	a) 300 mm dia	2	Each	343.00	686.00
	b) 100 mm dia	18	Each	137.00	2466.00
3	Making socket joints to DISS pipes & specials with supply of lead yarn etc. all complete.				
	a) 300 mm dia	1	Each	787.00	787.00
	b) 100 mm dia	15	Each	245.00	3675.00
4	Construction of masonry sluice valve chamber as per departmental type design having walls of 1st. Class brickworks in cement mortars (1:6) with weep holes at bottom including supply of CI surface box of approved design, fitting & fixing the same etc. all complete.				
	a) 300 mm dia	1	Each	5680.00	5680.00
	b) 100 mm dia	4	Each	3820.00	15280.00
5	Provision for wash out connection with supply of necessary specials, valves of approved quality with construction of masonry sluice valve chamber as per PHE Department's type design etc. complete	5	Each	3700.00	18500.00

**TOTAL : Rs. 6076524.00**  
say Rs. 60.77 lakh

**DETAILED ESTIMATE FOR DISTRIBUTION SYSTEM FOR ARAMBAGH  
MUNICIPAL WATER SUPPLY SCHEME  
(ZONE - II)**

Sl No	Items	Quantity	Unit	Rate (Rs.)	Amount (Rs.)
1	Supplying, laying, fitting, fixing and jointing with rubber gaskets DI (K7) pipe/Tyton pipe with all specials and valves upto an average depth so as to maintain throughout the length of pipe line an average cushion of one metre over the top of pipe including cutting trenches in any kind of soil, backfilling in layers, including testing and disinfection of pipeline all complete				
	a) 300 mm dia	110	Mtr.	3001.00	330110.00
	b) 250 mm dia	300	Mtr.	2328.00	698400.00
	c) 200 mm dia	480	Mtr.	1728.00	829440.00
	d) 150 mm dia	2440	Mtr.	1185.00	2891400.00
	e) 100 mm dia	16820	Mtr.	820.00	13792400.00
2	Making flange joints with supply of rubber insertion, bolts, nuts etc. complete.				
	a) 300 mm dia	2	Each	343.00	686.00
	b) 250 mm dia	4	Each	325.00	1300.00
	c) 200 mm dia	4	Each	222.00	888.00
	d) 150 mm dia	6	Each	215.00	1290.00
	e) 100 mm dia	34	Each	137.00	4658.00
3	Making socket joints to DISS pipes & specials with supply of lead yarn etc. all complete.				
	a) 300 mm dia	1	Each	787.00	787.00
	b) 250 mm dia	2	Each	645.00	1290.00
	c) 200 mm dia	2	Each	533.00	1066.00
	d) 150 mm dia	6	Each	375.00	2250.00
	e) 100 mm dia	35	Each	245.00	8575.00
4	Construction of masonry sluice valve chamber as per departmental type design having walls of 1st. Class brickworks in cement mortars (1:6) with weep holes at bottom including supply of CI surface box of approved design, fitting & fixing the same etc. all complete.				
	a) 300 mm dia	1	Each	5680.00	5680.00
	b) 250 mm dia	2	Each	5680.00	11360.00
	c) 200 mm dia	2	Each	4950.00	9900.00
	d) 150 mm dia	3	Each	3820.00	11460.00
	e) 100 mm dia	8	Each	3820.00	30560.00
5	Provision for wash out connection with supply of necessary specials, valves of approved quality with construction of masonry sluice valve chamber as per PHE Department's type design etc. complete				
		9	Each	3700.00	33300.00

**TOTAL : Rs. 18666800.00**

**say Rs. 186.67 lakh**

**DETAILED ESTIMATE FOR DISTRIBUTION SYSTEM FOR ARAMBAGH  
MUNICIPAL WATER SUPPLY SCHEME  
(ZONE - III)**

Sl No	Items	Quantity	Unit	Rate (Rs.)	Amount (Rs.)
1	Supplying, laying, fitting, fixing and jointing with rubber gaskets DI (K7) pipe/Tyton pipe with all specials and valves upto an average depth so as to maintain throughout the length of pipe line an average cushion of one metre over the top of pipe including cutting trenches in any kind of soil, backfilling in layers, including testing and disinfection of pipeline all complete				
	a) 300 mm dia	60	Mtr.	3001.00	180060.00
	b) 200 mm dia	980	Mtr.	1728.00	1693440.00
	c) 150 mm dia	2110	Mtr.	1185.00	2500350.00
	d) 100 mm dia	21530	Mtr.	820.00	17654600.00
2	Making flange joints with supply of rubber insertion, bolts, nuts etc. complete.				
	a) 300 mm dia	2	Each	343.00	686.00
	b) 200 mm dia	6	Each	222.00	1332.00
	c) 150 mm dia	6	Each	215.00	1290.00
	d) 100 mm dia	44	Each	137.00	6028.00
3	Making socket joints to DISS pipes & specials with supply of lead yarn etc. all complete.				
	a) 300 mm dia	1	Each	787.00	787.00
	b) 200 mm dia	3	Each	533.00	1599.00
	c) 150 mm dia	5	Each	375.00	1875.00
	d) 100 mm dia	44	Each	245.00	10780.00
4	Construction of masonry sluice valve chamber as per departmental type design having walls of 1st. Class brickworks in cement mortars (1:6) with weep holes at bottom including supply of CI surface box of approved design, fitting & fixing the same etc. all complete.				
	a) 300 mm dia	1	Each	5680.00	5680.00
	b) 200 mm dia	3	Each	4950.00	14850.00
	c) 150 mm dia	3	Each	3820.00	11460.00
	d) 100 mm dia	10	Each	3820.00	38200.00
5	Provision for wash out connection with supply of necessary specials, valves of approved quality with construction of masonry sluice valve chamber as per PHE Department's type design etc. complete				
		12	Each	3700.00	44400.00

**TOTAL : Rs. 22167417.00**  
**say Rs. 221.67 lakh**



**DETAILED ESTIMATE FOR DISTRIBUTION SYSTEM FOR ARAMBAGH  
MUNICIPAL WATER SUPPLY SCHEME  
(ZONE - IV)**

Sl No	Items	Quantity	Unit	Rate (Rs.)	Amount (Rs.)
1	Supplying, laying, fitting, fixing and jointing with rubber gaskets DI (K7) pipe/Tyton pipe with all specials and valves upto an average depth so as to maintain throughout the length of pipe line an average cushion of one metre over the top of pipe including cutting trenches in any kind of soil, backfilling in layers, including testing and disinfection of pipeline all complete				
	a) 350 mm dia	60	Mtr.	3001.00	180060.00
	b) 300 mm dia	770	Mtr.	3001.00	2310770.00
	c) 200 mm dia	1370	Mtr.	1728.00	2367360.00
	d) 150 mm dia	2480	Mtr.	1185.00	2938800.00
	e) 100 mm dia	17350	Mtr.	820.00	14227000.00
2	Making flange joints with supply of rubber insertion, bolts, nuts etc. complete.				
	a) 350 mm dia	2	Each	343.00	686.00
	b) 300 mm dia	8	Each	343.00	2744.00
	c) 200 mm dia	8	Each	222.00	1776.00
	d) 150 mm dia	6	Each	215.00	1290.00
	e) 100 mm dia	36	Each	137.00	4932.00
3	Making socket joints to DISS pipes & specials with supply of lead yarn etc. all complete.				
	a) 350 mm dia	1	Each	787.00	787.00
	b) 300 mm dia	3	Each	787.00	2361.00
	c) 200 mm dia	4	Each	533.00	2132.00
	d) 150 mm dia	6	Each	375.00	2250.00
	e) 100 mm dia	36	Each	245.00	8820.00
4	Construction of masonry sluice valve chamber as per departmental type design having walls of 1st. Class brickworks in cement mortars (1:6) with weep holes at bottom including supply of CI surface box of approved design, fitting & fixing the same etc. all complete.				
	a) 350 mm dia	1	Each	5680.00	5680.00
	b) 300 mm dia	4	Each	5680.00	22720.00
	c) 200 mm dia	4	Each	4950.00	19800.00
	d) 150 mm dia	3	Each	3820.00	11460.00
	e) 100 mm dia	8	Each	3820.00	30560.00
5	Provision for wash out connection with supply of necessary specials, valves of approved quality with construction of masonry sluice valve chamber as per PHE Department's type design etc. complete				
		10	Each	3700.00	37000.00

