CENTER FOR TECHNOLOGY ALTERNATIVES FOR RURAL AREAS
INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY

Piped Water Supply System for North Karjat

Techno-Economic Feasibility Study

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August 2010
Abstract

Over a hundred villages in north Karjat, Raigarh district, Maharashtra, suffer from severe water shortage in the months preceding the monsoons. A few check dams have been built to alleviate the problem in some of the villages but most habitations face empty wells and defunct hand-pumps in the summer. This project aims to evaluate the techno-economic feasibility of piped water supply to this region as well to establish a universally applicable design methodology for rural piped water supply systems. The target area within the Karjat block spans 120 sq. km and has a forecasted 2041 population of over 81,000. The source is taken to be the Pej River, south of the target region. We have designed primary and secondary grids for two supply norms: a livelihood norm of 200 lpcd and a sustenance norm of 40 lpcd. Given existing design norms, engineering practices, and schedules of costs our finding is that it economically viable to supply water in pipes from Pej River to the target area at the desirable livelihood norm of 200 lpcd. We estimate the investment cost of this supply system to be around Rs. 7000 per capita at 200 lpcd and Rs. 2100 per capita at 40 lpcd.

Keywords

Piped water supply, rural water supply, piped network design, drinking water, domestic water, Karjat, Maharastra



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1. Introduction

1.1 Motivation

Water for domestic use is scarce in many regions across rural India, especially in the months preceding the annual monsoon rains. The Center for Technology Alternatives for Rural Areas (CTARA) at the Indian Institute of Technology Bombay (IITB) has been exploring solutions to this problem since 2005. A number of projects have been implemented in the Karjat block of Raigarh district where many of the villages north of the river Pej face severe water shortage after February.

There are two main options available for securing year-round water access for water-stressed rural communities: increasing ground water recharge and tapping into surface water. At the community level, check dams can potentially achieve both and numerous CTARA's water related projects have centered around them. An alternative is transporting water in pipes to habitations. This project looks to assess

the viability of a piped water supply system as a solution to a community's domestic water woes.

1.2 Objective and Scope

Our project has two key objectives. Primarily, our aim is to assess the feasibility of a piped water distribution system for a target region spanning 120 sq. km and covering 70 villages in rural north Karjat. In addition, we aim to communicate a design methodology for a rural piped water supply system that can be applied universally. To achieve these aims have tried to design a highly optimized distribution network for north Karjat. Ours is a pre-design consisting of one primary and several secondary grids for transporting water from the water source to one point in each village in multiple stages. From estimates of the many costs of constructing and operating this network - and the size of the population served - we can gain a sense of the techno-economic feasibility of supplying piped water to rural regions at this scale.

Ultimately, the key output of the project is not a design that can be implemented exactly as is but rather a sound pre-design from which we can confidently assess the supply system's techno-economic feasibility. Certain salient aspects of rural water supply systems such as the distribution network within each village (tertiary grid) and potential cost-recovery plans have not been addressed in this project. Much of what follows the pre-design along the path to implementation requires a thorough study of socio-economic implications of the decisions that will need to be made. Such a study is not within the scope of this project but certainly a central theme in the projects that would follow this one.

2. Norms and Investments

2.1 Norms

The water supplied per day per capita in piped water schemes varies across the country. The government of Mahatrashtra's norm is 135 lpcd for urban areas and 40 lpcd for rural areas, though Mumbai receives 200 lpcd. 40 liters of water per day is

just enough to cover a person's drinking, cooking, bathing, laundry and household cleaning needs.

The current rural norm of 40 lpcd (sustenance norm) cannot provide for other uses such as home building and repairing and sustaining livelihoods. It is argued in Professor Sohoni's lecture notes and elsewhere that there is considerable unmet demand for water in rural areas and that the rural population is willing and able to pay for additional water supply. Additional water can be used to sustain ancillary livelihoods such as livestock rearing and brick making. The additional income from these activities will enable rural consumers to pay for the water and also improve their standard of living. Thus, there is a strong argument for extending the urban norm to rural areas. In this project we have designed a pipe water distribution system for a per capita supply of both 200 lpd (livelihood norm) and 40 lpd (sustenance norm).

2.2 Investments

The capital cost involved in the building of a piped water distribution system include the following:

- piping
- construction of jack well and pump house
- pumping machinery
- construction of a water treatment plant
- construction of a mass balanced reservoir (MBR)
- construction of elevated storage reservoirs (ESR)
- incremental water extraction from source

The per capita investment for Mumbai's piped water network, supplying 200 lpcd, is approximately Rs.7000. The investment for Thane (also at 200 lpcd) approaches Rs. 10,000. Maharashtra Jeevan Pradhikaran's Sugve and 6 Villages scheme cost approximately Rs. 2500 per capita for a supply of 40 lpcd . For our proposed supply system to be economically feasible the per capita investment would need to be well

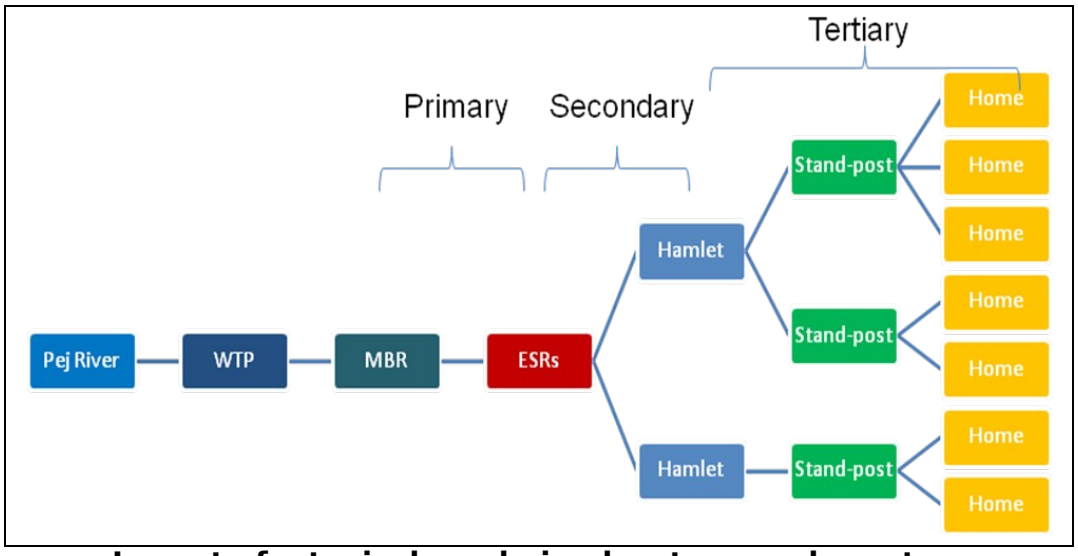
under Rs. 10,000. We must note here that there in addition to the capital investment there are the major costs of establishing the system, operation and maintenance, and of the electricity used for pumping.

3. Design Methodology

3.1 Components of Design

The following are the major components of a rural water supply system. We have designed the primary and secondary grids such that the end point of our design are villages. A tertiary network would transport water from a single delivery point at a village to stand posts and/or individual homes. The design of the tertiary network requires consensus at the hamlet level, and includes finalizing a pay-back mechanism and metering details. In addition, the tertiary design requires cadastral data which is GIS intensive. These requirements extend beyond the scope of this project and hence we not designed tertiary networks for the system.

- Source – *perennial surface water source (reservoir, river)*
- Rising Main – *large diameter pipeline that transports water from the source to the MBR via a water treatment plant*
- Water Treatment Plant (WTP) – *water treatment facility that treats raw water from the source*.
- Mass Balancing Reservoir (MBR) - *water tank that receives clean water coming out of the water treatment plant*
- Primary Network (Gravity Main) – *grid that transports water from the mass balanced reservoir to the various ESRs in the system*
- Elevated Storage Reservoir (ESR) – *elevated water tank that delivers water to a cluster of hamlets*
- Secondary Network - *grid that transports water from an ESR to one or more points (stand-posts) in the hamlets it serves*
- Tertiary Network – *grid that transports water from stand posts to homes in the hamlet*



Layout of a typical rural piped water supply system

3.2 Assumptions

Three key assumptions have been made during the process of designing the network.

1. Google Earth elevation data is reasonably accurate, and if there is an error it is constant across the region. Since the difference in elevation between points matters more than absolute elevation values, any constant error should not, in theory, affect the design.

2. A population of 600 has been assigned to the villages whose population data we do not have. We obtained data from difference sources; our area map came from MJP, our population data from the census database. The overlap in the two sources was not perfect, we have many villages whose position we know but whose population we are not sure of. There is a good chance that the name used for a particular village differs in the two sources. It is beyond the scope of this project, however, to research and ascertain the various identities of each village.

   The number 600 was chosen at the end of an involved process of population forecasting. The 2001 census population data for each village in Karjat was projected for 2011, 2026 and 2041 using Karjat taluka's previous years' population data. The projected populations were rounded to the nearest hundred. We found the mode of this modified data for 2026 to be 600. We have

chosen the population forecast for 2026 to calculate the water demand at each village, thus we chose to assign a 2026 population of 600 to the villages whose population we do not know.

We believe we are overestimating rather than underestimating the target area population for two reasons. If a village has a population of over 300, it is highly probably that it will be included in the census. Villages whose names are not in present the census but are marked on our map are probably small villages (population under 300) or are villages whose population has been included in a larger village. Thus, we are certain that we have overestimated the population and that given more accurate population data our network would cost less rather than more.

3. The source in our design, the Pej river, has sufficient water flow at and permission has been sought to extract this water. As we do not know the low water level of Pej River, we have taken the depth of the jack well to be 10m. We are certain that this depth is greater than the actual required depth.

3.3 Design Parameters

1. We have chosen one lift-up point along the Pej River which is at an elevation of 63 m. The MBR location has been chosen to be on a nearby hill at an elevation of 255 m. Water will be pumped from the life-up point to this MBR for 16 hours a day.

2. From the MBR the distribution system is entirely gravity fed (no pumping required). Water will be released 24 hours a day to 19 ESRs along a primary looped MBR-ESR network.

3. We have chosen to design our network such that each village receives their quota of water from an ESR within 6 hours every day: from 5-8am and 5-8pm.

4. We have designed for both 40 LPCD and 200 LPCD. The cost comparisons are outlined in report.

5. We have designed the primary and secondary networks such that each node served by the secondary network has a minimum pressure head of 8m. We

believe this head will be sufficient to supply water at a reasonable pressure through a tertiary network that may be built in the future.

6. The pipe material we have chosen for the gravity main (primary) and distribution network (secondary) in this design is High Density Poly-Ethylene (HDPE). We chose this material because of its relatively low-cost and resistance to corrosion.

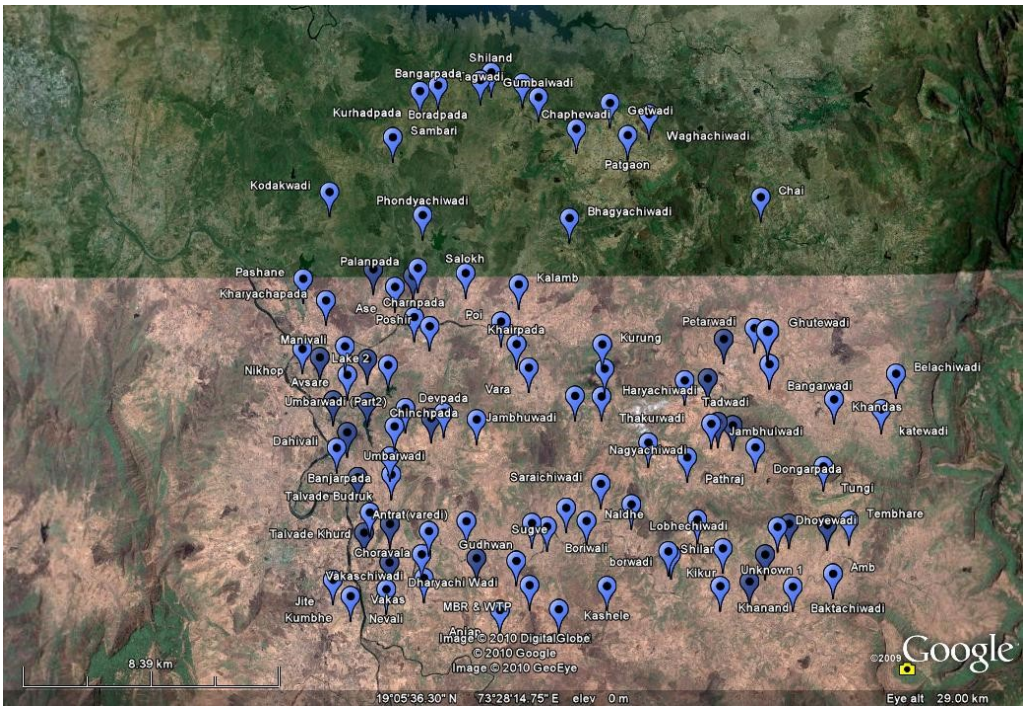
7. For the rising main we have chosen ductile iron as the pipe material because it can reliably meet the main's extreme pressure requirements.

8. We have chosen a Conventional water treatment plant (WTP) as opposed to an Unconventional WTP for the network since we do not anticipate a shortage of space. Unconventional WTPs have the advantage of being more compact.

3.4 Overall Design Methodology

In the following section we hope to illustrate in detail our methodology of design for our piped water supply system.

1. We began by using a detailed map of Karjat (obtained from Disha Kendra) to locate all villages and roads in the target region, and marked these on Google Earth.



Villages marked on Google Earth

2. Next we collected and tabulated all available population data for Karjat Taluka and averaged the results of the incremental and geometric methods of population forecast to estimate the population of each village in the target area for 2026 (15 years) and 2041 (30 years). *Sample Population Forecast*

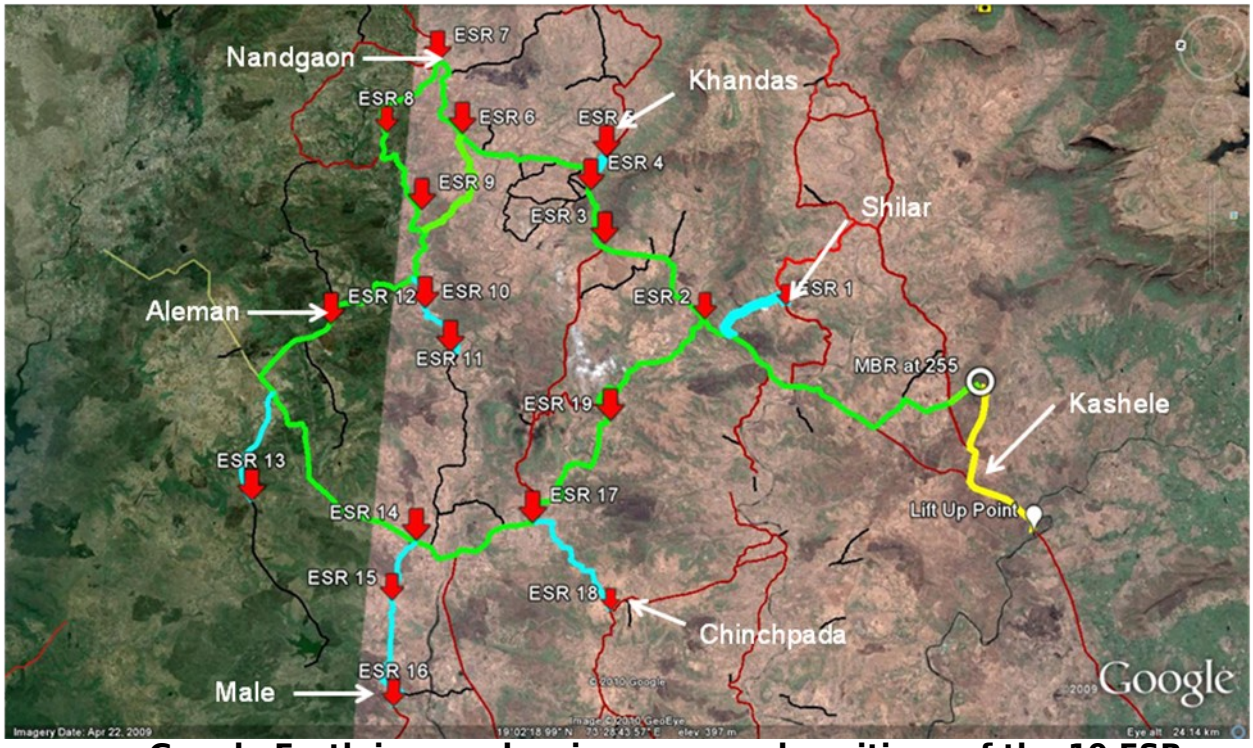
3. We then calculated water demand in LPS at each village for 200 LPCD and 40 LPCD given 6 hours of supply and added a 20% water loss margin.

   e.g. The 2041 population of Shilar is 1126. At 200 lpcd, the demand per day in Shilar is 200 multiplied by the population, equal to 225,200lpd. This quantity is to be delivered in 6 hours supply (within 3600*6 = 21600) seconds, thus the unadjusted demand is about 10.4 LPS. We then add a 20% water loss margin to get a design demand of 12.5 LPS.

4. We next decided on number of ESRs, their positions and the villages they will serve based on all of the following factors:

   - Elevation of villages - *Villages with similar elevations can be served by the same ESR easily.*

- Position of villages – *Piping is expensive*; *it is economical to place an ESR in a central location with respect to the villages it will serve.*
- Population of villages - *Very large villages will perhaps need an ESR of their own, or will share an ESR with fewer than usual villages*
- Elevation of terrain - *The higher the ground level elevation of the ESR, the lower the ESR height will have to be to achieve a given pressure (i.e. lower construction costs). Alternatively, the higher the ground level elevation of the ESR, the higher the water pressure for a given ESR height be will be (i.e. lower piping costs).*
- Proximity to major road – *The ESRs will be connected to the MBR along a main looped network that will consist of very large (and expensive) pipes. It is economical to minimize the length of this piping by keeping ESRs as close to the main looped network as possible. ESRs need to be position by a road also for ease of access.*
- Appearance of the land – *We avoid positioning the ESR on farmland (visible on Google Earth)*



Google Earth image showing proposed positions of the 19 ESRs

5. Once the clusters were established we finalized the ESR-village pipe layout for each ESR-based cluster of villages as follows:

    a. We drew up pipes along the roadways that connect the ESR to each village such that all marked nodes are connected to network.

    b. We then assigned unique pipe and node identification numbers to each pipe and node in the system and recorded the details of village nodes (name, elevation, demand) and node-pipe connections (nodes from and to, length of the pipe)

    c. We entered the above information into BRANCH 3.0, a C++ optimization programme created by the EMC and World Bank. BRANCH 3.0 calculates the lowest pipe diameters (from a user-fed list of available diameters) which will meet user-specified minimum and maximum pressure requirements.