**TOTAL : Rs. 22178988.00**

**say Rs. 221.79 lakh**



**DETAILED ESTIMATE FOR DISTRIBUTION SYSTEM FOR ARAMBAGH  
MUNICIPAL WATER SUPPLY SCHEME  
(ZONE - V)**

SI No	Items	Quantity	Unit	Rate (Rs.)	Amount (Rs.)
1	Supplying, laying, fitting, fixing and jointing with rubber gaskets DI (K7) pipe/Tyton pipe with all specials and valves upto an average depth so as to maintain throughout the length of pipe line an average cushion of one metre over the top of pipe including cutting trenches in any kind of soil, backfilling in layers, including testing and disinfection of pipeline all complete				
	a) 150 mm dia	60	Mtr.	1185.00	71100.00
	b) 100 mm dia	4750	Mtr.	820.00	3895000.00
2	Making flange joints with supply of rubber insertion, bolts, nuts etc. complete.				
	a) 150 mm dia	2	Each	215.00	430.00
	b) 100 mm dia	12	Each	137.00	1644.00
3	Making socket joints to DISS pipes & specials with supply of lead yarn etc. all complete.				
	a) 150 mm dia	1	Each	375.00	375.00
	b) 100 mm dia	11	Each	245.00	2695.00
4	Construction of masonry sluice valve chamber as per departmental type design having walls of 1st. Class brickworks in cement mortars (1:6) with weep holes at bottom including supply of CI surface box of approved design, fitting & fixing the same etc. all complete.				
	a) 150 mm dia	1	Each	3820.00	3820.00
	b) 100 mm dia	3	Each	3820.00	11460.00
5	Provision for wash out connection with supply of necessary specials, valves of approved quality with construction of masonry sluice valve chamber as per PHE Department's type design etc. complete	3	Each	3700.00	11100.00

**TOTAL : Rs. 3997624.00**  
say Rs. 39.98 lakh

**CHAPTER - XV**  
**FINANCIAL ANALYSIS**

**COST ESTIMATE**

The Abstract of the Cost estimate of various components of the project is as follows:

- |                   |                                 |                  |
|-------------------|---------------------------------|------------------|
| 1. Water Supply : | Estimated cost                  | Rs. 1122.21 Lakh |
|                   | (including contingencies @ 3 %) |                  |

**SOURCE OF FUNDING**

The project shall be funded from 80 % of Govt. of India, 10 % State Govt. and balance 10 % ULB share. The grant from the Central Govt. shall be available from Urban Infrastructure Development Scheme for Small & Medium Towns (UIDSSMT) fund.

**Financial pattern**

Total expenditure to be made for execution of the project:	Rs. 1122.21 Lakh
Share of GOI (80 %)	: Rs. 897.77 Lakh
Share of the State Govt. (10 %)	: Rs. 112.22 Lakh
Share of the ULB (10 %)	: Rs. 112.22 Lakh

**REVENUE SOURCE OF THE MUNICIPALITIES FOR THE PROJECT**

Execution of such project is obligation of the Municipalities and State Government, and therefore the required ULB's share of the project to be pooled by Municipalities shall be made available through its own resources in the interest of the Town. The Municipalities will arrange source of fund mainly from the following heads of Municipal Revenues :

- Property Tax on Land & Buildings
- Tax on Advertisements and Rents
- Professional Tax, Carts and Carriages
- Building Approvals & Licenses.

**FUND FLOW PATTERN**

(Rupees in Lakh)

SL. NO.	NAME OF THE SCHEME	ESTIMATED COST	YEAR								TOTAL
			2006-07				2007-08				
			GOI	GOWB	ULB	TOTAL	GOI	GOWB	ULB	TOTAL	
1	Water Supply Scheme	1122.21	448.885	56.11	56.11	561.105	448.885	56.11	56.11	561.105	1122.21
	<b>Total</b>	<b>1122.21</b>	<b>448.885</b>	<b>56.11</b>	<b>56.11</b>	<b>561.105</b>	<b>448.885</b>	<b>56.11</b>	<b>56.11</b>	<b>561.105</b>	<b>1122.21</b>

**YEAR WISE PHASING OF FUND**

(Rupees in Lakh)

YEAR	RELEASE OF FUND			TOTAL
	GOI	GOWB	ULB	
2006-07	448.885	56.11	56.11	561.105
2007-08	448.885	56.11	56.11	561.105
<b>TOTAL</b>	<b>897.77</b>	<b>112.22</b>	<b>112.22</b>	<b>1122.21</b>

**REQUIREMENT OF FUND**

(Rupees in Lakh)

SL. No.	Name of the Scheme	2006-07	2007-08	TOTAL
1	Water Supply Scheme	561.105	561.105	1122.21
<b>TOTAL</b>		<b>810.89</b>	<b>810.89</b>	<b>1122.21</b>

CHAPTER - XVI  
COSTS OF OPERATION AND MAINTENANCE

ESTIMATED OPERATION AND MAINTENANCE COST FOR PROPOSED  
WATER SUPPLY SCHEME UNDER ARAMBAGH MUNICIPALITY

Sl. No.	Particulars	Amount in Rs.
1	a) Civil Portion @ 2 % of the Capital Cost Rs. 1444.14 lakh b) O&M cost for existing infrastructure = Rs. 2.16 lakh	Rs. 22.36 lakh
2	a) Mechanical Cost (Cost of Pump etc.) @ 5% of the Capital Cost Rs. 130.40 lakh b) O&M cost for existing infrastructure = Rs. 1.84 lakh	Rs. 5.81 lakh
3	Cost of Energy Charges for Pumping Machinery. Total Energy Requirement per day a) From Deep TW to CWR (for Zone - II to Zone - IV) = (3 x 9 + 2 x 6 + 3 x 7.5) KW x 12 hrs = 738 KWH b) From CWR to OHR (for Zone - II to Zone - IV) = (25 + 18 + 28) KW x 12 hrs = 852 KWH c) From Deep TW to OHR (for Zone - V) = 9 KW x 12 hrs = 108 KWH Total Energy Required Per Day = 738 + 852 + 108 = 1698 KWH Cost of Energy @ Rs. 5/ KWH = Rs. 5.00 x 1698 = Rs. 8,490.00 Cost of Energy per annum = Rs. 8,490.00 x 365 = Rs. 30,98,850.00 = Rs. 30.99 lakh Electricity charges for present infrastructure = Rs. 13.80 lakh	Rs. 44.79 lakh
4	Operators - 10 Nos. (2 for each Zone) Guards - 5 Nos. (1 for each Zone) @ 3,000/- per month and Rs. 2,500/- per month respectively.	Rs. 5.10 lakh
	<b>Total O&amp;M Cost Per Annum</b>	<b>Rs. 78.06 lakh</b>



CHAPTER - XVII

VIABILITY OF THE PROJECT

NAME OF THE TOWN : ARAMBAGH      PREMIUM : Rs. 658.60 Lakh      RATE OF INTEREST: 9%      PROJECT COST : Rs.1122.21 Lakh

NAME OF SCHEME : PROPOSED WATER SUPPLY SCHEME FOR ZONE-I, II,III, IV AND V OF ARAMBAGH MUNICIPALITY (COMPRISING 18 WARDS)

NET WATER CHARGES : Rs.59.70 Lakh (LESS O&M)

YEAR OF : 10 YEAR REPAYMENT      PROJECT PERIOD : 2 YEARS

YEARS	AMOUNT DRAWN	BALANCE AMOUNT FOR INTEREST CALCULATION	PRINCIPAL	INTEREST	TOTAL	NET WATER CHARGES (LESS O&M)	PREMIUM	INTEREST OF PREMIUM	TOTAL	NET BALANCE	DISCT. FACTOR @ 12 %	PRESENT VALUE	REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
2006-2007	561.105										0.89		10 % Water Charges will be increased after every 2 years.
2007-2008	561.105	1122.21									0.80		
2008-2009		504.91	617.30	101.00	718.30	59.70	658.60		718.30		0.71		
2009-2010		490.65	14.26	45.44	59.70	59.70			59.70		0.64		
2010-2011		469.14	21.51	44.16	65.67	65.67			65.67		0.57		
2011-2012		445.69	23.45	42.22	65.67	65.67			65.67		0.51		
2012-2013		413.57	32.12	40.11	72.24	72.24			72.24		0.45		
2013-2014		378.55	35.02	37.22	72.24	72.24			72.24		0.40		
2014-2015		333.16	45.39	34.07	79.46	79.46			79.46		0.36		
2015-2016		283.68	49.48	29.98	79.46	79.46			79.46		0.32		
2016-2017		221.81	61.88	25.53	87.41	87.41			87.41		0.29		
2017-2018		154.36	67.44	19.96	87.41	87.41			87.41		0.26		
2018-2019		72.11	82.25	13.89	96.15	96.15			96.15		0.23		
2019-2020			72.11	6.49	78.60	96.15			96.15	17.55	0.20	3.59	
2020-2021				0	0	105.76			105.76	105.76	0.18	19.32	
<b>Total</b>			1122.21	440.09	1562.30	1027.01	658.60	0.00	1685.61	123.31		22.91	

## RETURN FROM THE SCHEME

DESIGNED ULTIMATE DEMAND FOR ZONE-I, II, III, IV AND V	:	8.73 MLD
NO. OF HOLDING EXPECTED TO BE PROVIDED WITH HOUSE SERVICE CONNECTION	:	Total Holding = 18,400 BPL Holding = 2,000 (assumed) Net Expected Connection = 16,400 Existing Connection = 3,228 New Connection = 13,172
CONNECTION CHARGE	:	Rs. 5,000.00
ONE TIME PREMIUM	:	Rs. 658.60 lakh
WATER CHARGE	:	Rs. 70 per Holding per month
DOMESTIC & OTHER SUPPLY	:	8.73 MLD
TOTAL WATER CHARGES PER MONTH	:	Rs. 11.48 Lakh
TOTAL WATER CHARGES PER YEAR	:	Rs. 11.48 x 12 = Rs. 137.76 Lakh

### NET RETURN FROM THE SCHEME

TOTAL WATER CHARGES COLLECTED PER YEAR : Rs. 137.76 Lakh

EXPENDITURE BY O&M COST PER YEAR : (-) Rs. 78.06 Lakh

NET RETURN AGAINST WATER CHARGES PER YEAR : **Rs. 59.70 Lakh**

**CHAPTER - XVIII**  
**ENVIRONMENTAL IMPACT ASSESSMENT**

**18.0 General**

Engineering projects involving development of basic infrastructures such as Road, Water Supply, Drainage and Sewerage and major projects like Thermal Power, Mining Operations and River Valley Water Resource Developments are found to cause certain adverse and negative impacts on surrounding environments. In case of the first category of projects, impacts are nominal and temporary in nature, while the other category creates major and long term impacts.

In view of the above, it is pertinent to examine and evaluate the impacts of the water supply schemes based on ground water sources for the Municipal Town of Arambagh and the same is presented as part of Project Report.

**A. PRESENT CONDITION**

1.	Climatic phenomenon	
	a. Rainfall	The rainy season is between June and September. The average rainfall is 1800 mm.
	b. Temperature	The annual mean temperature is 26.8°C, although monthly mean temperatures range from 16°C to 33°C. In summer the temperature crosses 40°C. Though winters are comfortable with temperatures lying between 11°C and 17°C, however, often fell below 10°C started from November and last till the end of February.
	c. Humidity	The climate is hot and humidity is high; Avg. 78%.

2.	Water bodies & aquatic animal and Flora & Fauna	There is a river (River Darakeswar) flowing through the Municipality from North-west to South-east. Another water body named Kana Darakeswar Khal also exists within the Municipality and runs almost parallel to river Darakeswar in North. It alives during monsoon only.
3.	Passage of storm water	Through road side surface drains and passages through the natural path to the river Darakeswar / Kana Darakeswar Khal.
4.	Topography	Almost plain. Slight downward topography along the river Darakeswar / Kana Darakeswar Khal.
5.	Human settlement	Thick by populated at the central portion. The roads & alignment drains already exists and no acquisition of already occupied land or property is required for OHRs. Question of eviction of human settlement does not arise.
6.	Animal Kingdom	The development project does not affect any forest as the sites are not within any forest of animal sheds.
7.	Green belt	The project does not affect any green belt.
8.	Obstruction / Barrier to existing facilities	No such obstruction will be created to the existing infrastructure facilities due to this development programme.
9.	Source of supply	Ground water



## B. IMPACT & REMEDIES

1.	Utilisation of alternative material characteristics and availability of alternative material	Indegenously available pipe materials and other civil construction material such as stone metal, sand and bricks etc. will be used.
2.	Rehabilitation of water bodies and measures for maintaining surface runoff smoothly	No water bodies will be affected by the alignment of pipe lines and the OHRs etc. the existing path of runoff to the rivers will remain unaffected.
3.	Measures of erosion control	There will be no reason for erosion
4.	<p>Conservation of Top soil</p> <p>a. Extent of loss of top soil</p> <p>b. Area requirement for top soil conservation</p> <p>c. Inclusion of conservation of top soil</p>	<p>Only a portion of the top soil equivalent to the quantity of the diameter of the laid pipes will be there which will be used to fill up low lying areas of the town.</p> <p>Very small. There are plenty of low areas in the fringes of the town.</p> <p>The excavated earth will be compacted thoroughly as per specification.</p>
5.	Power situation	There is no deficiency in power supply. The augmentation process shall consume less quantity of power.

6.	<p><b>Impact on Heritage &amp; Culture</b></p> <p>a. Identification of locally significant cultural properties</p> <p>b. Assessment of likely impacts on each cultural property due to project implementation</p> <p>c. Possible measures for avoidance</p> <p>i) Identification of alternative routes</p> <p>ii) Relocation of Cultural property in consultation with the local community</p> <p>iii) Common property</p>	<p>Water supply generally creates good impact on any cultural heritage. So it is here also.</p> <p>Quality will be better. Activities will improve. Impact assessment will be made by the Municipality after implementing the project.</p> <p>Question does not arise.</p>
7.	Location of natural habitats	It will not be disturbed.
8.	Construction of site office / Camp	Temporary construction of camp / office shall be constructed by the contractor and since the project site is scattered, the temporary impact on environment at the time of execution of work is negligible.

9.	<p>Quarrying of materials</p> <ol style="list-style-type: none"> <li>a. Sourcing of materials from quarries</li> <li>b. Lead from various existing quarries</li> <li>c. Adequacy of material for the project in these quarries</li> </ol>	<p>There is no scope for local quarrying materials as they will be procured from :</p> <ol style="list-style-type: none"> <li>1) Stone metal / stone chips from existing quarry of Pakur</li> <li>2) Bricks from Brick field outside the town</li> <li>3) Sand from river bed of Damodar / Ajay / Barakar away from the town.</li> </ol> <p>All these materials are sufficiently available at source.</p>
10.	<p>Water requirement : Identification of potential sources of water</p>	<p>Water required for construction of tube well, OHR and distribution system will be made available by digging small dia tube wells or from local ponds. Required permission from SWID, WB will be taken at the time of construction of tube well.</p>
11.	<p>Location of waste water disposal :</p> <ol style="list-style-type: none"> <li>a. Location for disposal site of toxic water</li> <li>b. Outfalls locations for longitudinal drains <ol style="list-style-type: none"> <li>i) Outfall level and back flow</li> <li>ii) The outfall is in natural stream; measures shall be taken to prevent sediment into the stream.</li> </ol> </li> </ol>	<p>There will be no toxic water. The existing drainage system of the town is sufficient to discharge the waste water.</p> <p>Natural slope of the ground will be maintained for water ways for discharge of surface runoff.</p> <p>No possibility of back flow except in the case of heavy flood.</p>
12.	<p>Air Pollution during construction</p>	<p>Question does not arise.</p>