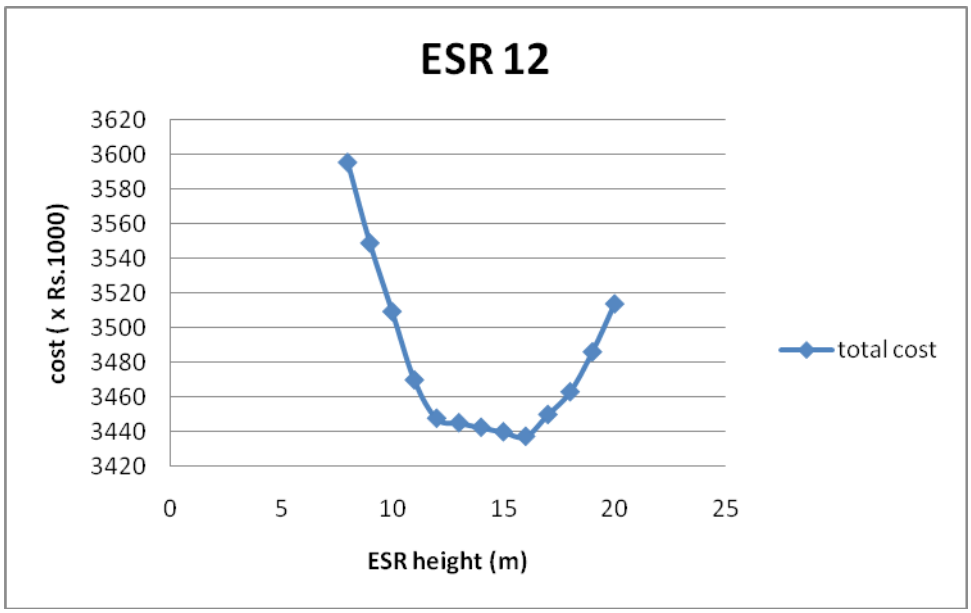
Example of a secondary (ESR to villages) network – ESR 17

6. In the next step we calculated an optimum height for the base of the water tank of the ESR. We believe this step has the potential to substantially save costs. Currently, in designs by the government the ESR height used is the minimum height at which the pressure requirement is met. However, we find that raising the height to an optimum value (which considers the drop in pipe costs due to a added pressure head) has the potential to reduce the overall cost of the project considerably.

    a. We first ran BRANCH/LOOP for HGLs ranging from the minimum allowable HGL to 20 meters above the ESR ground level elevation at intervals of one meter and recorded the total pipe cost in each case. The correlation between pipe cost and ESR height (ESR Height = HGL – GL elevation of ESR) is always negative.

b. We then used an MJP document on ESR construction cost estimates to estimate the cost of constructing an ESR of a given capacity at various heights. The correlation between the cost and ESR height is positive.

c. We summed the cost of piping and ESR construction for each height increment and graphed the total cost verses ESR height. The lowest point on the graph was taken as the optimum ESR height. As you can see, an ESR height of 8m would have satisfied pressure requirements but a height of 16 can save Rs. 1.6 lakh due to the lower piping costs at this staging height.

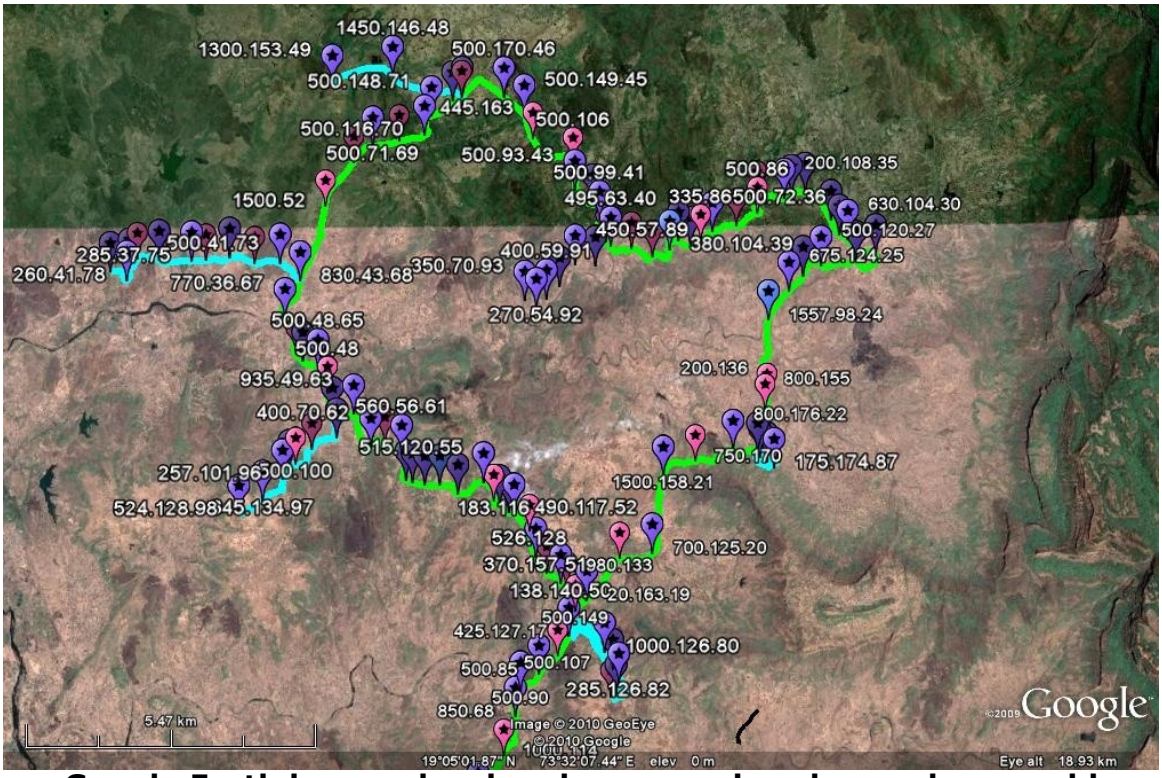


Example of a ESR staging height optimization graph – Optimum height chosen to be 16

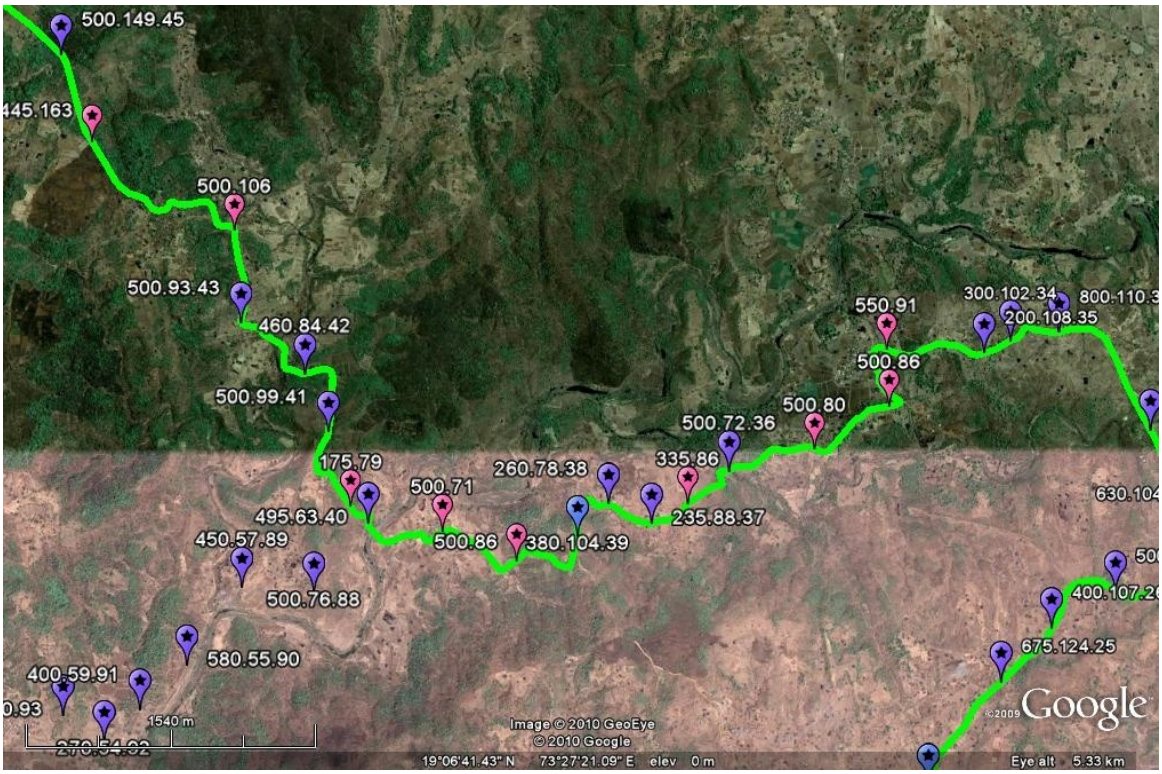
7. We designed the MBR-ESR network, a major component of the overall design, as follows:

a. We first tested several alternative pipe layouts for connecting the MRB to each ESR and chose the layout with the lowest pipeline length and costs. This is a very time intensive and tedious process requiring the creation and running of multiple complex LOOP files.

b. We then created dummy nodes at intervals of 500-1000m and at every sharp elevation drop or rise along the finalized pipelines, and entered them into LOOP 4.0 to ensure the design incorporates dips and rises in the elevation of the terrain. This network cannot be branched due to the head loss from the dead ends being too high.



Google Earth image showing dummy nodes along primary grid



A closer look at dummy nodes (naming convention depicts distance from previous node, elevation at current node and assigned node number in that order)

8. We designed the rising main as follows:

    a. Different diameter inputs were selected assuming an economic velocity of 1.25 m/s.

    b. Overall cost of rising main calculated for different diameters using an Excel spreadsheet provided by MJP with pre-entered formulae. The most economical diameter was selected and corresponding required pump capacity and piping were selected for the design. *Rising Main Design Calculation*

9. Finally, we tabulated all investment costs. Used documents prepared by MJP to estimate the cost of piping, construction of ESRs, sump, and water treatment plant (WTP) and divide by total population served to obtain a value for capital cost per capita of the project.

4. Design Details

4.1. **Water Source**

We considered a number of options for the water source. There are three rivers that flow in or around the target region: Ullhas, Shilar and Pej. Ullhas and Shilar are prone to drying up during the pre-monsoon months. Pej lies south of the target region and at an approximate straight-line distance of 20km to village in the target area furthest from it. It is in fact the only perennial river of the three, and our chosen water source. The water in the

Pej River is supplied by a TATA power plant that lets out water in pre-determined quantities throughout the year.

Barvi Dam, built and operated by the Maharashtra Industrial Development Corporation (MIDC), seemed at one point a promising source. The enormous reservoir lies far north of the target region. We found, however, that the distance from the reservoir to the nearest point with a sufficiently high elevation was over 13km. This would require a very long rising main whose cost could substantially compromise the economic viability of the system. Furthermore, the reservoir is currently supplying water at its full capacity.



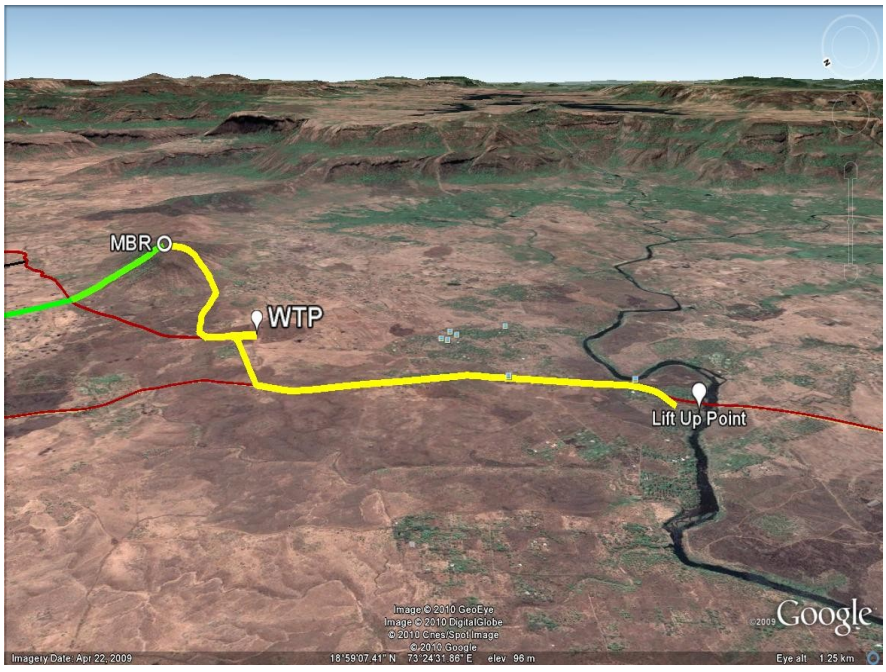
Pej River, May 1010

4.2. Rising Main

Two options were considered for the placement of the WTP. In the first, the WTP is placed 2.845 km from the lift-up point, and in the second the WTP is placed right next to the lift-up point. The piping cost of second option is lower by 4 crore rupees but it requires a pumping capacity that too high. Furthermore, the second option is not feasible for 40 lpcd due to high working pressure.

The following table contains the details of the rising main:

Specification	**Raw water rising main(1st stage)**	**Clean water rising main(2nd stage)**
Path	Lift-Up point to WTP	WTP to MBR
Length	1977 m	2845 m
Class of pipe	Ductile Iron	Ductile Iron
Diameter	600 mm (for 200LPCD) 350 mm (for 40LPCD)	700 mm (for 200LPCD) 350 mm (for 40LPCD)



Google Earth image showing the relative positions of the life-up point, MBR and WTP

5. Cost Breakdown

The following table contains the elements of design included in our cost estimate along with the cost breakdown.

			200 lpcd	40 lpcd
S.No.	**Particulars**		**Cost(Rs.)**	
1	Jack Well without Over Head Pump House		1122289	377287
2	Raw Water Pumping Machinery	1st Stage(Till 2026)	13335000	2478000
		2nd Stage(Till 2041)	19488000	3507000
3	Raw Water Rising Main		34874000	17762000
4	WTP	1st Stage(Till 2026)	24426480	6977800
		2nd Stage(Till 2041)	8870840	1973700
5	Pure Water Pumping Machinery	1st Stage(Till 2026)	43512000	8736000
		2nd Stage(Till 2041)	55965000	11424000
6	Pure Water Rising Main		34874000	12343000
7	MBR		12446990	3456190
8	Gravity Main		13746695 0	42368560
9	Distribution system(ESR + Pipe)		61814926	21943110
10	Excavation cost		11956912 6	38587002
	Total		**57,21,47,601**	**17,19,33,649**

The following two tables contains details on the cost per capita and the cost ratio between the 200 lpcd and 40 lpcd designs:

	For 200 LPCD	For 40 LPCD
Design Population	81,140	51,618
Daily Demand	19.47 MLD	3.90 MLD
Net Investment	Rs. 57,21,47,601	17,19,33,649
Cost per Person	**7051**	**2119**
Ratio of Design Demand	5	1
Ratio of Costs	3.3	1

6. GIS Application

We used Google Earth extensively at every stage of the design process. The nature of this software allowed us enormous flexibility in marking, editing, saving and sharing accumulated data, along with aiding decision making processes by providing a visual representation of the target area.

Early in the project Google Earth was used to detect and mark villages, road networks and water sources manually. All our elevation data was obtain from Google Earth. At a later stage we used it to decide ESR locations and visually assess alternative pipe layouts. In the final stage of the design, once the pipe layout was established, we used Google Earth to ‘survey’ the terrain along our proposed pipelines. Dummy nodes were created at intervals of 500-1000m and at every major elevation rise and dip along the pipeline. These nodes acted as a record of elevation changes along the pipeline and were entered into LOOP 4.0 to ensure our chosen pipe diameters incorporated any head-loss due to a bumpy terrain. This latter use of GIS, we argue, holds tremendous potential to save the man-hours and high costs associated with typically pre-design land surveying.

While Google Earth has proved to be useful GIS tool for pipe network design, we believe a more optimized and streamlined design process is possible with a stronger GIS interface catered specifically towards design of piped water systems. Such an

interface could include more reliable elevation data and could automate the detection of road networks, villages, uncultivated land and water sources as well as provide contour lines at small elevation intervals.

7. Conclusion

Our piped water supply network design has an estimated capital cost of Rs. 2100 per capita for a demand of 40 lpcd and Rs. 7000 per capita for a demand of 200 lpcd. These numbers incorporate all major costs of building the network. Given that the per capita capital cost for Thane's water supply scheme is Rs. 10,000 and Mumbai's is about Rs. 7000, our findings suggest that it is indeed economically feasible to supply water in a piped network to the villages of north Karjat.

The water level at our proposed lift-up point along the Pej depends on how much the TATA Bhivpuri hydro-electric plant lets out in a given period of time. The Pej River is already being used for a piped water supply scheme, and certainly the water that flows downstream is being used by someone, in part at least. We have made the assumption in this project that there is sufficient water in the Pej river since we were not certain one way or the other (due to lack of access to data), and also because in large part our aim was to establish a universally application design methodology. Making this assumption allowed us to progress

to the pre-design and fulfill part of our aim. Nevertheless, investigating the suitability of Pej river as a water source is the essential next step in CTARA’s venture to explore ways to secure water access in north Karjat.