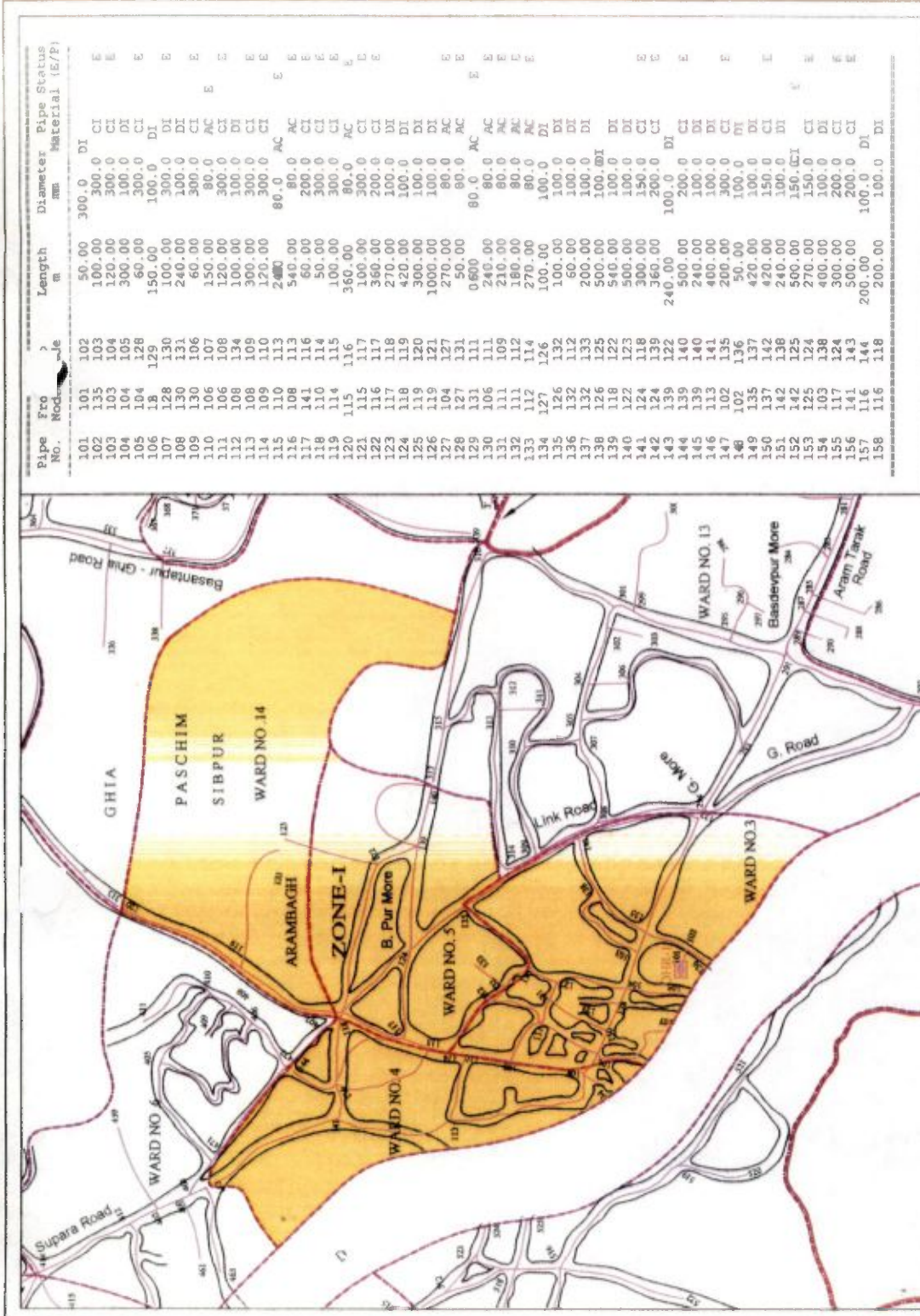
13.	Tree plantation provision	Social afforestation scheme will be encouraged.
14.	Identify locations susceptible to induced development	For this augmentation scheme there will not be any such location vulnerable to induced development.
15.	Roles and responsibilities of municipality in regulating development	The municipality shall lay down following restrictions: <ol style="list-style-type: none"> <li>1. Municipality will enforce restriction on building activity within 15 m on either side of proposed construction.</li> <li>2. Development of Residential sites outside Existing Settlement.</li> <li>3. Appropriate measure towards the removal of encroachments onto the public land to be taken.</li> </ol>
16.	Traffic congestion and related air & noise pollution	The question does not arise.
17.	Abatement of pollution due to influx of people	Necessary civic arrangement shall be made by the municipal authority.
18.	Opportunity in economic activities due to improvement of water supply scheme.	The benefits due to this water supply projects are <ol style="list-style-type: none"> <li>1. Generation of Man days.</li> <li>2. Employment in service (population serving) industries.</li> <li>3. Improvement in Household or population sector.</li> </ol>



19.	Ground water conservation	<p>Municipal shall undertake following action plans :-</p> <ol style="list-style-type: none"> <li>1. The water to be used economically from the water source.</li> <li>2. The industries to reduce their consumption of water by developing other measures in place of water in its various processes.</li> <li>3. The public to be propagated to use the water economically and prevent its wastage.</li> <li>4. Town people to be mobilized for roof top rain water harvesting.</li> <li>5. Action to be taken for the artificial recharge of ground water.</li> </ol>
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BAR CHART FOR MANAGEMENT OF PROJECT IMPLEMENTATION

Sl. No.	Activities / Jobs	DURATION IN MONTHS																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Tender Processing and Award of the works.	3																							
2	Preparation & Submission of Project Management programme covering planning, scheduling and controlling by the successful bidders.			1																					
3	(a) Handing over sites for major works such as Deep tubewells, Pump house, CWR, OHR and Rising main etc.. (b) Mobilisation of Material and Human Resources as well as site clearance.				1																				
4	Construction of Deep tubewells				3																				
5	Laying of Rising Main							1																	
6	Construction of OHRs								6																
7	Construction of CWR									9															
8	Construction of pump house & installation of pumps and motors.										6														
9	Laying of distribution pipes system.											6													
10	Testing of all pipe lines section by section.												15												
11	Trail Run																					3			
12	Commissing																							2	



Pipe No.	From Node	To Node	Length (m)	Diameter (mm)	Material	Pipe Status (E/P)
101	101	102	50.00	300.0	DI	E
102	102	103	100.00	300.0	CI	E
103	103	104	120.00	300.0	CI	E
104	104	105	300.00	100.0	DI	E
105	104	128	60.00	300.0	CI	E
106	18	129	150.00	100.0	DI	E
107	128	130	100.00	300.0	DI	E
108	130	131	240.00	100.0	DI	E
109	130	106	60.00	300.0	CI	E
110	106	107	150.00	80.0	AC	E
111	106	108	120.00	300.0	CI	E
112	108	134	100.00	100.0	DI	E
113	108	109	300.00	300.0	CI	E
114	109	110	120.00	300.0	CI	E
115	110	113	240.00	80.0	AC	E
116	108	113	540.00	80.0	AC	E
117	141	116	60.00	300.0	CI	E
118	110	114	50.00	300.0	CI	E
119	114	115	100.00	300.0	CI	E
120	115	116	360.00	80.0	AC	E
121	115	117	100.00	300.0	CI	E
122	116	117	360.00	200.0	CI	E
123	117	118	270.00	100.0	DI	E
124	118	119	420.00	100.0	DI	E
125	119	120	300.00	100.0	DI	E
126	119	121	1000.00	100.0	DI	E
127	104	127	270.00	80.0	AC	E
128	127	131	50.00	80.0	AC	E
129	131	111	060.00	80.0	AC	E
130	106	105	240.00	80.0	AC	E
131	111	109	210.00	80.0	AC	E
132	111	112	180.00	80.0	AC	E
133	112	114	270.00	80.0	AC	E
134	127	126	100.00	100.0	DI	E
135	126	132	100.00	100.0	DI	E
136	132	112	60.00	100.0	DI	E
137	132	133	200.00	100.0	DI	E
138	126	125	500.00	100.0	DI	E
139	118	122	540.00	100.0	DI	E
140	122	123	500.00	100.0	DI	E
141	124	118	300.00	150.0	CI	E
142	124	139	360.00	200.0	CI	E
143	139	122	240.00	100.0	DI	E
144	139	140	500.00	200.0	CI	E
145	139	140	240.00	100.0	DI	E
146	113	141	400.00	100.0	DI	E
147	102	135	200.00	300.0	CI	E
148	102	136	50.00	100.0	DI	E
149	135	137	420.00	100.0	DI	E
150	137	142	420.00	150.0	CI	E
151	142	138	240.00	100.0	DI	E
152	142	125	500.00	150.0	CI	E
153	125	124	270.00	150.0	CI	E
154	103	138	400.00	100.0	DI	E
155	117	124	300.00	200.0	CI	E
156	141	143	500.00	200.0	CI	E
157	116	144	200.00	100.0	DI	E
158	116	118	200.00	100.0	DI	E

**NOTES**

DESCRIPTION	SYMBOL
1. MUNICIPAL BOUNDARY	
2. WARD BOUNDARY	
3. ROAD	
4. OHR SHOWN WITH NO.	
5. PIPE SHOWN AS	
6. NODE SHOWN WITH NO.	

**LEGEND**

**LEGEND**

**CENTRE FOR SOCIAL & ENVIRONMENTAL CARE  
DELHI-110091**

**MUNICIPAL ENGINEERING DIRECTORATE  
GOVT OF WEST BENGAL**

WATER SUPPLY SCHEME BASED ON GROUND WATER  
SOURCE FOR MUNICIPAL TOWN OF ARAMBAG  
DIST. HOOGHLY WEST BENGAL UNDER U.I.D.S.S.M.T