Appendix 8.1

Village Data Summary

S.No.	ESR #	Village	Elevation	Population		
				2011	2026	2041
1	1	Shilar	138	737	912	1126
2		Unknown	119	480	600	800
3		Khadyrachiwadi	133	480	600	800
4		Kikur	91	480	600	800
5		Borwadi	90	480	600	800
6	2	Pathraj	150	2058	2402	2773
7		Nagyachiwadi	158	480	600	800
8	3	Morachiwadi	151	480	600	800
9		Tadwadi	144	827	985	1166
10		Margachiwadi	138	425	577	773
11		Jambhulwadi	137	480	600	800
12		Jalkatwadi	150	480	600	800
13		Dongarpada	165	480	600	800
14	4	Bhangarwadi	159	480	600	800
15		Dhabewadi	161	480	600	800
16		Govanwadi	123	480	600	800
17		Petarwadi	136	480	600	800
18		Ghutewadi	121	480	600	800
19	5	Belachiwadi	174	480	600	800
20		Amberpada	166	480	600	800
21		Katewadi	163	480	600	800
22		Khandas	166	2637	2947	3285
23	6	Mangal	122	480	600	800
24		Chafewadi	129	1418	2117	3207
25		Unknown	113	480	600	800
26		Jamhaiwadi	133	480	600	800
27	7	Nandgaon	120	865	995	1137
28		Daunsewadi 1	116	480	600	800
29		Ballvare	117	1168	1477	1867
30		Daunsewadi 2	110	480	600	800

31	Gorechiwadi	108	480	600	800

S.No.	ESR #	Village	Elevation	Population		
				2011	2026	2041
32	8	Chevne	87	542	660	795
33		Chai	105	902	1394	2173
34		Kotwalwadi	102	480	600	800
35		Zugarachiwadi	112	785	911	1047
36	9	Bhopalwadi	96	480	600	800
37		Pendarawadi	71	480	600	800
38	10	Bondshet	62	480	600	800
39	11	Borgaon	65	1095	1305	1545
40	12	Aleman	162	1012	1274	1587
41		Telangwadi	132	480	600	800
42		Borichiwadi	161	480	600	800
43		Bhagyachiwadi	128	480	600	800
44	13	Murchulwadi	153	480	600	800
45		Bhikarwadi	136	480	600	800
46		Narthewadi	119	480	600	800
47	14	Kalamb	50	4691	5814	7140
48	15	Salokh	47	1788	2165	2601
49	16	Poshir	45	2624	2962	3332
50		Charnpada	40	480	600	800
51		Ase	43	215	303	427
52		Ardhe	59	854	1062	1308
53		Male	53	1573	1934	2370
54		Palanpada	48	480	600	800
55	17	Ware	65	1755	2009	2286
56		Khairpada	54	480	600	800
57		Mankivili	56	480	600	800
58		Poi	46	436	551	695
59	18	Chinchpada	128	480	600	800
60		Devpada	87	480	600	800
61		Giripada	118	480	600	800
62		Umberwadi 2	105	480	600	800
63		Umberwadi 1	103	480	600	800

64		Banjarpada	61	480	600	800
65		Talwade Budruk	57	480	600	800
66	19	Thakurwadi	111	480	600	800
67		Jambhulwadi	106	480	600	800
68		Haryachiwadi	121	480	600	800
69		Kurung	96	650	765	899

Appendix - 8.2

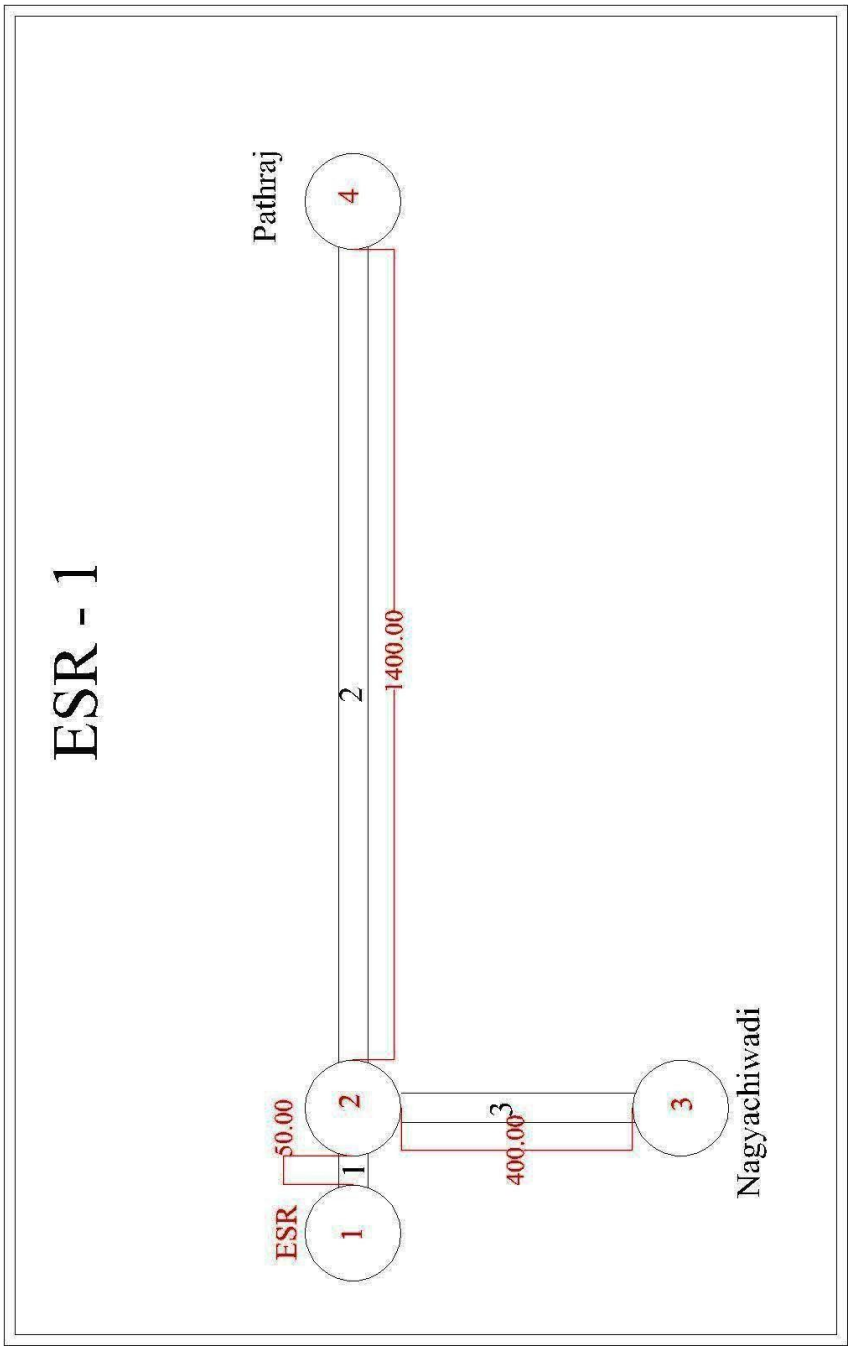
ESR Profiles

for 200 LPCD Design

ESR 1 – Shilar

S.No.	Village	Elevation	Population		
			2011	2026	2041
1	Shilar	138	737	912	1126
2	Unknown	119	480	600	800
3	Khadyrachiwadi	133	480	600	800
4	Kikur	91	480	600	800
5	Borwadi	90	480	600	800
	Total		**2657**	**3312**	**4326**

S.



Shilar
Shilar ESR- GL 136m
Khadyrachiwadi
Unknown
Kikur
borwadi
Google
© 2009
© 2010 Google
Image © 2010 GeoEye
19°01'38.16" N 73°26'28.44" E elev 130 m
Eye alt 4.27 km
Imagery Date: Apr 22, 2009

ESR 1 -
Shilar

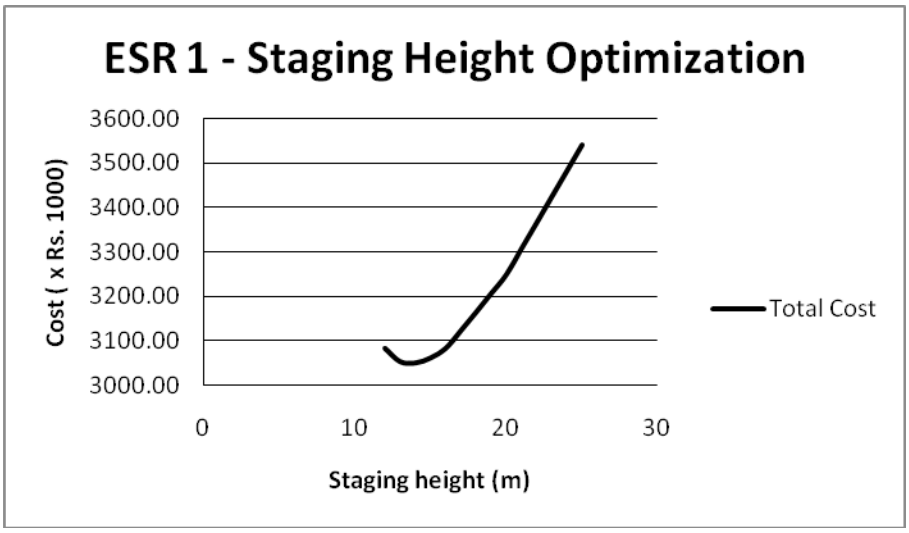
ESR 1 – Staging Height Optimization

Total Daily Demand(l)	1038240
ESR Capacity Required(l)	389340
ESR Capacity Proposed(l)	**390000**
ESR Elevation(m)	**135**
Minimum Working HGL(m)	147

Staging height(m)	HGL(m)	Pipe Cost	ESR Cost	Total Cost
12	147	1477.73	1606.21	3083.94
13	148	1415.47	1638.33	3053.80
14	**149**	**1380.47**	**1670.46**	**3050.93**
15	150	1359.47	1702.58	3062.05
16	151	1349.16	1734.71	3083.87
17	152	1340.54	1782.89	3123.43
18	153	1333.85	1831.08	3164.93
19	154	1328.12	1879.27	3207.39
20	155	1322.39	1927.45	3249.84
21	156	1316.66	1991.70	3308.36

Optimum ESR Height(m)	14
Tank Height(m)	5
Total Height of ESR(m)	**19**

ERS Cost('000 Rs.)	1670.46
Pipe Cost('000 Rs.)	1380.47
Total Cost('000 Rs.)	**3050.93**
Cost per Person(Rs.)	**705**



ESR 1 – Branch Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 1
 Name of the User                        :
 Number of Pipes                         :  9
 Number of Nodes                         :  10
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m         mm       Const    (E/P)
------------------------------------------------------------
    1     1     2       50.00
    2     2     3      200.00
    3     3     4       50.00
    4     3     5     2050.00
    5     2     6      340.00
    6     6     7       50.00
    7     6     8     1400.00
    8     8     9      100.00
    9     8    10      100.00
============================================================
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	135.00	8.00	
2	1.00	0.000	134.90	8.00	
3	1.00	0.000	133.00	8.00	
4	1.00	-12.511	138.00	8.00	
5	1.00	-8.889	119.00	8.00	
6	1.00	0.000	133.00	8.00	
7	1.00	-8.889	133.00	8.00	
8	1.00	0.000	85.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
9	1.00	-8.889	91.00	8.00	
10	1.00	-8.889	90.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	149.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00

200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design Output

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	48.067	200.0	140.00000	0.53	10.60	50.00	
2	2	3	21.400	140.0	140.00000	1.35	13.35	101.16	
				160.0	140.00000	0.69	6.98	98.84	
3	3	4	12.511	125.0	140.00000	0.43	8.60	50.00	
4	3	5	8.889	90.0	140.00000	3.14	22.64	138.68	
				110.0	140.00000	16.29	8.52	1911.32	
5	2	6	26.667	140.0	140.00000	6.83	20.09	340.00	
6	6	7	8.889	90.0	140.00000	0.34	22.47	15.13	
				110.0	140.00000	0.30	8.60	34.87	
7	6	8	17.778	125.0	140.00000	23.08	16.49	1400.00	
8	8	9	8.889	90.0	140.00000	2.26	22.60	100.00	
9	8	10	8.889	90.0	140.00000	2.26	22.60	100.00	

Node Details

Node	Peak Flow	Elevation	H G L	Cal Pres	Spc Pres	Meet Res

No.		(lps)	(m)	(m)	(m)	(m)	Pres. (Y)
1	S	48.067	135.00	149.00	14.00	8.00	
2		0.000	134.90	148.47	13.57	8.00	
3		0.000	133.00	146.43	13.43	8.00	
4	T	-12.511	138.00	146.00	8.00	8.00	
5	T	-8.889	119.00	127.00	8.00	8.00	
6		0.000	133.00	141.64	8.64	8.00	
7	T	-8.889	133.00	141.00	8.00	8.00	
8		0.000	85.00	118.56	33.56	8.00	
9	T	-8.889	91.00	116.29	25.29	8.00	
10	T	-8.889	90.00	116.29	26.29	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	353.81	66.87	66.87
110.0	1946.19	525.47	592.34
125.0	1450.00	503.15	1095.49
140.0	441.16	190.58	1286.07
160.0	98.84	54.96	1341.03
200.0	50.00	39.45	1380.48

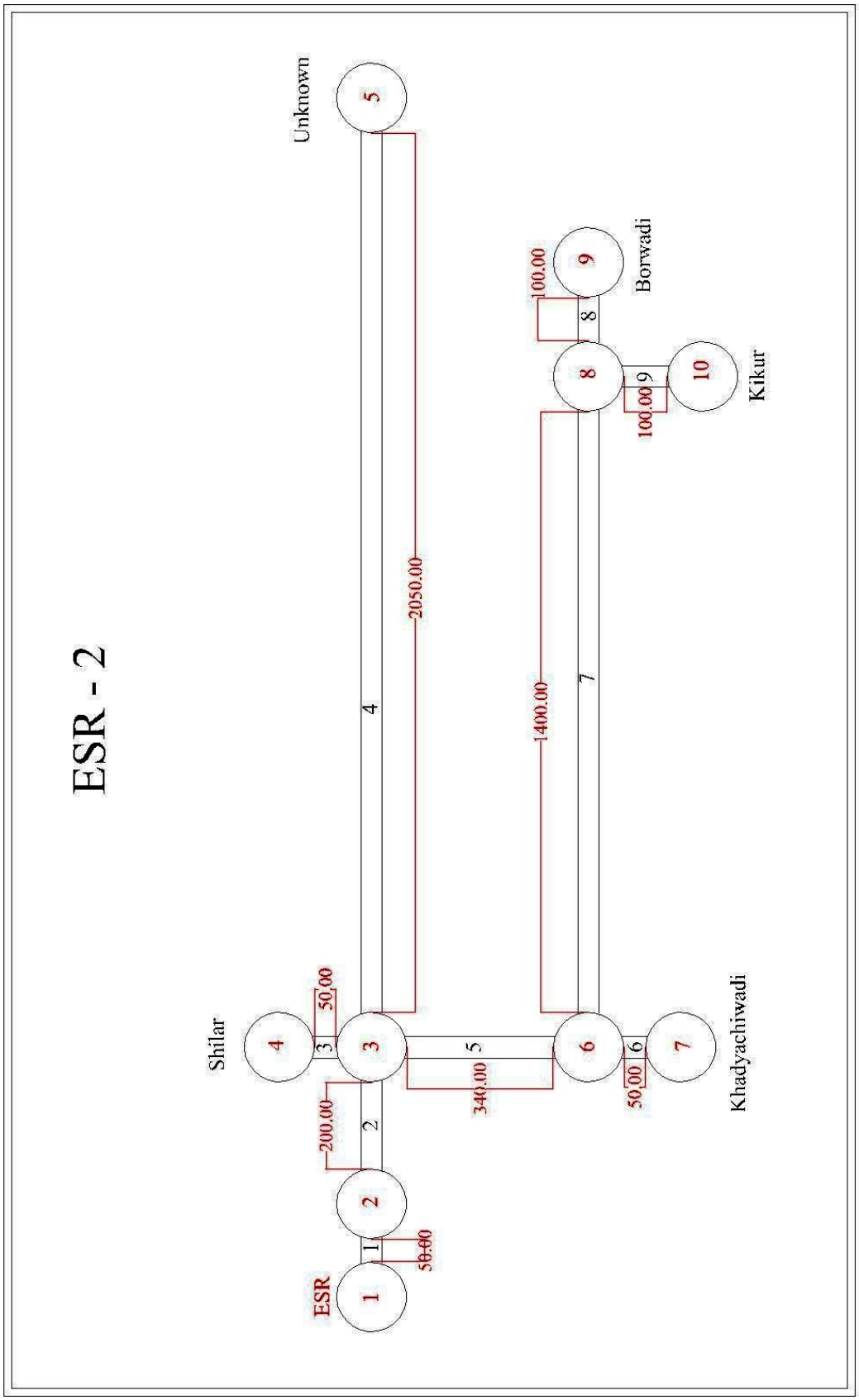
Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	200.0	50.00	39.45	39.45
2	140.0	101.16	43.70	83.15
	160.0	98.84	54.96	138.11
3	125.0	50.00	17.35	155.46
4	90.0	138.68	26.21	181.67
	110.0	1911.32	516.06	697.72
5	140.0	340.00	146.88	844.60
6	90.0	15.13	2.86	847.46
	110.0	34.87	9.41	856.88
7	125.0	1400.00	485.80	1342.68
8	90.0	100.00	18.90	1361.58
9	90.0	100.00	18.90	1380.48

ESR 2 – Pathraj

S.No.	Village	Elevation (m)	Population 2011	Population 2026	Population 2041
1	Pathraj	150	2058	2402	2773
2	Nagyachiwadi	158	480	600	800
	Total		2538	3002	3573

Daily Water Demand at 200 LPCD					
S.No.	Village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Pathraj	0.494	0.666	22.867	30.811
2	Nagyachiwadi	0.115	0.192	5.333	8.889
	Total	0.609	0.858	28.200	39.700


ESR - 2
ESR
Shilar
Unknown
Borwadi
Kikur
Khadyachiwadi
1
2
3
4
5
6
7
8
9
10
50.00
200.00
50.00
2050.00
340.00
1400.00
50.00
100.00
100.00

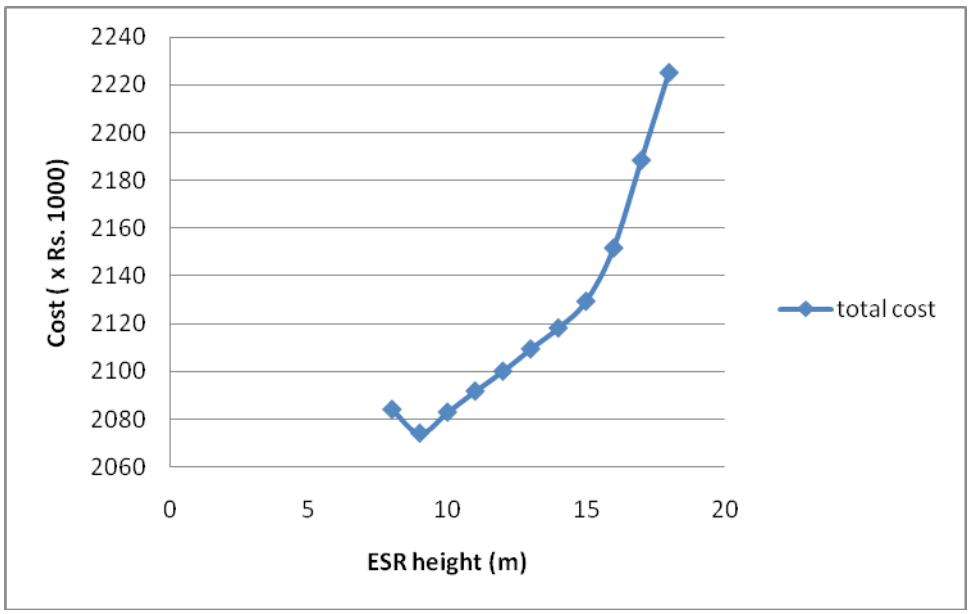
ESR 2 -
Pathraj

ESR 2 – Staging Height Optimization

Total Demand	857520
ESR capacity required	321570
ESR capacity proposed	322000
Low level Height	172
ESR elevation	164

HGL	PIPE cost	ESR cost	Total	Height (m)
172	781.47	1302.545	2084.015	8
173	**743.2**	**1330.861**	**2074.061**	**9**
174	723.7	1359.178	2082.878	10
175	704.21	1387.494	2091.704	11
176	684.21	1415.81	2100.02	12
177	665.22	1444.126	2109.346	13
178	645.72	1472.442	2118.162	14

ESR capacity	322000
Optimum ESR height	9
ERS cost	1330.86
Pipe cost	743.20
Total	2074.06
cost per person	580



ESR 2 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 2
 Name of the User                        :
 Number of Pipes                         :  3
 Number of Nodes                         :  4
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length     Diameter  Hazen's   Status
  No.  Node  Node       m          mm       Const    (E/P)
------------------------------------------------------------
    1     1     2       50.00
    2     2     3      400.00
    3     2     4     1400.00
============================================================


 Node Data
-----------
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	164.00	8.00	
2	1.00	0.000	163.90	8.00	
3	1.00	-30.811	150.00	8.00	
4	1.00	-8.889	158.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	173.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2215.00
400.0	140.00000	3147.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	39.700	200.0	140.00000	0.37	7.40	50.00	
2	2	3	30.811	160.0	140.00000	5.48	13.70	400.00	
3	2	4	8.889	110.0	140.00000	0.49	8.48	57.79	
				125.0	140.00000	6.14	4.57	1342.21	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1	S	39.700	164.00	173.00	9.00	8.00	
2		0.000	163.90	172.63	8.73	8.00	
3	T	-30.811	150.00	167.15	17.15	8.00	
4	T	-8.889	158.00	166.00	8.00	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
110.0	57.79	15.60	15.60
125.0	1342.21	465.75	481.35
160.0	400.00	222.40	703.75
200.0	50.00	39.45	743.20

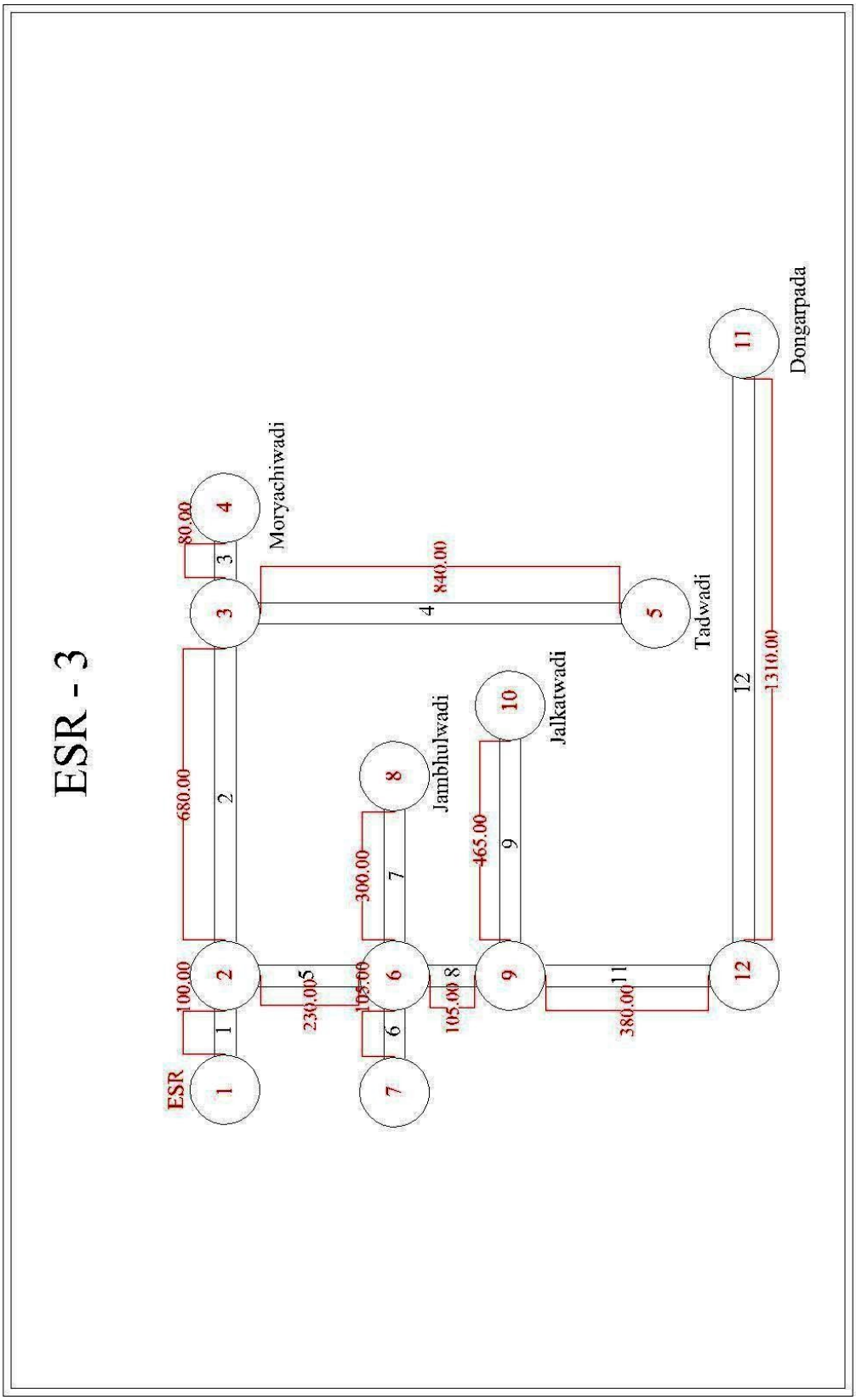
Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	200.0	50.00	39.45	39.45
2	160.0	400.00	222.40	261.85
3	110.0	57.79	15.60	277.45
	125.0	1342.21	465.75	743.20

ESR 3 – Tadwadi

S.No.	Village	Elevation		Population	
			2011	2026	2041
1	Morachiwadi	151	480	600	800
2	Tadwadi	144	827	985	1166
3	Margachiwadi	138	425	577	773
4	Jambhulwadi	137	480	600	800
5	Jalkatwadi	150	480	600	800
6	Dongarpada	165	480	600	800
	Total		3172	3962	5139

Daily Water Demand at 200 LPCD					
		Demand(MLD)		Demand(LPS)	
S.No.	Village	2011	2041	2011	2041
1	Morachiwadi	0.115	0.192	5.333	8.889
2	Tadwadi	0.198	0.280	9.189	12.956
3	Margachiwadi	0.102	0.186	4.722	8.589
4	Jambhulwadi	0.115	0.192	5.333	8.889
5	Jalkatwadi	0.115	0.192	5.333	8.889
6	Dongarpada	0.115	0.192	5.333	8.889
	Total	0.761	1.233	35.244	57.100


ESR - 3
ESR
Moryachiwadi
Jambhulwadi
Jalkatwadi
Tadwadi
Dongarpada
1
2
3
4
5
6
7
8
9
10
11
12
100.00
680.00
80.00
840.00
230.00
105.00
300.00
105.00
465.00
380.00
1310.00

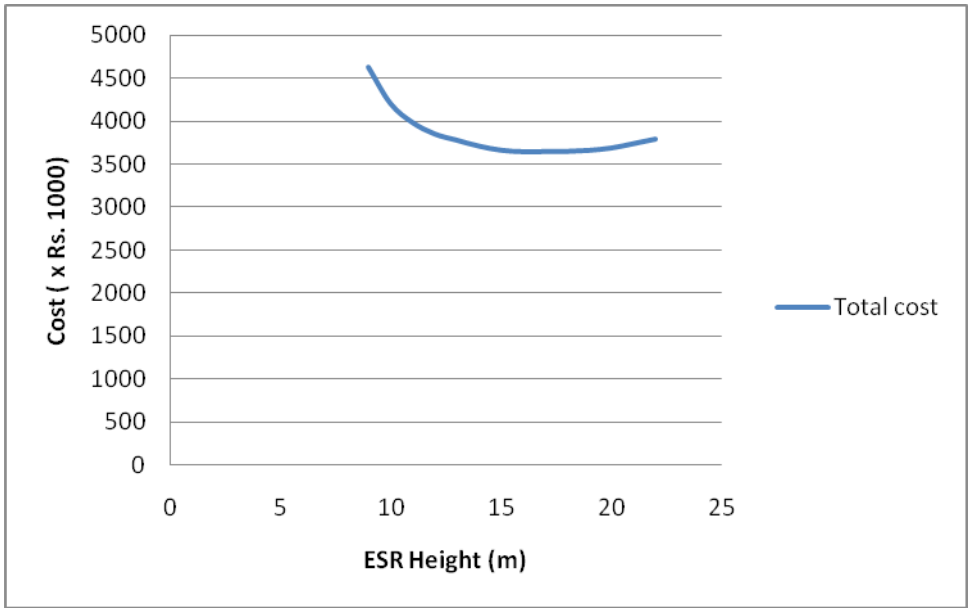
ESR 3 -
Tadwadi

ESR 3 – Staging Height Optimization

Total Demand	1233360
ESR capacity Required	462510
ESR capacity Proposed	463000
Low level Height	174
ESR elevation	165

HGL	PIPE cost	ESR cost	Total	Height (m)
174	2927.5	1693.542	4621.042	9
175	2471.5	1729.574	4201.074	10
176	2214.73	1765.607	3980.337	11
177	2046.48	1801.64	3848.12	12
178	1939.68	1837.673	3777.353	13
179	1834.6	1873.706	3708.306	14
180	1751.57	1909.738	3661.308	15
181	1696.99	1945.771	3642.761	16

ESR capacity	463000
Optimum ESR height	16
ERS cost	1945.77
Pipe cost	1696.99
Total	3642.76
/person	708.846313



ESR 3 - BRANCH Input and Output

```
 Echoing Input Variables
------------------------

 Title of the Project                    : ESR 3
 Name of the User                        :
 Number of Pipes                         :  11
 Number of Nodes                         :  12
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      1      2      100.00
    2      2      3      680.00
    3      3      4       80.00
    4      3      5      840.00
    5      2      6      230.00
    6      6      7      105.00
    7      6      8      300.00
```

8	6	9	105.00
9	9	10	465.00
11	9	12	380.00
12	12	11	1310.00

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	165.00	8.00	
2	1.00	0.000	161.00	8.00	
3	1.00	0.000	151.00	8.00	
4	1.00	-8.889	151.00	8.00	
5	1.00	-12.956	144.00	8.00	
6	1.00	0.000	135.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
7	1.00	-8.589	138.00	8.00	
8	1.00	-8.889	137.00	8.00	
9	1.00	0.000	134.00	8.00	
10	1.00	-8.889	150.00	8.00	
11	1.00	-8.889	165.00	8.00	
12	1.00	0.000	127.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	181.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m	length
63.0	140.00000	98.00	
75.0	140.00000	138.00	
90.0	140.00000	189.00	
110.0	140.00000	270.00	
125.0	140.00000	347.00	
140.0	140.00000	432.00	
160.0	140.00000	556.00	
180.0	140.00000	695.00	
200.0	140.00000	789.00	
225.0	140.00000	1004.00	
250.0	140.00000	1228.00	
280.0	140.00000	1532.00	
315.0	140.00000	1932.00	
355.0	140.00000	2215.00	
400.0	140.00000	3147.00	

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	57.101	225.0	140.00000	0.82	8.20	100.00	
2	2	3	21.845	125.0	140.00000	10.28	24.13	426.01	
				140.0	140.00000	3.53	13.90	253.99	
3	3	4	8.889	90.0	140.00000	1.81	22.63	80.00	
4	3	5	12.956	110.0	140.00000	14.37	17.11	840.00	
5	2	6	35.256	200.0	140.00000	1.36	5.91	230.00	
6	6	7	8.589	90.0	140.00000	2.23	21.24	105.00	
7	6	8	8.889	90.0	140.00000	6.79	22.63	300.00	
8	6	9	17.778	160.0	140.00000	0.52	4.95	105.00	
9	9	10	8.889	90.0	140.00000	10.53	22.65	465.00	
11	9	12	8.889	125.0	140.00000	1.74	4.58	380.00	
12	12	11	8.889	125.0	140.00000	0.27	4.66	57.99	
				140.0	140.00000	3.30	2.64	1252.01	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)
1	S	57.101	165.00	181.00	16.00	8.00	
2		0.000	161.00	180.18	19.18	8.00	
3		0.000	151.00	166.37	15.37	8.00	
4	T	-8.889	151.00	164.56	13.56	8.00	
5	T	-12.956	144.00	152.00	8.00	8.00	
6		0.000	135.00	178.82	43.82	8.00	
7	T	-8.589	138.00	176.59	38.59	8.00	
8	T	-8.889	137.00	172.03	35.03	8.00	
9		0.000	134.00	178.30	44.30	8.00	
10	T	-8.889	150.00	167.77	17.77	8.00	
11	T	-8.889	165.00	173.00	8.00	8.00	
12		0.000	127.00	176.56	49.56	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	950.00	179.55	179.55
110.0	840.00	226.80	406.35
125.0	864.00	299.81	706.16
140.0	1506.00	650.59	1356.75
160.0	105.00	58.38	1415.13
200.0	230.00	181.47	1596.60
225.0	100.00	100.40	1697.00

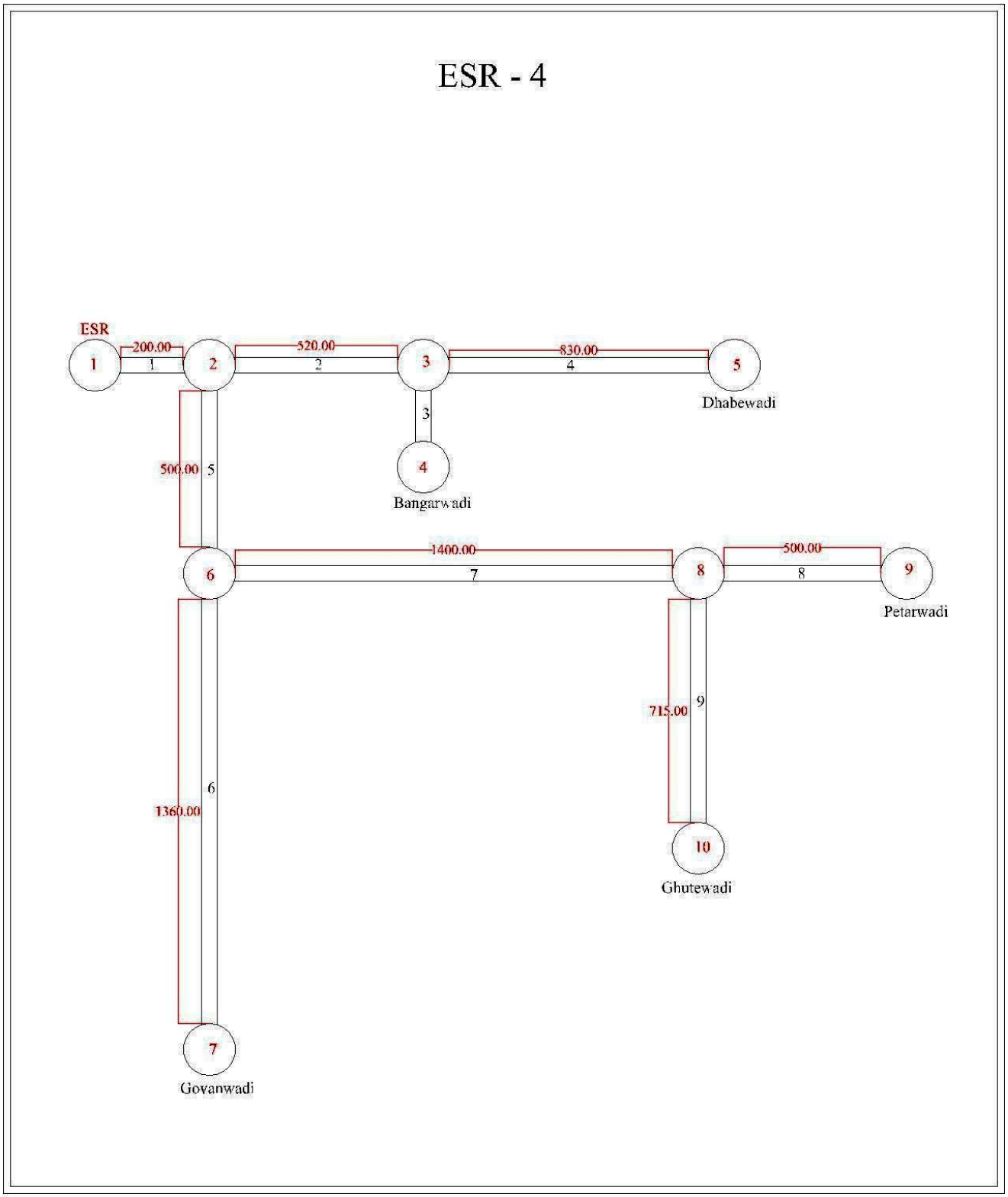
Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	225.0	100.00	100.40	100.40
2	125.0	426.01	147.83	248.23
	140.0	253.99	109.72	357.95
3	90.0	80.00	15.12	373.07
4	110.0	840.00	226.80	599.87
5	200.0	230.00	181.47	781.34
6	90.0	105.00	19.84	801.18
7	90.0	300.00	56.70	857.88
8	160.0	105.00	58.38	916.26
9	90.0	465.00	87.89	1004.15
11	125.0	380.00	131.86	1136.01
12	125.0	57.99	20.12	1156.13
	140.0	1252.01	540.87	1697.00

ESR 4 – Bangarwadi

			Population		
S.No.	Village	Elevation	2011	2026	2041
1	Bhangarwadi	159	480	600	800
2	Dhabewadi	161	480	600	800
3	Govanwadi	123	480	600	800
4	Petarwadi	136	480	600	800
5	Ghutewadi	121	480	600	800
	Total		2400	3000	4000

Daily Water Demand at 200 LPCD					
S.No.	Village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Bhangarwadi	0.115	0.192	5.333	8.889
2	Dhabewadi	0.115	0.192	5.333	8.889
3	Govanwadi	0.115	0.192	5.333	8.889
4	Petarwadi	0.115	0.192	5.333	8.889
5	Ghutewadi	0.115	0.192	5.333	8.889
	Total	0.576	0.960	26.667	44.444


ESR - 4
ESR
1
200.00
1
2
520.00
2
3
830.00
4
5
Dhabewadi
3
4
Bangarwadi
500.00
5
6
1400.00
7
8
500.00
8
9
Petarwadi
715.00
9
10
Ghutewadi
6
1360.00
7
Govanwadi

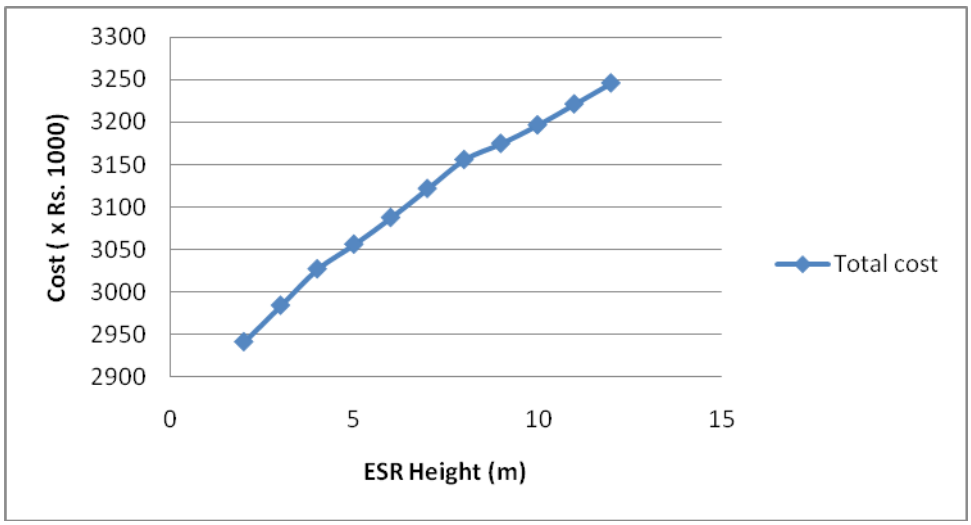
ESR 4 -
Bangarwadi

ESR 4 – Staging Height Optimization

Total Demand	960000
ESR capacity Required	360000
ESR capacity Proposed	360000
Low level Height	184
ESR elevation	182

HGL	PIPE cost	ESR cost	Total	Height
184	**1845.18**	**1095.991**	**2941.171**	**2**
185	1827.28	1156.88	2984.16	3
186	1809.35	1217.768	3027.118	4
187	1792.83	1263.434	3056.264	5
188	1778.65	1309.101	3087.751	6
189	1767.18	1354.767	3121.947	7
190	1755.7	1400.433	3156.133	8
191	1744.24	1430.877	3175.117	9

ESR capacity	360000
Optimum ESR height	2
ERS cost	1095.99
Pipe cost	1845.18
Total	2941.17
/person	735.2928



ESR 4 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 4
 Name of the User                        :
 Number of Pipes                         :  9
 Number of Nodes                         :  10
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      1      2       200.00
    2      2      3       520.00
    3      3      4       150.00
    4      3      5       830.00
    5      2      6       500.00
    6      6      7      1360.00
    7      6      8      1400.00
    8      8      9       500.00
    9      8     10       715.00
============================================================


 Node Data
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	182.00	8.00	
2	1.00	0.000	175.00	8.00	
3	1.00	0.000	157.00	8.00	
4	1.00	-8.889	159.00	8.00	
5	1.00	-8.889	161.00	8.00	
6	1.00	0.000	160.00	8.00	
7	1.00	-8.889	123.00	8.00	
8	1.00	0.000	137.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
9	1.00	-8.889	136.00	8.00	
10	1.00	-8.889	121.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	184.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00