DETAIL OF DISTRIBUTION SYSTEM  
FOR ZONE - I

DRAWN BY: \_\_\_\_\_  
CHECKED BY: \_\_\_\_\_  
SCALE: 1:10000  
DATE: \_\_\_\_\_

CONSULTANT: \_\_\_\_\_  
DRG. NO.: \_\_\_\_\_  
PLOT SCALE: 1:1  
SHEET NO.: 38 OF 40

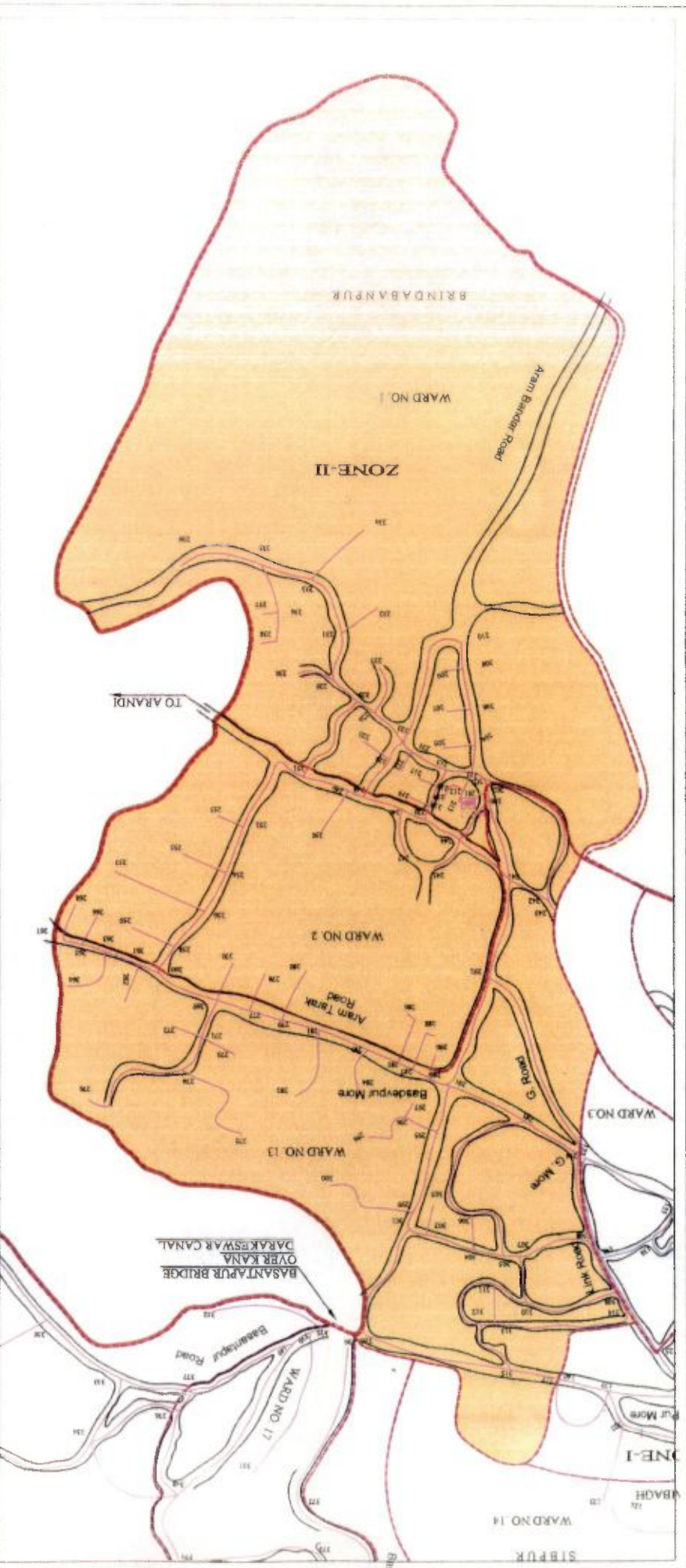


**NOTES**  
 CENTRE FOR SOCIAL & ENVIRONMENTAL CARE  
 DELHI-110091  
 MUNICIPAL ENGINEERING DIRECTORATE  
 GOVT OF WEST BENGAL  
 WATER SUPPLY SCHEME BASED ON GROUND WATER  
 SOURCE FOR MUNICIPAL TOWN OF ARAMBAG  
 DIST HOOGHLY WEST BENGAL UNDER U.I.D.S.M.T.  
 DETAIL OF DISTRIBUTION SYSTEM  
 SCALE: 1:10000  
 DATE: 1988

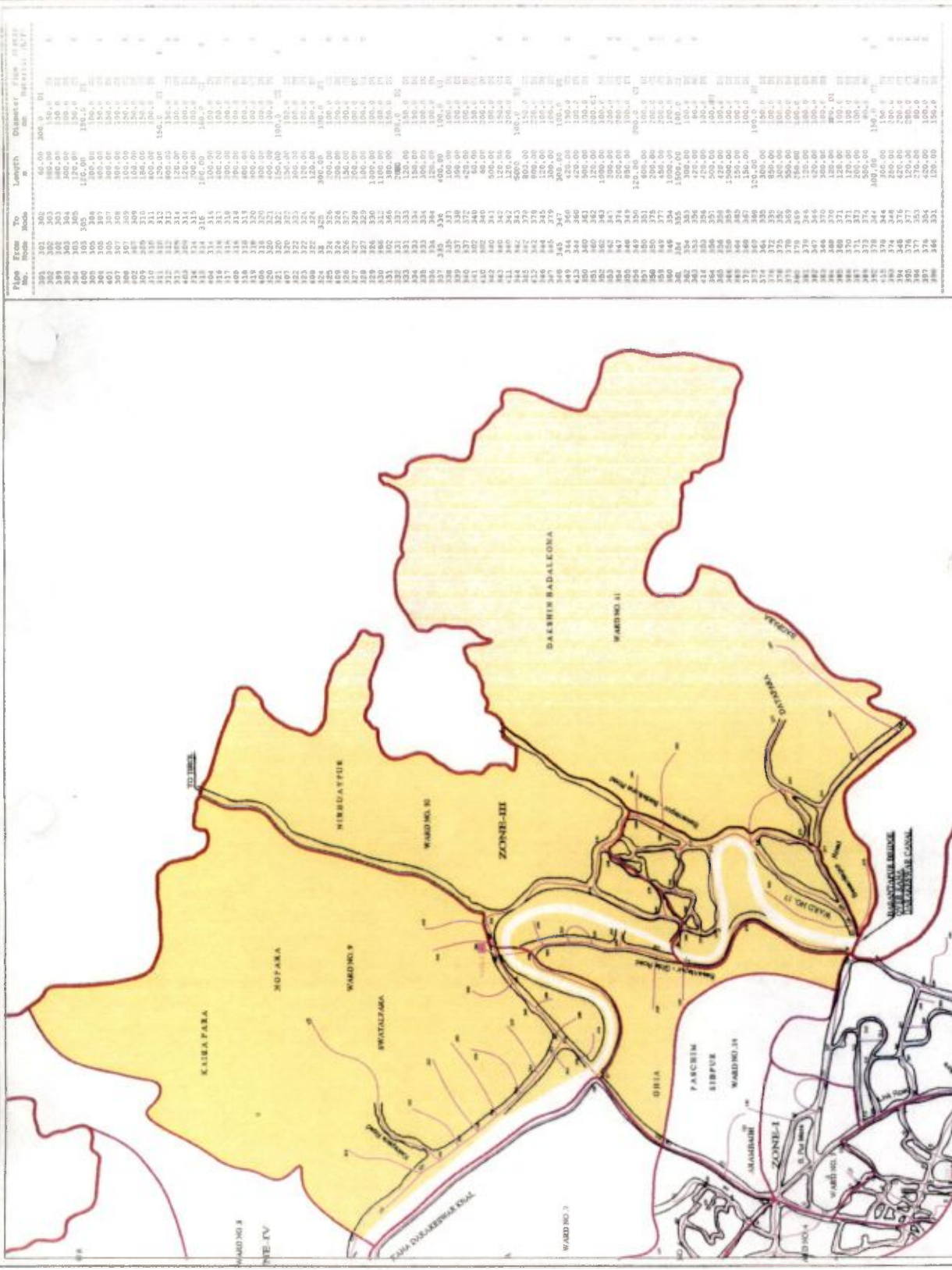
SYMBOL	DESCRIPTION
	1. MUNICIPAL BOUNDARY
	2. WARD BOUNDARY
	3. ROAD
	4. OHR SHOWN WITH NO.
	5. PIPE SHOWN AS
	6. NODE SHOWN WITH NO.

From Node No.	To Node No.	Length (m)	Structure	Pipe Dia. (mm)	Flow Direction
101	102	100.00	PIPE	150	101-102
102	103	100.00	PIPE	150	102-103
103	104	100.00	PIPE	150	103-104
104	105	100.00	PIPE	150	104-105
105	106	100.00	PIPE	150	105-106
106	107	100.00	PIPE	150	106-107
107	108	100.00	PIPE	150	107-108
108	109	100.00	PIPE	150	108-109
109	110	100.00	PIPE	150	109-110
110	111	100.00	PIPE	150	110-111
111	112	100.00	PIPE	150	111-112
112	113	100.00	PIPE	150	112-113
113	114	100.00	PIPE	150	113-114
114	115	100.00	PIPE	150	114-115
115	116	100.00	PIPE	150	115-116
116	117	100.00	PIPE	150	116-117
117	118	100.00	PIPE	150	117-118
118	119	100.00	PIPE	150	118-119
119	120	100.00	PIPE	150	119-120
120	121	100.00	PIPE	150	120-121
121	122	100.00	PIPE	150	121-122
122	123	100.00	PIPE	150	122-123
123	124	100.00	PIPE	150	123-124
124	125	100.00	PIPE	150	124-125
125	126	100.00	PIPE	150	125-126
126	127	100.00	PIPE	150	126-127
127	128	100.00	PIPE	150	127-128
128	129	100.00	PIPE	150	128-129
129	130	100.00	PIPE	150	129-130
130	131	100.00	PIPE	150	130-131
131	132	100.00	PIPE	150	131-132
132	133	100.00	PIPE	150	132-133
133	134	100.00	PIPE	150	133-134
134	135	100.00	PIPE	150	134-135
135	136	100.00	PIPE	150	135-136
136	137	100.00	PIPE	150	136-137
137	138	100.00	PIPE	150	137-138
138	139	100.00	PIPE	150	138-139
139	140	100.00	PIPE	150	139-140
140	141	100.00	PIPE	150	140-141
141	142	100.00	PIPE	150	141-142
142	143	100.00	PIPE	150	142-143
143	144	100.00	PIPE	150	143-144
144	145	100.00	PIPE	150	144-145
145	146	100.00	PIPE	150	145-146
146	147	100.00	PIPE	150	146-147
147	148	100.00	PIPE	150	147-148
148	149	100.00	PIPE	150	148-149
149	150	100.00	PIPE	150	149-150
150	151	100.00	PIPE	150	150-151
151	152	100.00	PIPE	150	151-152
152	153	100.00	PIPE	150	152-153
153	154	100.00	PIPE	150	153-154
154	155	100.00	PIPE	150	154-155
155	156	100.00	PIPE	150	155-156
156	157	100.00	PIPE	150	156-157
157	158	100.00	PIPE	150	157-158
158	159	100.00	PIPE	150	158-159
159	160	100.00	PIPE	150	159-160
160	161	100.00	PIPE	150	160-161
161	162	100.00	PIPE	150	161-162
162	163	100.00	PIPE	150	162-163
163	164	100.00	PIPE	150	163-164
164	165	100.00	PIPE	150	164-165
165	166	100.00	PIPE	150	165-166
166	167	100.00	PIPE	150	166-167
167	168	100.00	PIPE	150	167-168
168	169	100.00	PIPE	150	168-169
169	170	100.00	PIPE	150	169-170
170	171	100.00	PIPE	150	170-171
171	172	100.00	PIPE	150	171-172
172	173	100.00	PIPE	150	172-173
173	174	100.00	PIPE	150	173-174
174	175	100.00	PIPE	150	174-175
175	176	100.00	PIPE	150	175-176
176	177	100.00	PIPE	150	176-177
177	178	100.00	PIPE	150	177-178
178	179	100.00	PIPE	150	178-179
179	180	100.00	PIPE	150	179-180
180	181	100.00	PIPE	150	180-181
181	182	100.00	PIPE	150	181-182
182	183	100.00	PIPE	150	182-183
183	184	100.00	PIPE	150	183-184
184	185	100.00	PIPE	150	184-185
185	186	100.00	PIPE	150	185-186
186	187	100.00	PIPE	150	186-187
187	188	100.00	PIPE	150	187-188
188	189	100.00	PIPE	150	188-189
189	190	100.00	PIPE	150	189-190
190	191	100.00	PIPE	150	190-191
191	192	100.00	PIPE	150	191-192
192	193	100.00	PIPE	150	192-193
193	194	100.00	PIPE	150	193-194
194	195	100.00	PIPE	150	194-195
195	196	100.00	PIPE	150	195-196
196	197	100.00	PIPE	150	196-197
197	198	100.00	PIPE	150	197-198
198	199	100.00	PIPE	150	198-199
199	200	100.00	PIPE	150	199-200







Pipe No.	From	To	Length	Zone
	Node	Node	m	
300	301	302	60.00	III
302	302	303	80.00	III
303	303	304	100.00	III
304	304	305	120.00	III
305	305	306	150.00	III
306	306	307	180.00	III
307	307	308	200.00	III
308	308	309	220.00	III
309	309	310	250.00	III
310	310	311	280.00	III
311	311	312	300.00	III
312	312	313	320.00	III
313	313	314	350.00	III
314	314	315	380.00	III
315	315	316	400.00	III
316	316	317	420.00	III
317	317	318	450.00	III
318	318	319	480.00	III
319	319	320	500.00	III
320	320	321	520.00	III
321	321	322	550.00	III
322	322	323	580.00	III
323	323	324	600.00	III
324	324	325	620.00	III
325	325	326	650.00	III
326	326	327	680.00	III
327	327	328	700.00	III
328	328	329	720.00	III
329	329	330	750.00	III
330	330	331	780.00	III
331	331	332	800.00	III
332	332	333	820.00	III
333	333	334	850.00	III
334	334	335	880.00	III
335	335	336	900.00	III
336	336	337	920.00	III
337	337	338	950.00	III
338	338	339	980.00	III
339	339	340	1000.00	III
340	340	341	1020.00	III
341	341	342	1050.00	III
342	342	343	1080.00	III
343	343	344	1100.00	III
344	344	345	1120.00	III
345	345	346	1150.00	III
346	346	347	1180.00	III
347	347	348	1200.00	III
348	348	349	1220.00	III
349	349	350	1250.00	III
350	350	351	1280.00	III
351	351	352	1300.00	III
352	352	353	1320.00	III
353	353	354	1350.00	III
354	354	355	1380.00	III
355	355	356	1400.00	III
356	356	357	1420.00	III
357	357	358	1450.00	III
358	358	359	1480.00	III
359	359	360	1500.00	III
360	360	361	1520.00	III
361	361	362	1550.00	III
362	362	363	1580.00	III
363	363	364	1600.00	III
364	364	365	1620.00	III
365	365	366	1650.00	III
366	366	367	1680.00	III
367	367	368	1700.00	III
368	368	369	1720.00	III
369	369	370	1750.00	III
370	370	371	1780.00	III
371	371	372	1800.00	III
372	372	373	1820.00	III
373	373	374	1850.00	III
374	374	375	1880.00	III
375	375	376	1900.00	III
376	376	377	1920.00	III
377	377	378	1950.00	III
378	378	379	1980.00	III
379	379	380	2000.00	III
380	380	381	2020.00	III
381	381	382	2050.00	III
382	382	383	2080.00	III
383	383	384	2100.00	III
384	384	385	2120.00	III
385	385	386	2150.00	III
386	386	387	2180.00	III
387	387	388	2200.00	III
388	388	389	2220.00	III
389	389	390	2250.00	III
390	390	391	2280.00	III
391	391	392	2300.00	III
392	392	393	2320.00	III
393	393	394	2350.00	III
394	394	395	2380.00	III
395	395	396	2400.00	III
396	396	397	2420.00	III
397	397	398	2450.00	III
398	398	399	2480.00	III
399	399	400	2500.00	III

**CENTRE FOR SOCIAL & ENVIRONMENTAL CARE**  
DELHI-110091

**MUNICIPAL ENGINEERING DIRECTORATE**  
GOVT OF WEST BENGAL

**WATER SUPPLY SCHEME BASED ON GROUND WATER**  
SOURCE FOR MUNICIPAL TOWN OF AGRAHALLI  
DIST. HOOGHLY WEST BENGAL UNDER U.I.S.S.M.