160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2215.00
400.0	140.00000	3147.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	44.445	200.0	140.00000	1.82	9.10	200.00	
2	2	3	17.778	125.0	140.00000	2.76	16.51	167.13	
				140.0	140.00000	3.35	9.49	352.87	
3	3	4	8.889	90.0	140.00000	3.40	22.67	150.00	
4	3	5	8.889	110.0	140.00000	7.07	8.52	830.00	
5	2	6	26.667	140.0	140.00000	10.05	20.10	500.00	
6	6	7	8.889	90.0	140.00000	30.80	22.65	1360.00	
7	6	8	17.778	125.0	140.00000	23.08	16.49	1400.00	
8	8	9	8.889	90.0	140.00000	1.26	22.60	55.75	
				110.0	140.00000	3.79	8.53	444.25	
9	8	10	8.889	90.0	140.00000	16.19	22.64	715.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)

1	S	44.445	182.00	184.00	2.00	8.00
2		0.000	175.00	182.18	7.18 *	8.00
3		0.000	157.00	176.07	19.07	8.00
4	T	-8.889	159.00	172.68	13.68	8.00
5	T	-8.889	161.00	169.00	8.00	8.00
6		0.000	160.00	172.13	12.13	8.00
7	T	-8.889	123.00	141.33	18.33	8.00
8		0.000	137.00	149.05	12.05	8.00
9	T	-8.889	136.00	144.00	8.00	8.00
10	T	-8.889	121.00	132.86	11.86	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	2280.75	431.06	431.06
110.0	1274.25	344.05	775.11
125.0	1567.13	543.79	1318.90
140.0	852.87	368.44	1687.34
200.0	200.00	157.80	1845.14

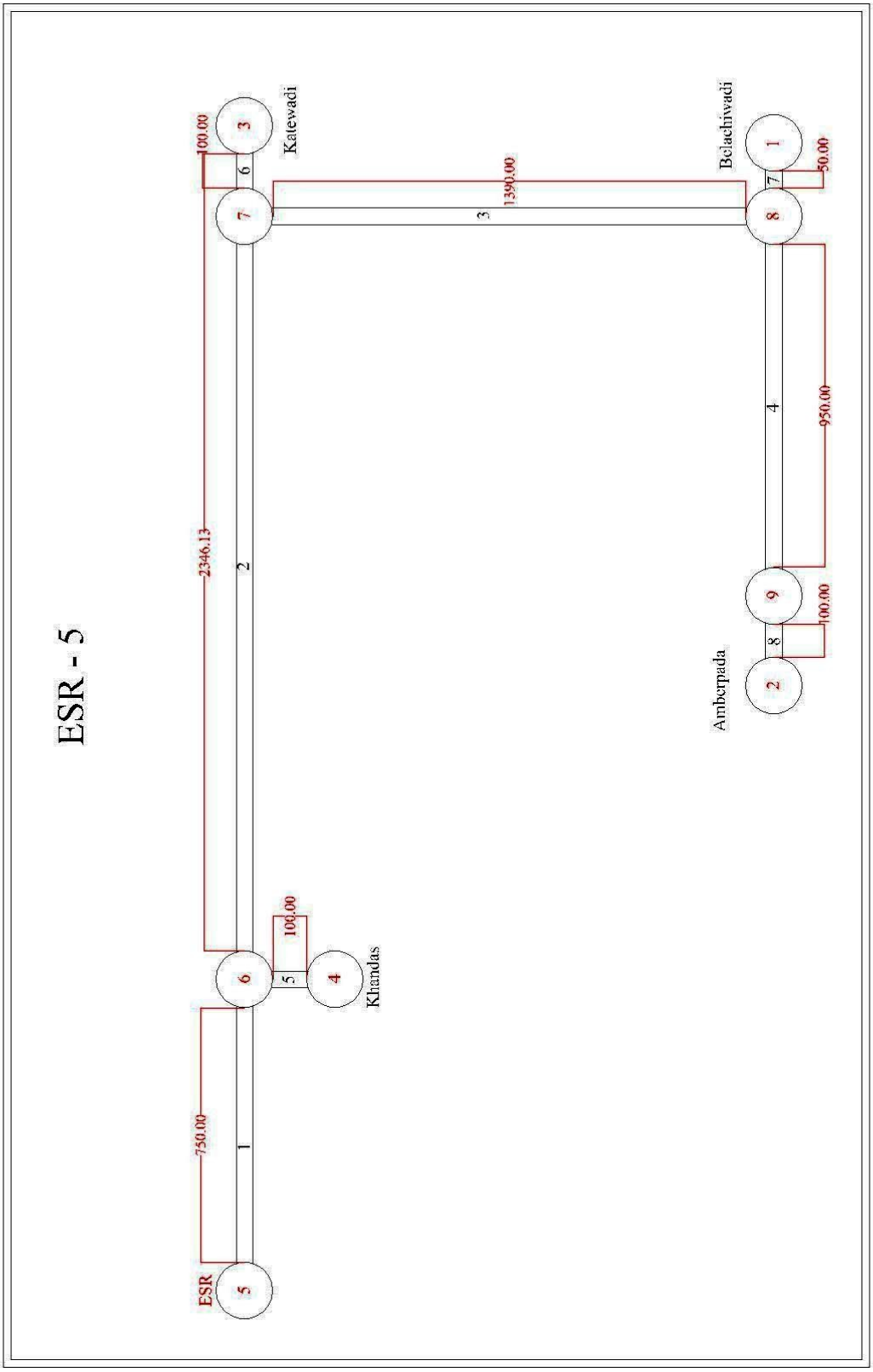
Pipe-wise Cost Summary

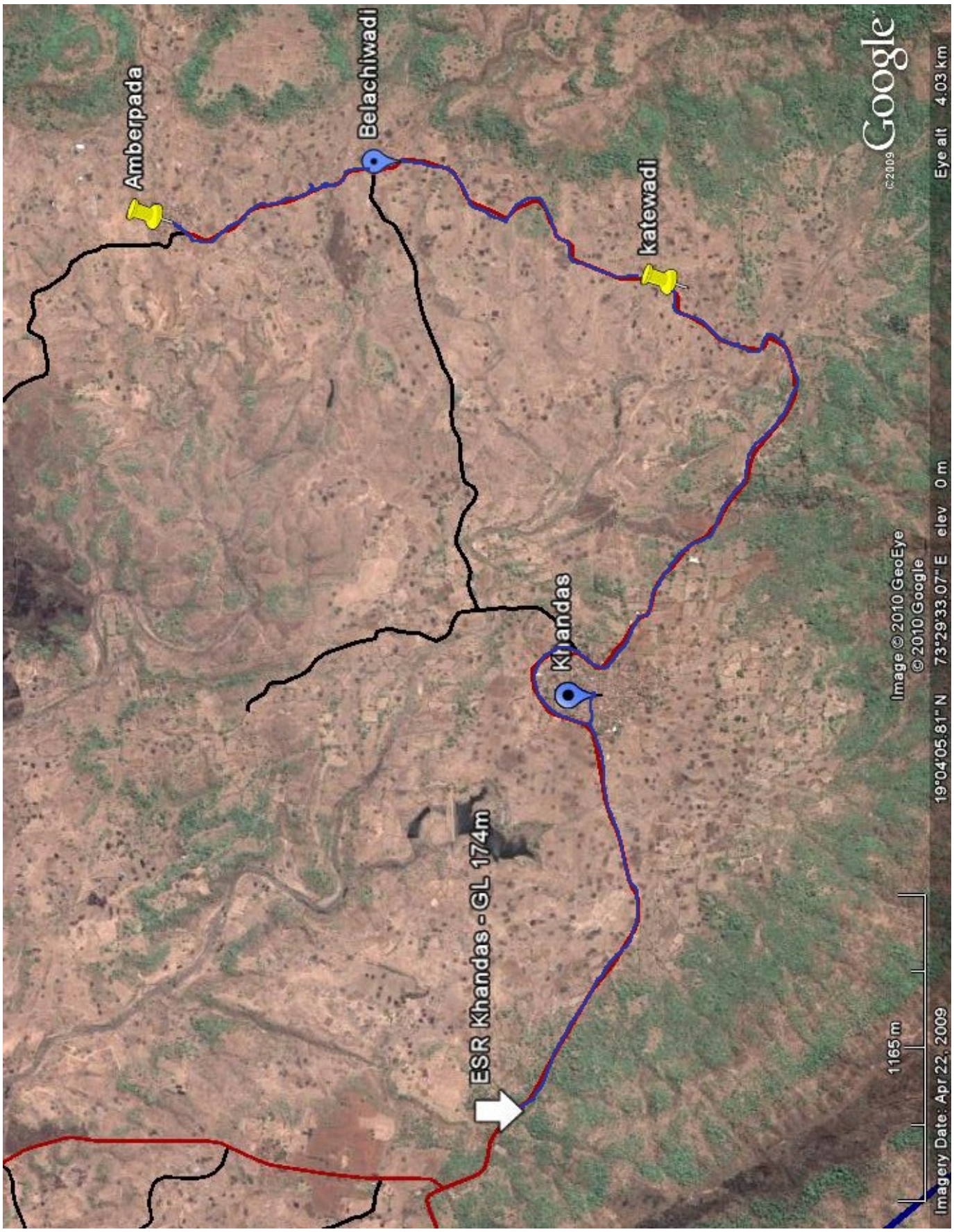
Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	200.0	200.00	157.80	157.80
2	125.0	167.13	57.99	215.79
	140.0	352.87	152.44	368.23
3	90.0	150.00	28.35	396.58
4	110.0	830.00	224.10	620.68
5	140.0	500.00	216.00	836.68
6	90.0	1360.00	257.04	1093.72
7	125.0	1400.00	485.80	1579.52
8	90.0	55.75	10.54	1590.06
	110.0	444.25	119.95	1710.01
9	90.0	715.00	135.13	1845.14

ESR 5 – Khandas

S.No.	Village	Elevation		Population	
			2011	2026	2041
1	Belachiwadi	174	480	600	800
2	Amberpada	166	480	600	800
3	Katewadi	163	480	600	800
4	Khandas	166	2637	2947	3285
	Total		4077	4747	5685

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Belachiwadi	0.115	0.192	5.333	8.889
2	Amberpada	0.115	0.192	5.333	8.889
3	Katewadi	0.115	0.192	5.333	8.889
4	Khandas	0.633	0.788	29.300	36.500
	Total	0.978	1.364	45.300	63.167


ESR - 5
ESR
Katewadi
Belachiwadi
Ambernada
Khandas
750.00
2346.13
100.00
1390.00
50.00
950.00
100.00
1
2
3
4
5
6
7
8
9



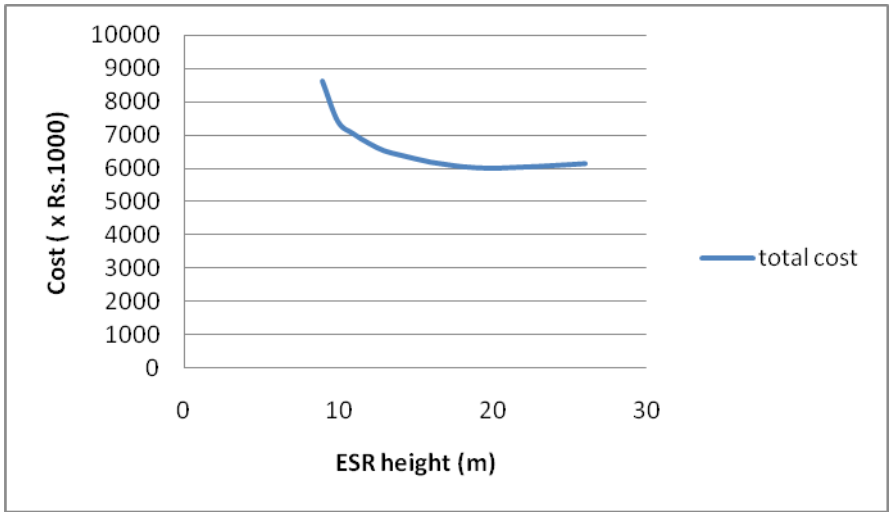
ESR 5 - Khandas

ESR 5 – Staging Height Optimization

Total Demand	1364400
ESR capacity	512000
Low level Height	183
esr elevation	174

HGL	PIPE cost	ESR cost	Total	Height
187	4571.38	1956.778	6528.158	13
188	4408.82	1995.146	6403.966	14
189	4255.29	2033.515	6288.805	15
190	4113.13	2071.883	6185.013	16
191	3984.66	2129.435	6114.095	17
192	3862.85	2186.987	6049.837	18
193	3769.34	2244.54	6013.88	19
194	**3694.6**	**2302.092**	**5996.692**	**20**
195	3637.82	2378.828	6016.648	21
196	3581.03	2455.565	6036.595	22

ESR capacity	512000
Esr height	20
esr cost	2455.56
pipe cost	3581.03
total	6036.59
/Person cost	1061.846



ESR 5 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 5
 Name of the User                        :
 Number of Pipes                         :  8
 Number of Nodes                         :  9
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      5      6       750.00
    2      6      7      2080.00
    3      7      8      1390.00
    4      8      9       950.00
    5      6      4       100.00
    6      7      3       100.00
    7      8      1        60.00
    8      9      2       100.00
============================================================
  Node Data
-----------
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	-8.889	174.00	8.00	
2	1.00	-8.889	166.00	8.00	
3	1.00	-8.889	163.00	8.00	
4	1.00	-36.500	166.00	8.00	
6	1.00	0.000	166.00	8.00	
7	1.00	0.000	163.00	8.00	
8	1.00	0.000	174.00	8.00	
9	1.00	0.000	166.00	8.00	
5	1.00	0.000	174.00	8.00	

Reference Node Data

Node No.	Grade Line m
5	184.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	5	7	63.167	355.0	140.00000	0.80	1.07	750.00	
2	7	6	36.500	200.0	140.00000	2.65	6.33	418.41	
				225.0	140.00000	5.92	3.56	1661.59	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
3	7	8	17.778	225.0	140.00000	0.97	0.94	1027.68	
				250.0	140.00000	0.20	0.55	362.32	
4	8	9	8.889	110.0	140.00000	6.96	8.52	816.80	
				125.0	140.00000	0.61	4.58	133.20	
5	6	4	36.500	200.0	140.00000	0.63	6.30	100.00	
6	7	3	8.889	90.0	140.00000	2.26	22.60	100.00	
7	8	1	8.889	200.0	140.00000	0.03	0.50	60.00	
8	9	2	8.889	125.0	140.00000	0.46	4.60	100.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1 T	-8.889	174.00	182.00	8.00	8.00	
2 T	-8.889	166.00	174.00	8.00	8.00	
3 T	-8.889	163.00	180.94	17.94	8.00	

4 T	-36.500	166.00	174.00	8.00	8.00
6	0.000	166.00	174.63	8.63	8.00
7	0.000	163.00	183.20	20.20	8.00
8	0.000	174.00	182.03	8.03	8.00
9	0.000	166.00	174.46	8.46	8.00
5 S	63.167	174.00	184.00	10.00	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	100.00	18.90	18.90
110.0	816.80	220.54	239.44
125.0	233.20	80.92	320.36
200.0	578.41	456.36	776.72
225.0	2689.28	2700.04	3476.76
250.0	362.32	444.92	3921.68
355.0	750.00	1657.50	5579.18

Pipe-wise Cost Summary

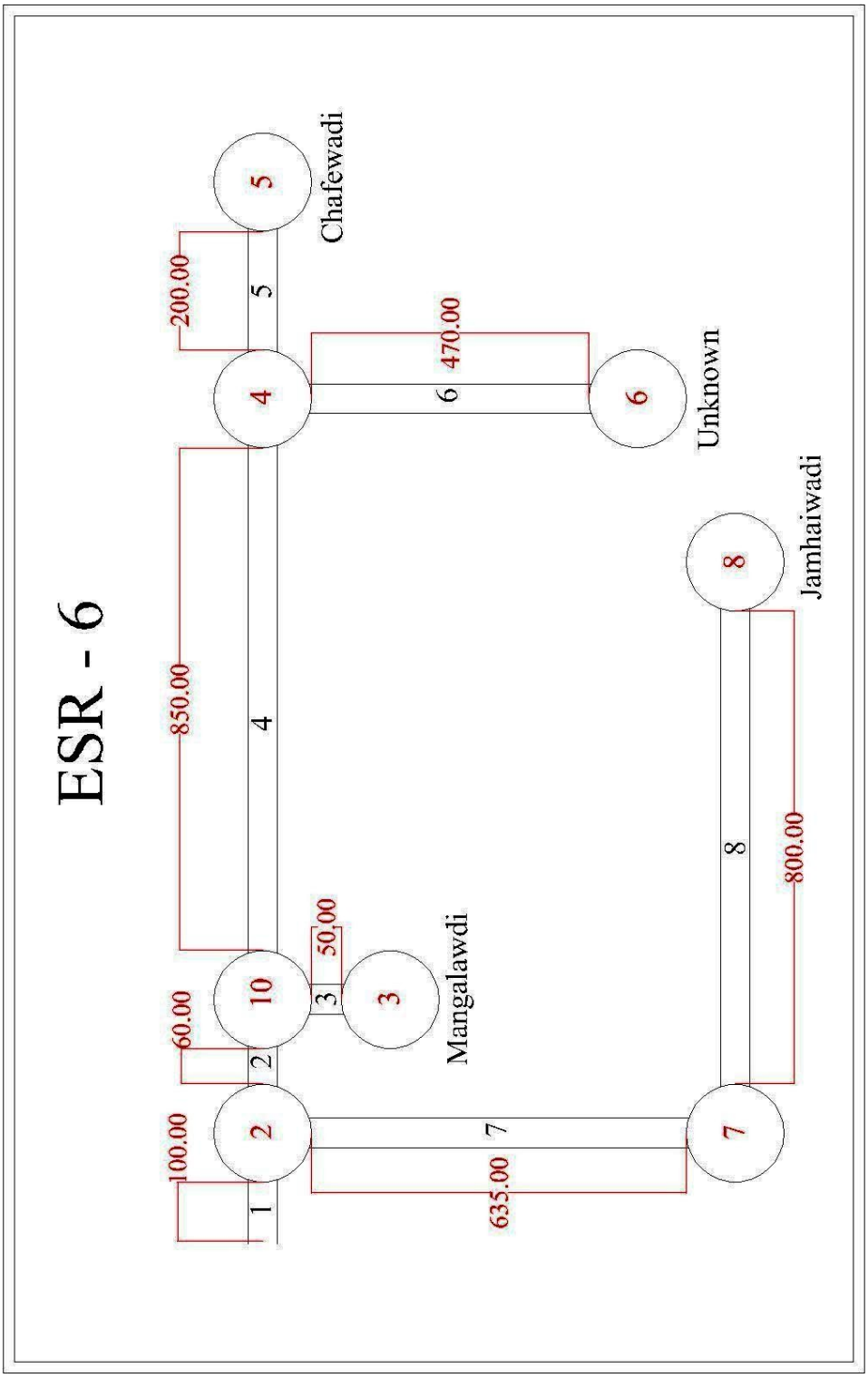
Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	355.0	750.00	1657.50	1657.50
2	200.0	418.41	330.13	1987.63
	225.0	1661.59	1668.24	3655.86
3	225.0	1027.68	1031.79	4687.65
	250.0	362.32	444.93	5132.58
4	110.0	816.80	220.54	5353.12
	125.0	133.20	46.22	5399.34
5	200.0	100.00	78.90	5478.24
6	90.0	100.00	18.90	5497.14
7	200.0	60.00	47.34	5544.48
8	125.0	100.00	34.70	5579.18