**DETAIL OF DISTRIBUTION SYSTEM**  
FOR ZONE- III

PIPE NO.	FROM	TO	LENGTH	ZONE
1	1	2	100.00	III
2	2	3	120.00	III
3	3	4	150.00	III
4	4	5	180.00	III
5	5	6	200.00	III
6	6	7	220.00	III
7	7	8	250.00	III
8	8	9	280.00	III
9	9	10	300.00	III
10	10	11	320.00	III
11	11	12	350.00	III
12	12	13	380.00	III
13	13	14	400.00	III
14	14	15	420.00	III
15	15	16	450.00	III
16	16	17	480.00	III
17	17	18	500.00	III
18	18	19	520.00	III
19	19	20	550.00	III
20	20	21	580.00	III
21	21	22	600.00	III
22	22	23	620.00	III
23	23	24	650.00	III
24	24	25	680.00	III
25	25	26	700.00	III
26	26	27	720.00	III
27	27	28	750.00	III
28	28	29	780.00	III
29	29	30	800.00	III
30	30	31	820.00	III
31	31	32	850.00	III
32	32	33	880.00	III
33	33	34	900.00	III
34	34	35	920.00	III
35	35	36	950.00	III
36	36	37	980.00	III
37	37	38	1000.00	III
38	38	39	1020.00	III
39	39	40	1050.00	III
40	40	41	1080.00	III
41	41	42	1100.00	III
42	42	43	1120.00	III
43	43	44	1150.00	III
44	44	45	1180.00	III
45	45	46	1200.00	III
46	46	47	1220.00	III
47	47	48	1250.00	III
48	48	49	1280.00	III
49	49	50	1300.00	III
50	50	51	1320.00	III
51	51	52	1350.00	III
52	52	53	1380.00	III
53	53	54	1400.00	III
54	54	55	1420.00	III
55	55	56	1450.00	III
56	56	57	1480.00	III
57	57	58	1500.00	III
58	58	59	1520.00	III
59	59	60	1550.00	III
60	60	61	1580.00	III
61	61	62	1600.00	III
62	62	63	1620.00	III
63	63	64	1650.00	III
64	64	65	1680.00	III
65	65	66	1700.00	III
66	66	67	1720.00	III
67	67	68	1750.00	III
68	68	69	1780.00	III
69	69	70	1800.00	III
70	70	71	1820.00	III
71	71	72	1850.00	III
72	72	73	1880.00	III
73	73	74	1900.00	III
74	74	75	1920.00	III
75	75	76	1950.00	III
76	76	77	1980.00	III
77	77	78	2000.00	III
78	78	79	2020.00	III
79	79	80	2050.00	III
80	80	81	2080.00	III
81	81	82	2100.00	III
82	82	83	2120.00	III
83	83	84	2150.00	III
84	84	85	2180.00	III
85	85	86	2200.00	III
86	86	87	2220.00	III
87	87	88	2250.00	III
88	88	89	2280.00	III
89	89	90	2300.00	III
90	90	91	2320.00	III
91	91	92	2350.00	III
92	92	93	2380.00	III
93	93	94	2400.00	III
94	94	95	2420.00	III
95	95	96	2450.00	III
96	96	97	2480.00	III
97	97	98	2500.00	III

**LEGEND**

1	PIPE BORE WITH NO.
2	PIPE BORE WITH
3	PIPE BORE WITH NO.
4	ROAD
5	WATER BORE
6	MUNICIPAL BORE
7	EXHAUSTED

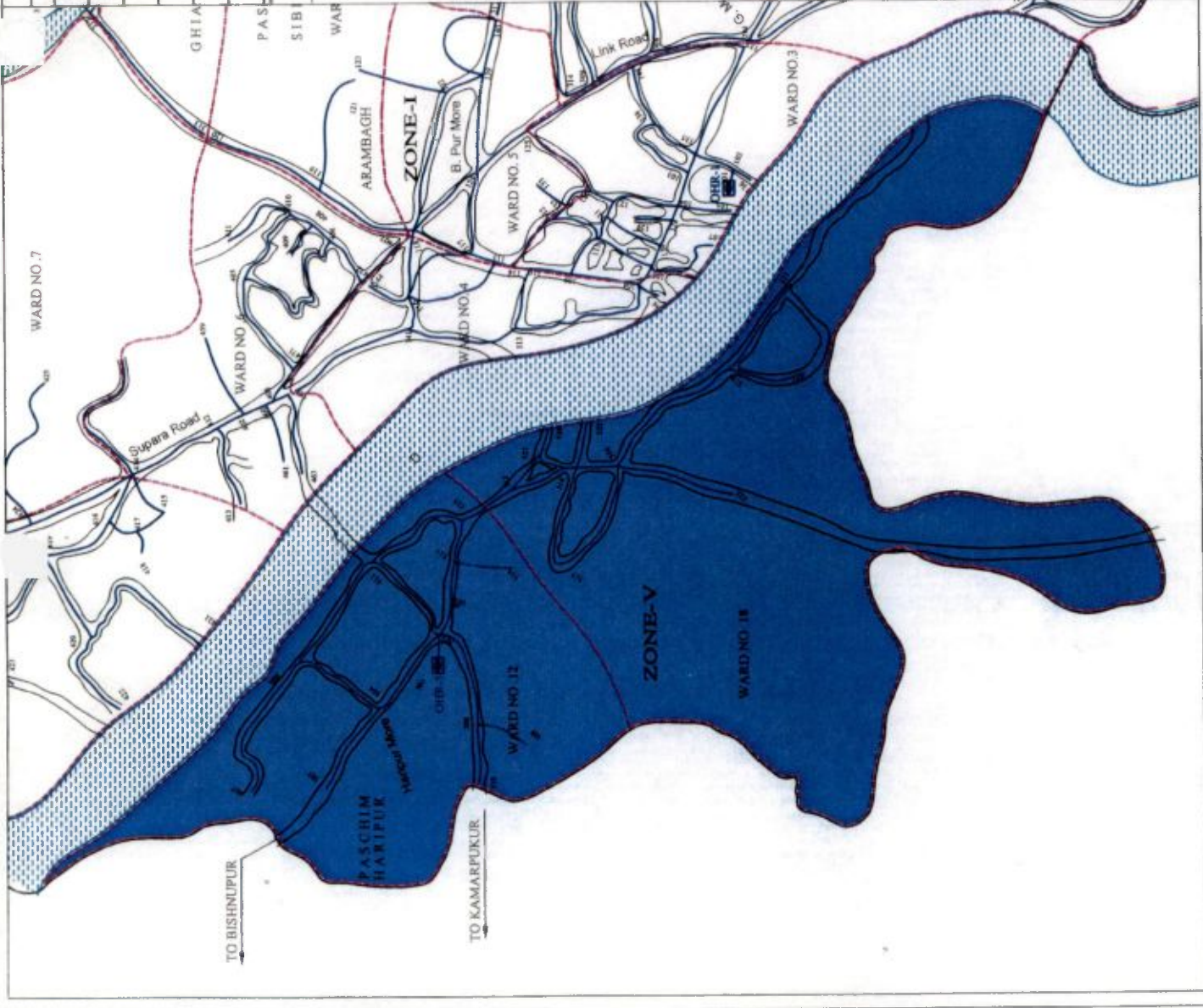




# LEGEND

DESCRIPTION	SYMBOL
1. MUNICIPAL BOUNDARY	
2. WARD BOUNDARY	
3. ROAD	
4. CHR SHOWN WITH NO.	
5. PIPE SHOWN AS	

6. NODE SHOWN WITH NO.		Length	Pipe Status
From Node	To Node	m	(S/P)
501	503	60.00	DI
502	503	120.00	AC
503	504	150.00	AC
504	505	360.00	DI
505	506	360.00	AC
506	507	300.00	DI
507	508	420.00	AC
508	509	420.00	DI
509	510	200.00	DI
510	511	400.00	AC
511	512	420.00	DI
512	513	120.00	AC
513	514	200.00	DI
514	515	180.00	AC
515	516	700.00	DI
516	517	240.00	AC
517	518	420.00	DI
518	519	100.00	DI
519	520	600.00	AC
520	521	240.00	AC
521	522	100.00	DI
522	523	240.00	AC
523	524	180.00	AC
524	525	240.00	DI
525	526	120.00	DI
526	527	240.00	DI
527	528	240.00	DI
528	529	240.00	DI
529	530	300.00	DI



# NOTES

CENTRE FOR SOCIAL & ENVIRONMENTAL CARE  
DELHI-110091

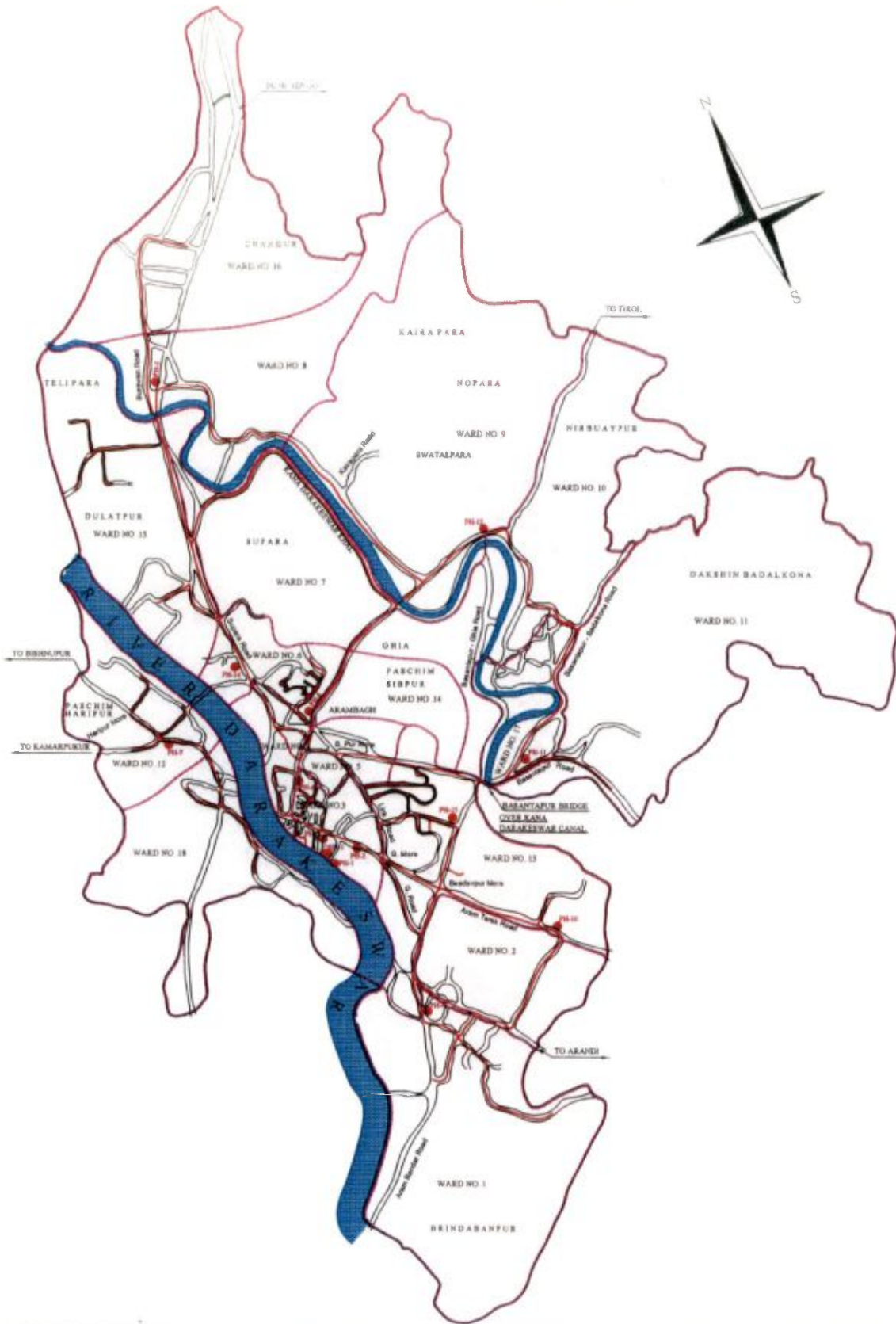
MUNICIPAL ENGINEERING DIRECTORATE  
GOVT OF WEST BENGAL

WATER SUPPLY SCHEME BASED ON GROUND WATER  
SOURCE FOR MUNICIPAL TOWN OF ARAMBAGH  
DIST. HOOGHLY WEST BENGAL UNDER U.I.D.S.M.T

DETAIL OF DISTRIBUTION SYSTEM  
FOR ZONE - V

DRAWN BY	CHECKED BY	DATE	SCALE
			1:1000

CONSULTANT	TEB	UFT	ENR/NO. 1



DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL
5. PIPE LINE			
4. TW & PUMP HOUSE WITH NO.			
3. OHR WITH NO.			
2. ROAD			
2. WARD BOUNDARY			
1. MUNICIPAL BOUNDARY			

**LEGEND**

**NOTES**



CENTRE FOR SOCIAL & ENVIRONMENTAL CARE  
DELHI-110091

MUNICIPAL ENGINEERING DIRECTORATE  
GOVT OF WEST BENGAL

WATER SUPPLY SCHEME BASED ON GROUND WATER  
SOURCE FOR MUNICIPAL TOWN OF ARAMBAG  
DIST. HOOGHLY WEST BENGAL UNDER U.I.D.S.S.M.T

EXISTING WATER SUPPLY SCHEME

DESIGNED BY :  
CHECKED BY :  
SCALE : 1 : 5000  
DATE :

DATE :

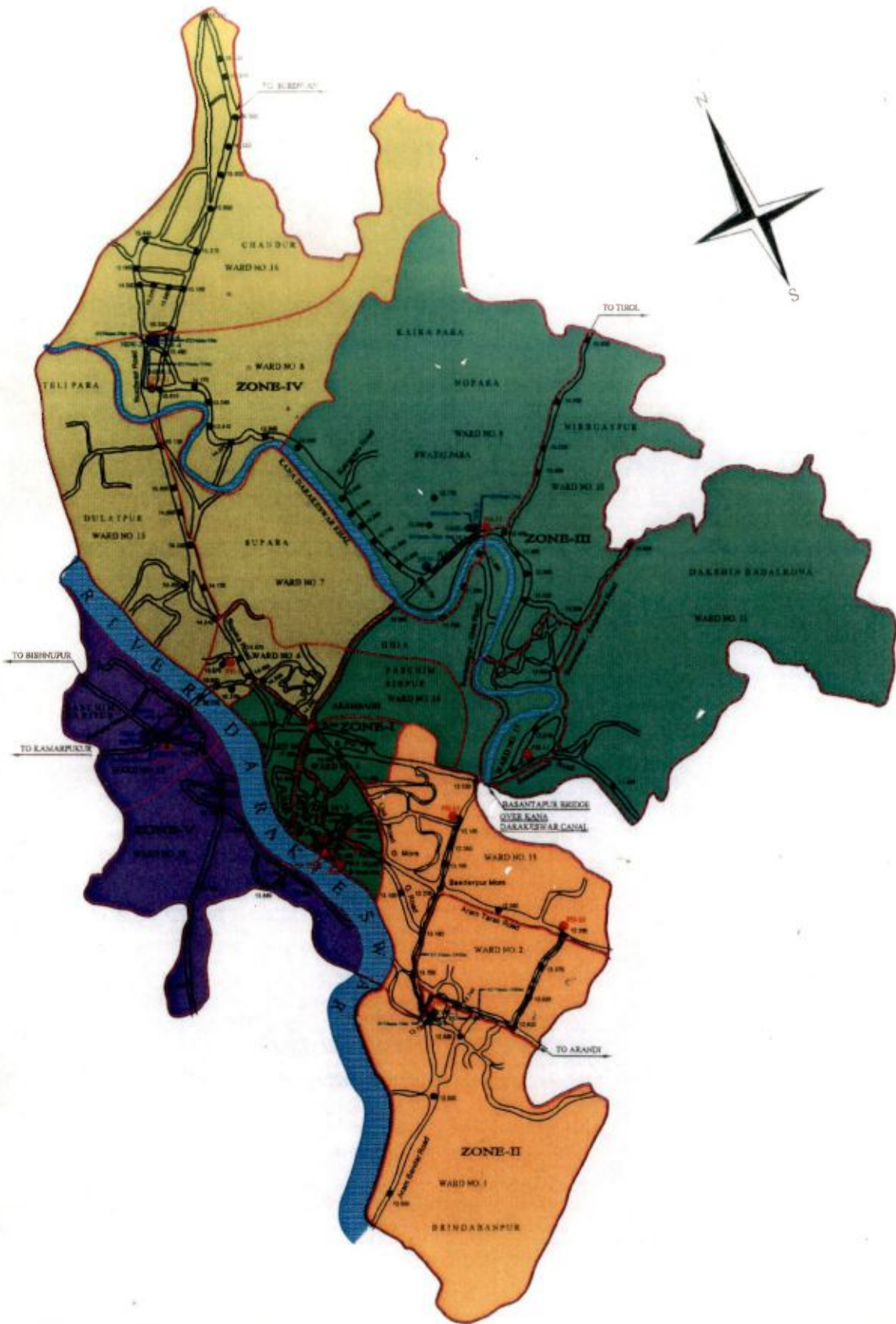
DATE :

DATE :

DATE :

DATE :





DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL
6. PROPOSED TW & EXISTING PUMP HOUSE WITH NO.		12. EXISTING RISING MAIN (C)	
7. EXISTING TW & PUMP HOUSE WITH NO.		11. PROPOSED RISING MAIN (C)	
8. PROPOSED TW & PUMP HOUSE WITH NO.		10. SPOT LEVEL IN METRE	15.150 ●
9. EXISTING OHR WITH NO.		9. PROPOSED OHR WITH NO.	OHR-9
4. PROPOSED OHR WITH NO.	OHR-4		
3. ROAD			
2. WARD BOUNDARY			
1. MUNICIPAL BOUNDARY			

**LEGEND**

**NOTES**

CENTRE FOR SOCIAL & ENVIRONMENTAL CARE  
DELHI-110091

MUNICIPAL ENGINEERING DIRECTORATE  
GOVT OF WEST BENGAL

WATER SUPPLY SCHEME BASED ON GROUND WATER  
SOURCE FOR MUNICIPAL TOWN OF ARAMBAG  
DIST. HOOGHLY WEST BENGAL UNDER U.I.D.S.S.M.T

DRAWN BY -  
CHECKED BY -  
SCALE - 1:2000  
DATE -

PROPOSED W/S SCHEME SHOWING TW,  
PUMP HOUSE, CWR, OHR, RISING MAIN  
AND SPOT LEVEL

PROJECT NO. -

1/25

1/25

PROJ. NO. -

1/25