ESR 6 – Mangalwadi

S.No.	Village	Elevation	Population		
			2011	2026	2041
1	Mangal	122	480	600	800
2	Chafewadi	129	1418	2117	3207
3	Unknown	113	480	600	800
4	Jamhaiwadi	133	480	600	800
	Total		2858	3917	5607

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Mangal	0.115	0.192	5.333	8.889
2	Chafewadi	0.340	0.770	15.756	35.633
3	Unknown	0.11	0.19	5.333	8.889

		5	2		
4	Jamhaiwadi	0.115	0.192	5.333	8.889
	Total	0.686	1.346	31.756	62.300


ESR - 6
Chafewadi
Unknown
Jamhaiwadi
Mangalawdi
200.00
470.00
850.00
50.00
60.00
100.00
635.00
800.00
1
2
3
4
5
6
7
8
10

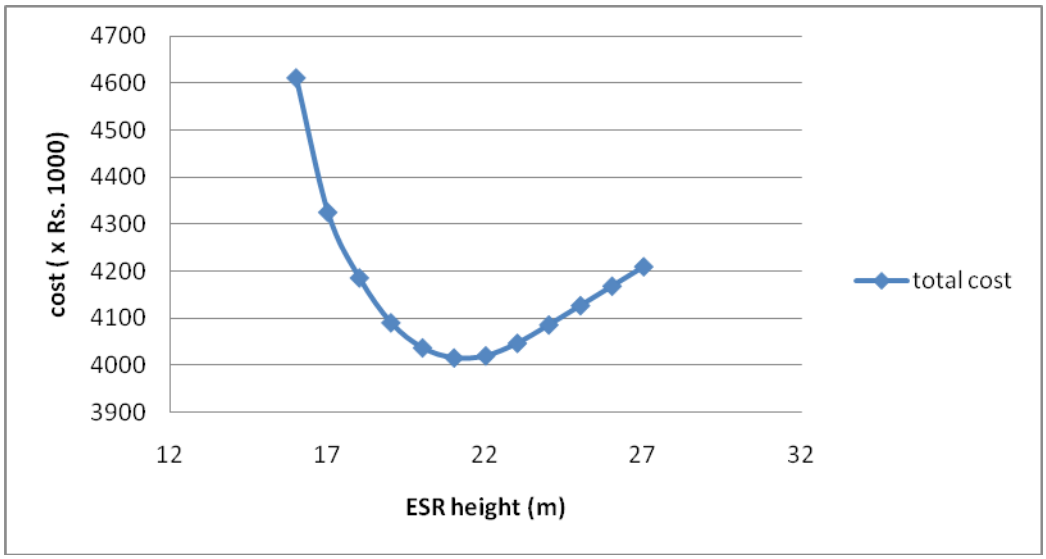
ESR 6 -
Mangalwadi

ESR 6 – Staging Height Optimization

Total Demand	1345680
ESR capacity Required	504630
ESR capacity Proposed	505000
Low level Height	142
ESR elevation	126

HGL	PIPE cost	ESR cost	Total	height
144	2016.89	2169.352	4186.242	18
145	1864.48	2226.44	4090.92	19
146	**1754.13**	**2283.528**	**4037.658**	**20**
147	1656.7	2359.646	4016.346	21
148	1584.88	2435.763	4020.643	22
149	1535.57	2511.881	4047.451	23
150	1498.32	2587.998	4086.318	24
151	1463.29	2664.116	4127.406	25

ESR capacity	505000
Optimum ESR height	20
ERS cost	2283.53
Pipe cost	1754.13
Total	4037.66
/person	720.110219



ESR 6 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 6
 Name of the User                        :
 Number of Pipes                         :  8
 Number of Nodes                         :  9
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m         mm       Const    (E/P)
------------------------------------------------------------
    1     1     2      100.00
    2     2    10       60.00
    3    10     3       50.00
    4    10     4      850.00
    5     4     5      200.00
    6     4     6      470.00
    7     2     7      635.00
```

```
    8     7     8      800.00
=============================================================


 Node Data
-----------

=================================================================
 Node    Peak      Flow     Elevation  Res. Press  Meet Res.
 No.   Factor      lps         m           m      Pres (Y/N)?
-----------------------------------------------------------------
    1   1.00       0.000      126.00       8.00
    2   1.00       0.000      125.90       8.00
    3   1.00      -8.889      122.00       8.00
    4   1.00       0.000      126.00       8.00
    5   1.00     -35.633      129.00       8.00
    6   1.00      -8.889      113.00       8.00
    7   1.00       0.000       99.00       8.00
    8   1.00      -8.889      133.00       8.00
   10   1.00       0.000      122.00       8.00
=================================================================

Reference Node Data
---------------------

====================
 Node   Grade Line
  No.       m
--------------------
    1      146.00
====================

  Commercial Diameter Data
--------------------------

====================================
 Pipe Dia.   Hazen's    Unit Cost
 Int. (mm)   Const    Rs /m   length
------------------------------------
    63.0   140.00000       98.00
    75.0   140.00000      138.00
    90.0   140.00000      189.00
   110.0   140.00000      270.00
   125.0   140.00000      347.00
   140.0   140.00000      432.00
   160.0   140.00000      556.00
   180.0   140.00000      695.00
   200.0   140.00000      789.00
   225.0   140.00000     1004.00
   250.0   140.00000     1228.00
   280.0   140.00000     1532.00
   315.0   140.00000     1932.00
   355.0   140.00000     2215.00
   400.0   140.00000     3147.00
```

```
====================================


 Branched Water Distribution Network Design OutPut
--------------------------------------------------
  Pipe Details
--------------

=============================================================================
==
 Pipe From  To   Peak Flow   Diam   Hazen's     HL    HL/1000  Length
Status
  No. Node Node    (lps)     (mm)    Const     (m )     (m )    (m )
(E/P)
-----------------------------------------------------------------------------
--
   1    1    2      62.300   250.0 140.00000    0.57     5.70    100.00
   2    2   10      53.411   225.0 140.00000    0.43     7.17     60.00
   3   10    3       8.889    90.0 140.00000    1.13    22.60     50.00
   4   10    4      44.522   200.0 140.00000    5.52     9.13    604.38


Pipe Details  cont`d
---------------------

=============================================================================
==
 Pipe From  To   Peak Flow   Diam   Hazen's     HL    HL/1000  Length
Status
  No. Node Node    (lps)     (mm)    Const     (m )     (m )    (m )
(E/P)
-----------------------------------------------------------------------------
--
                           225.0 140.00000    1.26     5.13    245.62
   5    4    5      35.633   200.0 140.00000    1.21     6.05    200.00
   6    4    6       8.889    90.0 140.00000   10.64    22.64    470.00
   7    2    7       8.889   125.0 140.00000    1.53     4.58    333.79
                           140.0 140.00000    0.79     2.62    301.21
   8    7    8       8.889   140.0 140.00000    2.11     2.64    800.00
=============================================================================
==


 Node Details
--------------

=============================================================================
===
 Node    Peak Flow    Elevation    H G L    Cal Pres     Spc Pres   Meet
Res
  No.       (lps)        (m )       (m )      (m )          (m )    Pres.
(Y)
-----------------------------------------------------------------------------
---
```

1	S	62.300	126.00	146.00	20.00	8.00
2		0.000	125.90	145.43	19.53	8.00
3	T	-8.889	122.00	143.86	21.86	8.00
4		0.000	126.00	138.21	12.21	8.00
5	T	-35.633	129.00	137.00	8.00	8.00
6	T	-8.889	113.00	127.57	14.57	8.00
7		0.000	99.00	143.11	44.11	8.00
8	T	-8.889	133.00	141.00	8.00	8.00
10		0.000	122.00	144.99	22.99	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	520.00	98.28	98.28
125.0	333.79	115.82	214.10
140.0	1101.21	475.72	689.83
200.0	804.38	634.65	1324.48
225.0	305.62	306.85	1631.33
250.0	100.00	122.80	1754.13

Pipe-wise Cost Summary

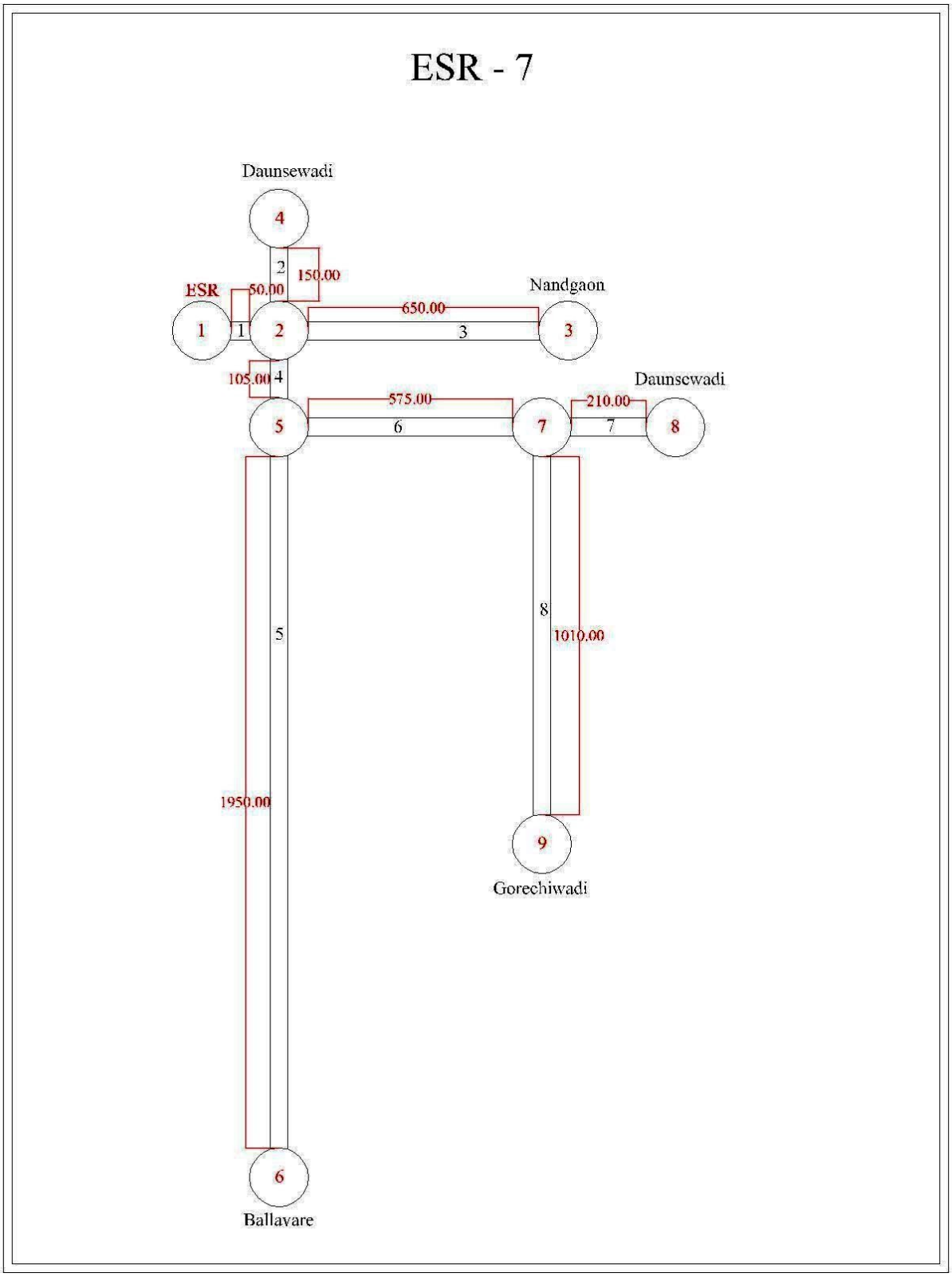
Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	250.0	100.00	122.80	122.80
2	225.0	60.00	60.24	183.04
3	90.0	50.00	9.45	192.49
4	200.0	604.38	476.86	669.35
	225.0	245.62	246.60	915.95
5	200.0	200.00	157.80	1073.75
6	90.0	470.00	88.83	1162.58
7	125.0	333.79	115.83	1278.40
	140.0	301.21	130.12	1408.53
8	140.0	800.00	345.60	1754.13

ESR 7 – Nandgaon

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Nandgaon	120	865	995	1137
2	Daunsewadi1	116	480	600	800
3	Ballvare	117	1168	1477	1867
4	Daunsewadi2	110	480	600	800
5	Gorechiwadi	108	480	600	800
	Total		3473	4272	5404

Daily Water Demand at 200 LPCD			
S.No.	village	Demand(MLD)	Demand(LPS)

		2011	2041	2011	2041
1	Nandgaon	0.208	0.273	9.611	12.633
2	Daunsewadi1	0.115	0.192	5.333	8.889
3	Ballvare	0.280	0.448	12.978	20.744
4	Daunsewadi2	0.115	0.192	5.333	8.889
5	Gorechiwadi	0.115	0.192	5.333	8.889
	Total	0.834	1.297	38.589	60.044


ESR - 7
Daunsewadi
4
2
150.00
ESR
50.00
Nandgaon
650.00
1
1
2
3
3
105.00
4
Daunsewadi
575.00
210.00
5
6
7
7
8
8
5
1010.00
1950.00
9
Gorechiwadi
6
Ballavare

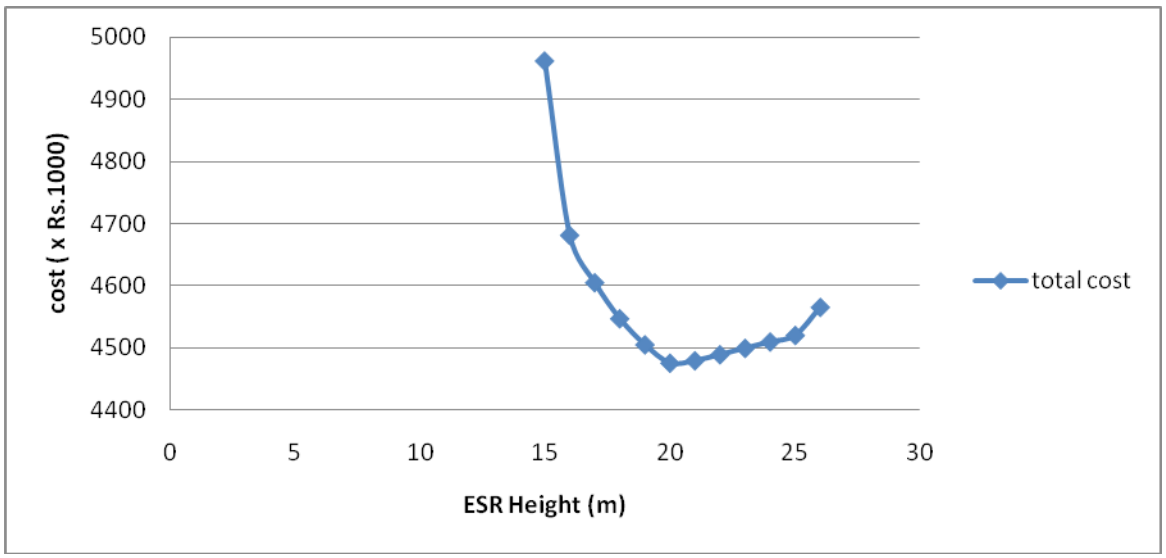
ESR 7 -
Nandgaon

ESR 7 – Staging Height Optimization

Total Demand	1296960
ESR capacity Required	486360
ESR capacity Proposed	487000
Low level Height	
ESR elevation	114

HGL	PIPE cost	ESR cost	Total	height (m)
130	2670.51	2010.83	4681.34	16
131	2538.42	2066.687	4605.107	17
132	2424.71	2122.543	4547.253	18
133	2327	2178.4	4505.4	19
134	**2241.68**	**2234.256**	**4475.936**	**20**
135	2171.04	2308.731	4479.771	21
136	2106.24	2383.206	4489.446	22
137	2042.03	2457.682	4499.712	23

ESR capacity	487000
Optimum ESR height	20
ERS cost	2234.26
Pipe cost	2241.68
Total	4475.94
/person	828.263509



ESR 7 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 7
 Name of the User                        :
 Number of Pipes                         :  8
 Number of Nodes                         :  9
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m          mm       Const    (E/P)
------------------------------------------------------------
    1     1     2       50.00
    2     2     4      150.00
    3     2     3      650.00
    4     2     5      105.00
    5     5     6     1950.00
    6     5     7      575.00
    7     7     8      210.00
    8     7     9     1010.00
============================================================
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	114.00	8.00	
2	1.00	0.000	113.90	8.00	
3	1.00	-12.633	120.00	8.00	
4	1.00	-8.889	116.00	8.00	
5	1.00	0.000	114.00	8.00	
6	1.00	-20.744	117.00	8.00	
7	1.00	0.000	106.00	8.00	
8	1.00	-8.889	110.00	8.00	
9	1.00	-8.889	108.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	134.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m	length
63.0	140.00000	98.00	
75.0	140.00000	138.00	
90.0	140.00000	189.00	
110.0	140.00000	270.00	
125.0	140.00000	347.00	
140.0	140.00000	432.00	
160.0	140.00000	556.00	
180.0	140.00000	695.00	
200.0	140.00000	789.00	
225.0	140.00000	1004.00	
250.0	140.00000	1228.00	
280.0	140.00000	1532.00	
315.0	140.00000	1932.00	
355.0	140.00000	2215.00	
400.0	140.00000	3147.00	

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	60.044	250.0	140.00000	0.27	5.40	50.00	
2	2	4	8.889	90.0	140.00000	3.40	22.67	150.00	
3	2	3	12.633	110.0	140.00000	0.08	16.53	4.84	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
4	2	5	38.522	200.0	140.00000	0.73	6.95	105.00	
5	5	6	20.744	160.0	140.00000	1.73	6.59	262.70	
				180.0	140.00000	6.27	3.72	1687.30	
6	5	7	17.778	125.0	140.00000	6.91	16.48	419.26	
				140.0	140.00000	1.48	9.50	155.74	
7	7	8	8.889	90.0	140.00000	4.76	22.67	210.00	
8	7	9	8.889	110.0	140.00000	8.61	8.52	1010.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1 S	60.044	114.00	134.00	20.00	8.00	

2		0.000	113.90	133.73	19.83	8.00
3	T	-12.633	120.00	128.00	8.00	8.00
4	T	-8.889	116.00	130.34	14.34	8.00
5		0.000	114.00	133.00	19.00	8.00
6	T	-20.744	117.00	125.00	8.00	8.00
7		0.000	106.00	124.61	18.61	8.00
8	T	-8.889	110.00	119.85	9.85	8.00
9	T	-8.889	108.00	116.00	8.00	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	360.00	68.04	68.04
110.0	1014.84	274.01	342.05
125.0	1064.42	369.35	711.40
140.0	155.74	67.28	778.68
160.0	262.70	146.06	924.74
180.0	1687.30	1172.67	2097.42
200.0	105.00	82.85	2180.26
250.0	50.00	61.40	2241.66

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	250.0	50.00	61.40	61.40
2	90.0	150.00	28.35	89.75
3	110.0	4.84	1.31	91.06
	125.0	645.16	223.87	314.93
4	200.0	105.00	82.85	397.77
5	160.0	262.70	146.06	543.83
	180.0	1687.30	1172.67	1716.51
6	125.0	419.26	145.48	1861.99
	140.0	155.74	67.28	1929.27
7	90.0	210.00	39.69	1968.96

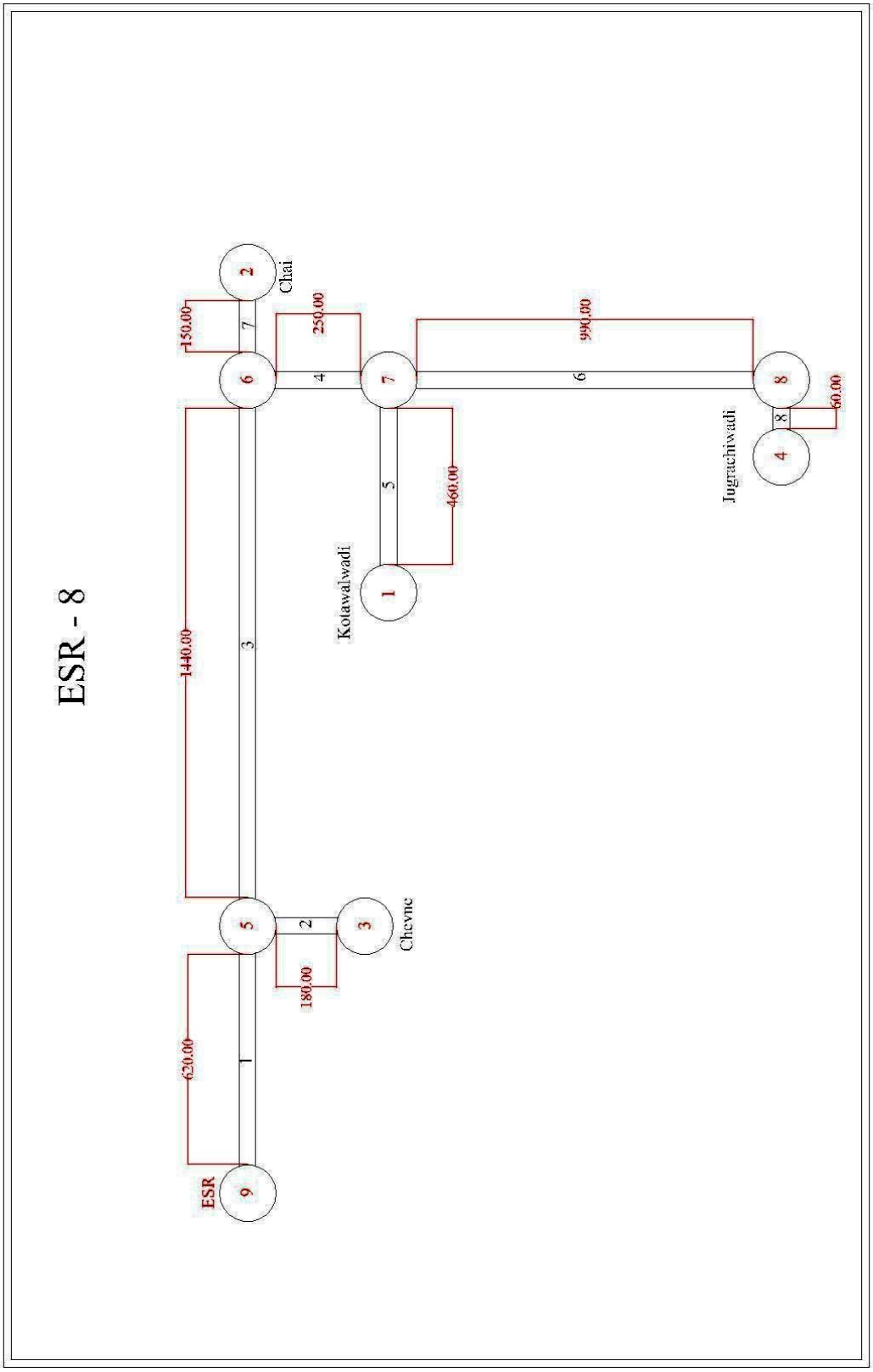
8 110.0 1010.00 272.70 2241.66

ESR 8 – Chai

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Chevne	87	542	660	795
2	Chai	105	902	1394	2173
3	Kotwalwadi	102	480	600	800
4	Zugarachiwadi	112	785	911	1047
	Total		2709	3565	4815

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Chevne	0.130	0.191	6.022	8.833
2	Chai	0.216	0.522	10.022	24.144

3	Kotwalwadi	0.115	0.192	5.333	8.889
4	Zugarachiwadi	0.188	0.251	8.722	11.633
Total		0.650	1.156	30.100	53.500


ESR - 8
2
Chai
150.00
7
250.00
6
4
7
990.00
6
8
60.00
8
4
Jugrachiwadi
5
460.00
Kolawalwadi
1
1440.00
3
5
2
3
Chevne
180.00
620.00
1
ESR
9

Zugarachiwadi
kotwalwadi
Chai
Chevane
ChaiESR
© 2010 Google
Image © 2010 GeoEye
19°07'15.39" N 73°28'30.03" E elev 90 m
Imagery Date: Apr 11, 2009
©2009 Google
Eye alt 4.42 km

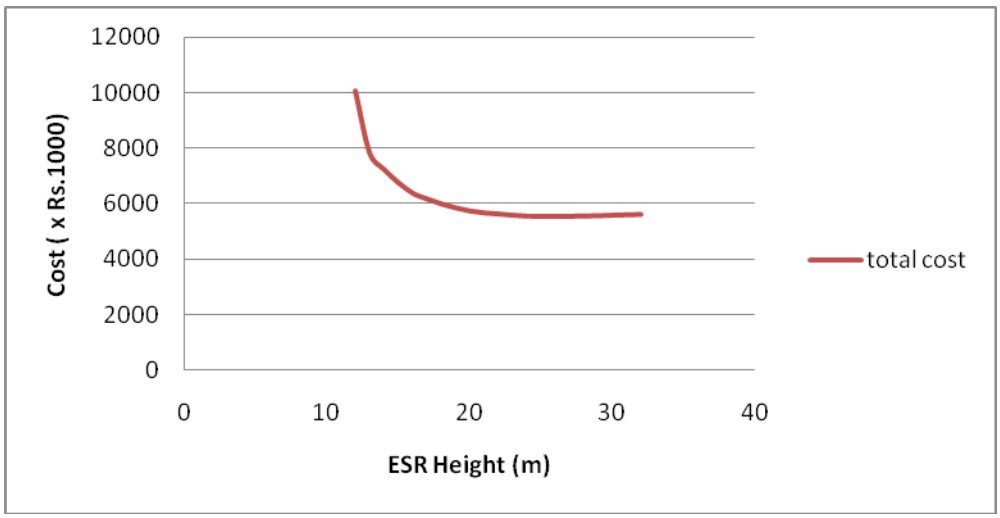
ESR 8 - Chai

ESR 8 – Staging Height Optimization

Total Demand	1155600
ESR capacity Required	433350
ESR capacity Proposed	435000
Low level Height	121
ESR elevation	109

HGL	PIPE cost	ESR cost	Total	Height of ESR
131	3395.7	2216.141	5611.841	22
132	3284.9	2285.395	5570.295	23
133	3180.11	2354.65	5534.76	24
134	3101.15	2423.904	5525.054	25
135	**3025.8**	**2493.158**	**5518.958**	**26**
136	2964.94	2562.413	5527.353	27
137	2905.07	2631.667	5536.737	28
138	2848.98	2700.922	5549.902	29

ESR capacity	435000
Optimum ESR height	26
ERS cost	2493.16
Pipe cost	3025.80
Total	5518.96



ESR 8 - BRANCH Input and Output

```
 Echoing Input Variables
------------------------

 Title of the Project                    : ESR 8
 Name of the User                        :
 Number of Pipes                         :  8
 Number of Nodes                         :  9
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      9      5       620.00
    2      5      3       180.00
    3      5      6      1440.00
    4      6      7       250.00
    5      7      1       460.00
    6      7      8       990.00
    7      6      2       150.00
    8      8      4        60.00
============================================================


 Node Data
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	-8.889	102.00	8.00	
2	1.00	-24.144	105.00	8.00	
3	1.00	-8.833	87.00	8.00	
4	1.00	-11.633	112.00	8.00	
5	1.00	0.000	89.00	8.00	
6	1.00	0.000	89.00	8.00	
7	1.00	0.000	87.00	8.00	
8	1.00	0.000	112.00	8.00	
9	1.00	0.000	109.00	8.00	

Reference Node Data

Node No.	Grade Line m
9	135.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	9	5	53.499	225.0	140.00000	4.48	7.23	620.00	
2	5	3	8.833	90.0	140.00000	4.03	22.39	180.00	
3	5	6	44.666	225.0	140.00000	7.46	5.18	1440.00	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
4	6	7	20.522	180.0	140.00000	0.36	3.66	98.33	
				200.0	140.00000	0.33	2.18	151.67	
5	7	1	8.889	90.0	140.00000	10.42	22.65	460.00	
6	7	8	11.633	160.0	140.00000	2.24	2.26	990.00	
7	6	2	24.144	140.0	140.00000	2.51	16.73	150.00	
8	8	4	11.633	160.0	140.00000	0.14	2.33	60.00	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)
1	T	-8.889	102.00	111.96	9.96	8.00	
2	T	-24.144	105.00	120.55	15.55	8.00	
3	T	-8.833	87.00	126.49	39.49	8.00	
4	T	-11.633	112.00	120.00	8.00	8.00	
5		0.000	89.00	130.52	41.52	8.00	

6	0.000	89.00	123.06	34.06	8.00
7	0.000	87.00	122.37	35.37	8.00
8	0.000	112.00	120.14	8.14	8.00
9 S	53.499	109.00	135.00	26.00	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	640.00	120.96	120.96
140.0	150.00	64.80	185.76
160.0	1050.00	583.80	769.56
180.0	98.33	68.34	837.90
200.0	151.67	119.67	957.57
225.0	2060.00	2068.24	3025.81

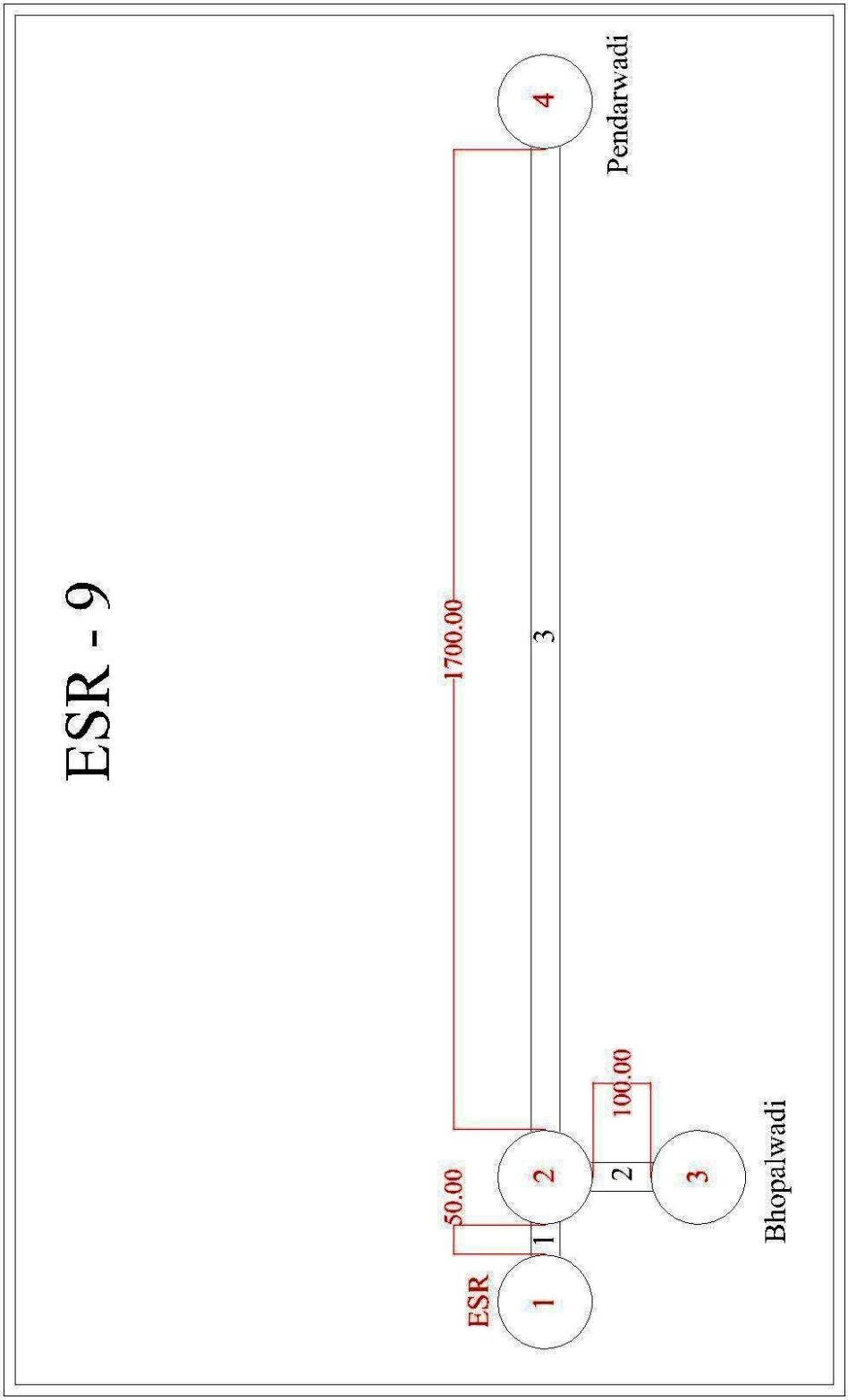
Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	225.0	620.00	622.48	622.48
2	90.0	180.00	34.02	656.50
3	225.0	1440.00	1445.76	2102.26
4	180.0	98.33	68.34	2170.60
	200.0	151.67	119.67	2290.27
5	90.0	460.00	86.94	2377.21
6	160.0	990.00	550.44	2927.65
7	140.0	150.00	64.80	2992.45
8	160.0	60.00	33.36	3025.81

ESR 9 – Bhopalwadi

S.No.	Village	Elevation		Population	
			2011	2026	2041
1	Bhopalwadi	96	480	600	800
2	Pendarawadi	71	480	600	800
	Total		960	1200	1600

Daily Water Demand at 200 LPCD					
S.No.	Village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Bhopalwadi	0.115	0.192	5.333	8.889
2	Pendarawadi	0.115	0.192	5.333	8.889
	Total	0.230	0.384	10.667	17.778


ESR - 9
ESR
1
2
3
4
1
2
3
50.00
100.00
1700.00
Bhopalwadi
Pendarwadi

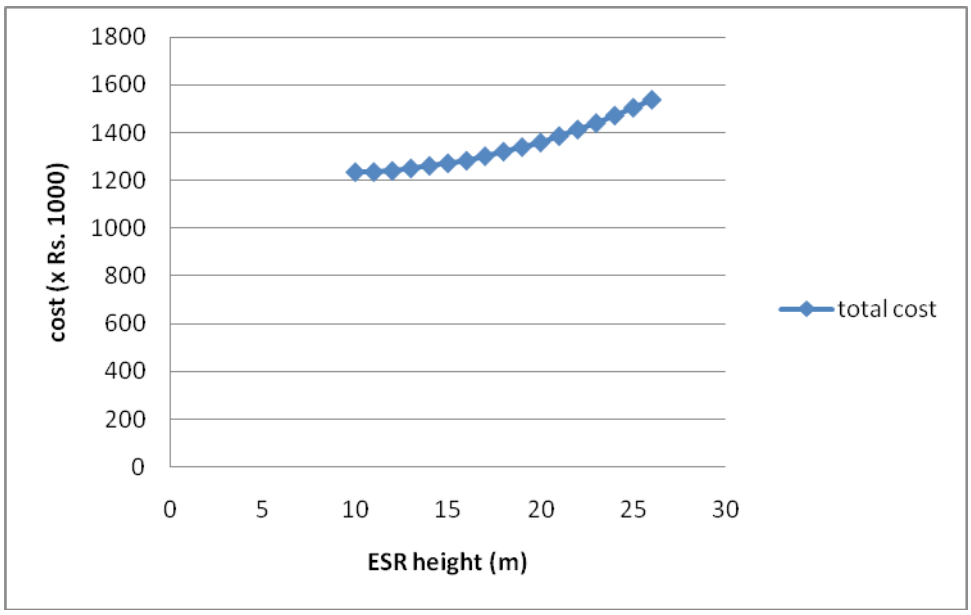
ESR 9 -
Bhopalwadi

ESR 9 – Staging Height Optimization

Total Demand	384000
ESR capacity Required	144000
ESR capacity Proposed	144000
Low level Height	105
ESR elevation	95

HGL	PIPE cost	ESR cost	Total	height
105	450.68	785.3424	1236.022	10
106	434.47	801.7037	1236.174	11
107	422.99	818.065	1241.055	12
108	416.75	834.4263	1251.176	13
109	411.01	850.7876	1261.798	14
110	405.28	867.1489	1272.429	15
111	399.55	883.5102	1283.06	16

ESR capacity	144000
Optimum ESR height	10
ERS cost	785.34
Pipe cost	450.68
Total	1236.02



ESR 9 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 9
 Name of the User                        :
 Number of Pipes                         :  3
 Number of Nodes                         :  4
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To      Length     Diameter  Hazen's   Status
  No.  Node  Node        m          mm       Const    (E/P)
------------------------------------------------------------
    1     1     2       50.00
    2     2     3      100.00
    3     2     4     1700.00
============================================================


 Node Data
-----------
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	95.00	8.00	
2	1.00	0.000	94.90	8.00	
3	1.00	-8.889	96.00	8.00	
4	1.00	-8.889	71.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	105.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	17.778	140.0	140.00000	0.47	9.40	50.00	
2	2	3	8.889	110.0	140.00000	0.15	8.71	17.22	
				125.0	140.00000	0.38	4.59	82.78	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
3	2	4	8.889	90.0	140.00000	17.70	22.65	781.42	
				110.0	140.00000	7.83	8.52	918.58	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1	S	17.778	95.00	105.00	10.00	8.00	
2		0.000	94.90	104.53	9.63	8.00	
3	T	-8.889	96.00	104.00	8.00	8.00	
4	T	-8.889	71.00	79.00	8.00	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	781.42	147.69	147.69
110.0	935.80	252.66	400.35
125.0	82.78	28.72	429.08
140.0	50.00	21.60	450.68

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	140.0	50.00	21.60	21.60
2	110.0	17.22	4.65	26.25
	125.0	82.78	28.72	54.97
3	90.0	781.42	147.69	202.66
	110.0	918.58	248.02	450.68

ESR 10 – Bondshet

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Bondshet	62	480	600	800
	Total		480	600	800

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Bondshet	0.115	0.192	5.333	8.889
	Total	0.115	0.192	5.333	8.889

ESR 10 Design Details

Total Demand	192000
ESR capacity Required	72000
ESR capacity Proposed	72000


Bondshet
ESR 10
© 2010 Google
Image © 2010 GeoEye
©2009 Google
Imagery Date: Apr 22, 2009
19°06'04.56" N 73°26'25.52" E elev 57 m
Eye alt 920 m

ESR 11 – Borgaon

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Borgaon	65	1095	1305	1545
	Total		1095	1305	1545

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Borgaon	0.263	0.371	12.170	17.163
	Total	0.263	0.371	12.170	17.163

ESR 11 Design Details

Total Demand	370711
ESR capacity Required	139016
ESR capacity Proposed	140000
Low level Height	10
ESR elevation	65

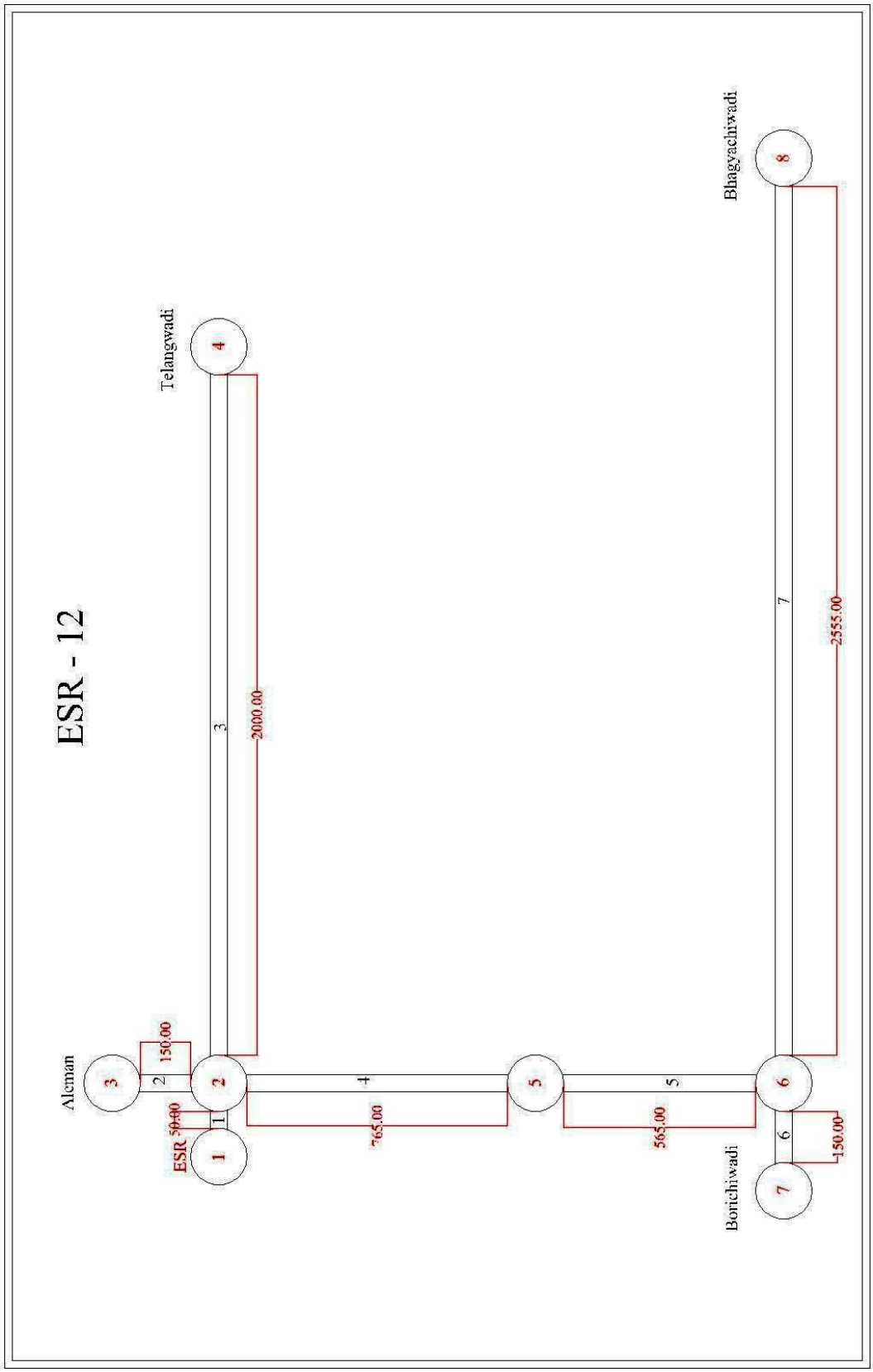
ESR 11 Borgaon



ESR 12 – Aleman

S.No.	village	Elevation	Population		
			2011	2026	2041
1	Aleman	162	1012	1274	1587
2	Telangwadi	132	480	600	800
3	Borichiwadi	161	480	600	800
4	Bhagyachiwadi	128	480	600	800
	Total		2452	3074	3987

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Aleman	0.243	0.381	11.248	17.628
2	Telangwadi	0.115	0.192	5.333	8.889
3	Borichiwadi	0.115	0.192	5.333	8.889
4	Bhagyachiwadi	0.115	0.192	5.333	8.889
	Total	0.589	0.957	27.248	44.295


ESR - 12
Telangwadi
Bhagyachiwadi
Aleman
Borichiwadi
ESR
2000.00
2555.00
765.00
565.00
150.00
150.00
50.00
1
2
3
4
5
6
7
8

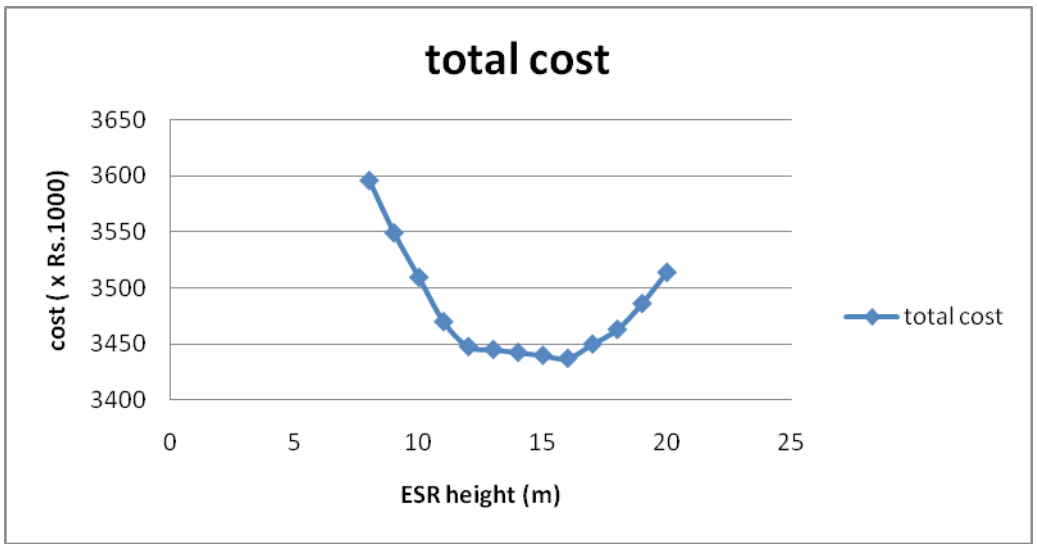
ESR 12 -
Aleman

ESR 12 – Staging Height Optimization

Total Demand	956773
ESR capacity Required	358790
ESR capacity Proposed	360000
Low level Height	173
ESR elevation	165

HGL	PIPE cost	ESR cost	Total	height
176	1977.89	1491.766	3469.656	11
177	1925.28	1522.21	3447.49	12
178	1892.23	1552.654	3444.884	13
179	1859.18	1583.098	3442.278	14
180	1826.13	1613.543	3439.673	15
181	1793.07	1643.987	3437.057	16
182	1760.03	1689.653	3449.683	17
183	1727.46	1735.319	3462.779	18
184	1704.89	1780.986	3485.876	19
185	1687.01	1826.652	3513.662	20

Optimum ESR height	16
ERS cost	1643.99
Pipe cost	1793.07
Total	3437.06
/person	862



ESR 12 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 12
 Name of the User                        :
 Number of Pipes                         :  7
 Number of Nodes                         :  8
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m          mm       Const    (E/P)
------------------------------------------------------------
    1     1     2       50.00
    2     2     3      150.00
    3     2     4     2000.00
    4     2     5      765.00
    5     5     6      565.00
    6     6     7      150.00
    7     6     8     2555.00
============================================================
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	165.00	8.00	
2	1.00	0.000	164.90	8.00	
3	1.00	-17.628	162.00	8.00	
4	1.00	-8.889	132.00	8.00	
5	1.00	0.000	160.00	8.00	
6	1.00	0.000	161.00	8.00	
7	1.00	-8.889	161.00	8.00	
8	1.00	-8.889	128.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	181.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	44.295	200.0	140.00000	0.45	9.00	50.00	
2	2	3	17.628	125.0	140.00000	2.43	16.20	150.00	
3	2	4	8.889	90.0	140.00000	37.68	22.64	1664.01	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
				110.0	140.00000	2.86	8.51	335.99	
4	2	5	17.778	140.0	140.00000	7.26	9.49	765.00	
5	5	6	17.778	140.0	140.00000	1.67	9.48	176.22	
				160.0	140.00000	1.93	4.96	388.78	
6	6	7	8.889	125.0	140.00000	0.69	4.60	150.00	
7	6	8	8.889	90.0	140.00000	19.10	22.65	843.28	
				110.0	140.00000	14.59	8.52	1711.72	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres.	Res (Y)
1	S	44.295	165.00	181.00	16.00	8.00	

2		0.000	164.90	180.55	15.65	8.00
3	T	-17.628	162.00	178.11	16.11	8.00
4	T	-8.889	132.00	140.00	8.00	8.00
5		0.000	160.00	173.29	13.29	8.00
6		0.000	161.00	169.69	8.69	8.00
7	T	-8.889	161.00	169.00	8.00	8.00
8	T	-8.889	128.00	136.00	8.00	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	2507.30	473.88	473.88
110.0	2047.70	552.88	1026.76
125.0	300.00	104.10	1130.86
140.0	941.22	406.61	1537.47
160.0	388.78	216.16	1753.63
200.0	50.00	39.45	1793.08

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	200.0	50.00	39.45	39.45
2	125.0	150.00	52.05	91.50
3	90.0	1664.01	314.50	406.00
	110.0	335.99	90.72	496.72
4	140.0	765.00	330.48	827.20
5	140.0	176.22	76.13	903.32
	160.0	388.78	216.16	1119.48
6	125.0	150.00	52.05	1171.53
7	90.0	843.28	159.38	1330.91

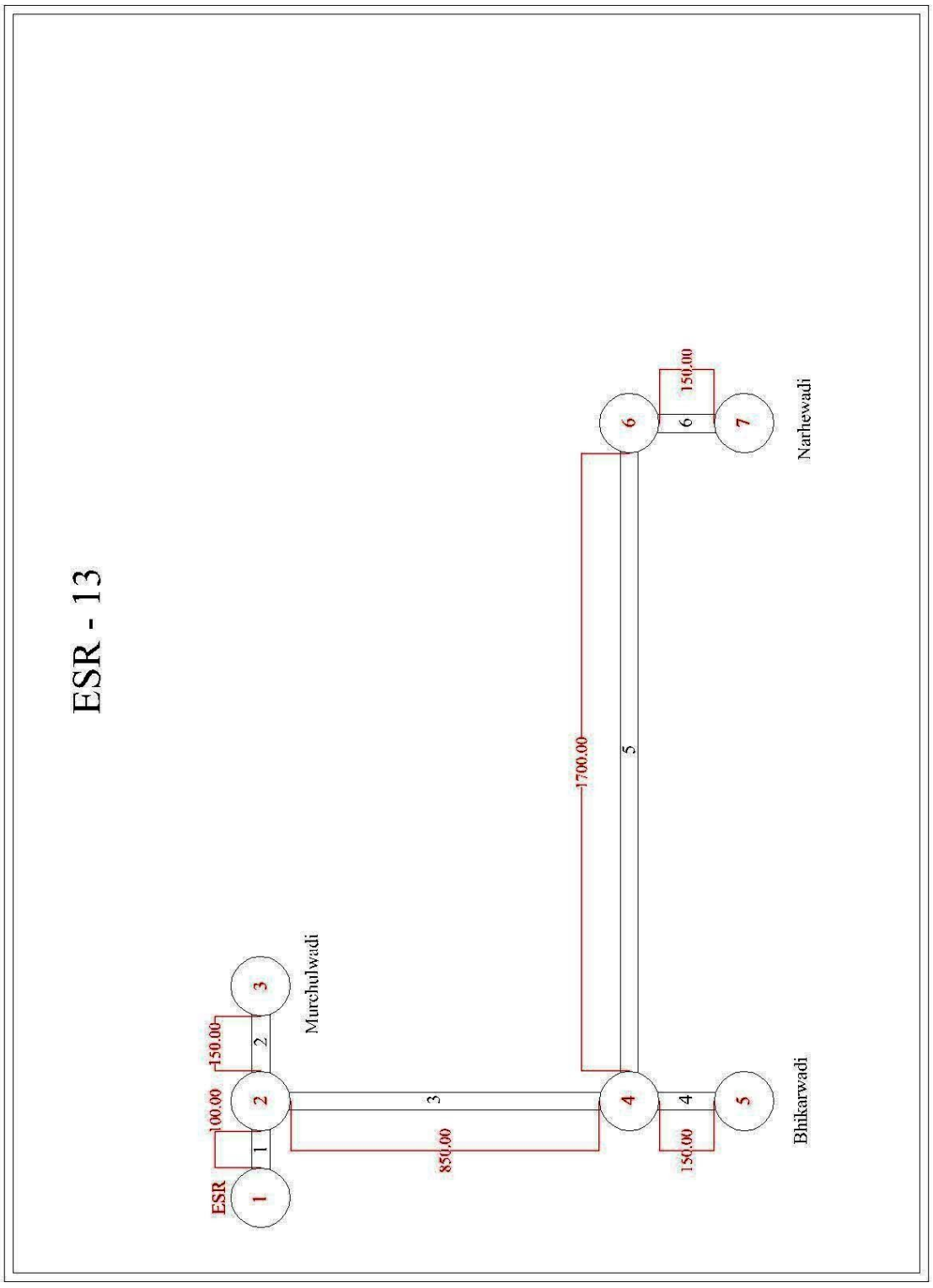
110.0 1711.72 462.16 1793.08

ESR 13 – Murchulwadi

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Murchulwadi	153	480	600	800
2	Bhikarwadi	136	480	600	800
3	Narthewadi	119	480	600	800
	Total		1440	1800	2400

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Murchulwadi	0.115	0.192	5.333	8.889
2	Bhikarwadi	0.115	0.192	5.333	8.889

3	Narthewadi	0.115	0.192	5.333	8.889
	Total	0.346	0.576	16.000	26.667


ESR - 13
ESR
1
100.00
1
2
150.00
2
3
Murchulwadi
3
850.00
4
1700.00
5
4
150.00
5
Bhikarwadi
6
150.00
6
7
Narhewadi

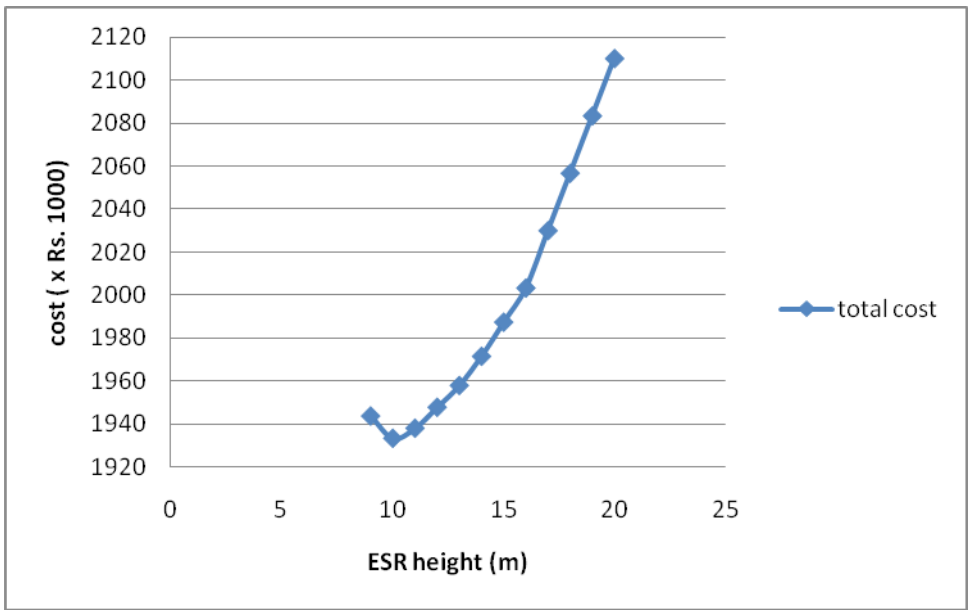
ESR 13 - Murchulwadi

ESR 13 – Staging Height Optimization

Total Demand	576000
ESR capacity Required	216000
ESR capacity Proposed	216000
Low level Height	162
ESR elevation	153

HGL	PIPE cost	ESR cost	Total	Height (m)
162	927.59	1016.262	1943.852	9
163	**895.63**	**1037.885**	**1933.515**	**10**
164	878.69	1059.507	1938.197	11
165	866.81	1081.13	1947.94	12
166	855.34	1102.753	1958.093	13
167	847.27	1124.375	1971.645	14
168	841.53	1145.998	1987.528	15

Optimum ESR height	10
ERS cost	1037.88
Pipe cost	895.63
Total	1933.51
/person	806



ESR 13 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 13
 Name of the User                        :
 Number of Pipes                         :  6
 Number of Nodes                         :  7
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length     Diameter  Hazen's   Status
  No.  Node  Node       m          mm       Const    (E/P)
------------------------------------------------------------
    1     1     2      100.00
    2     2     3      150.00
    3     2     4      850.00
    4     4     5      150.00
    5     4     6     1700.00
    6     6     7      150.00
============================================================
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	153.00	8.00	
2	1.00	0.000	152.90	8.00	
3	1.00	-8.889	153.00	8.00	
4	1.00	0.000	134.00	8.00	
5	1.00	-8.889	136.00	8.00	
6	1.00	0.000	119.00	8.00	
7	1.00	-8.889	119.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	163.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	26.667	160.0	140.00000	1.05	10.50	100.00	
2	2	3	8.889	110.0	140.00000	0.57	8.49	67.11	
				125.0	140.00000	0.38	4.58	82.89	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
3	2	4	17.778	125.0	140.00000	14.01	16.48	850.00	
4	4	5	8.889	90.0	140.00000	3.40	22.67	150.00	
5	4	6	8.889	90.0	140.00000	4.89	22.63	216.11	
				110.0	140.00000	12.65	8.52	1483.89	
6	6	7	8.889	90.0	140.00000	3.40	22.67	150.00	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1	S	26.667	153.00	163.00	10.00	8.00	
2		0.000	152.90	161.95	9.05	8.00	
3	T	-8.889	153.00	161.00	8.00	8.00	

4	0.000	134.00	147.94	13.94	8.00
5 T	-8.889	136.00	144.54	8.54	8.00
6	0.000	119.00	130.40	11.40	8.00
7 T	-8.889	119.00	127.00	8.00	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	516.11	97.54	97.54
110.0	1551.00	418.77	516.31
125.0	932.89	323.71	840.03
160.0	100.00	55.60	895.63

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	160.0	100.00	55.60	55.60
2	110.0	67.11	18.12	73.72
	125.0	82.89	28.76	102.48
3	125.0	850.00	294.95	397.43
4	90.0	150.00	28.35	425.78
5	90.0	216.11	40.84	466.63
	110.0	1483.89	400.65	867.28
6	90.0	150.00	28.35	895.63

ESR 14 – Kalamb

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Kalamb	50	4691	5814	7140
	Total		4691	5814	7140

Daily Water Demand at 200 LPCD					
		Demand(MLD)		Demand(LPS)	
S.No.	village	2011	2041	2011	2041
1	Kalamb	1.126	1.714	52.125	79.334
	Total	1.126	1.714	52.125	79.334

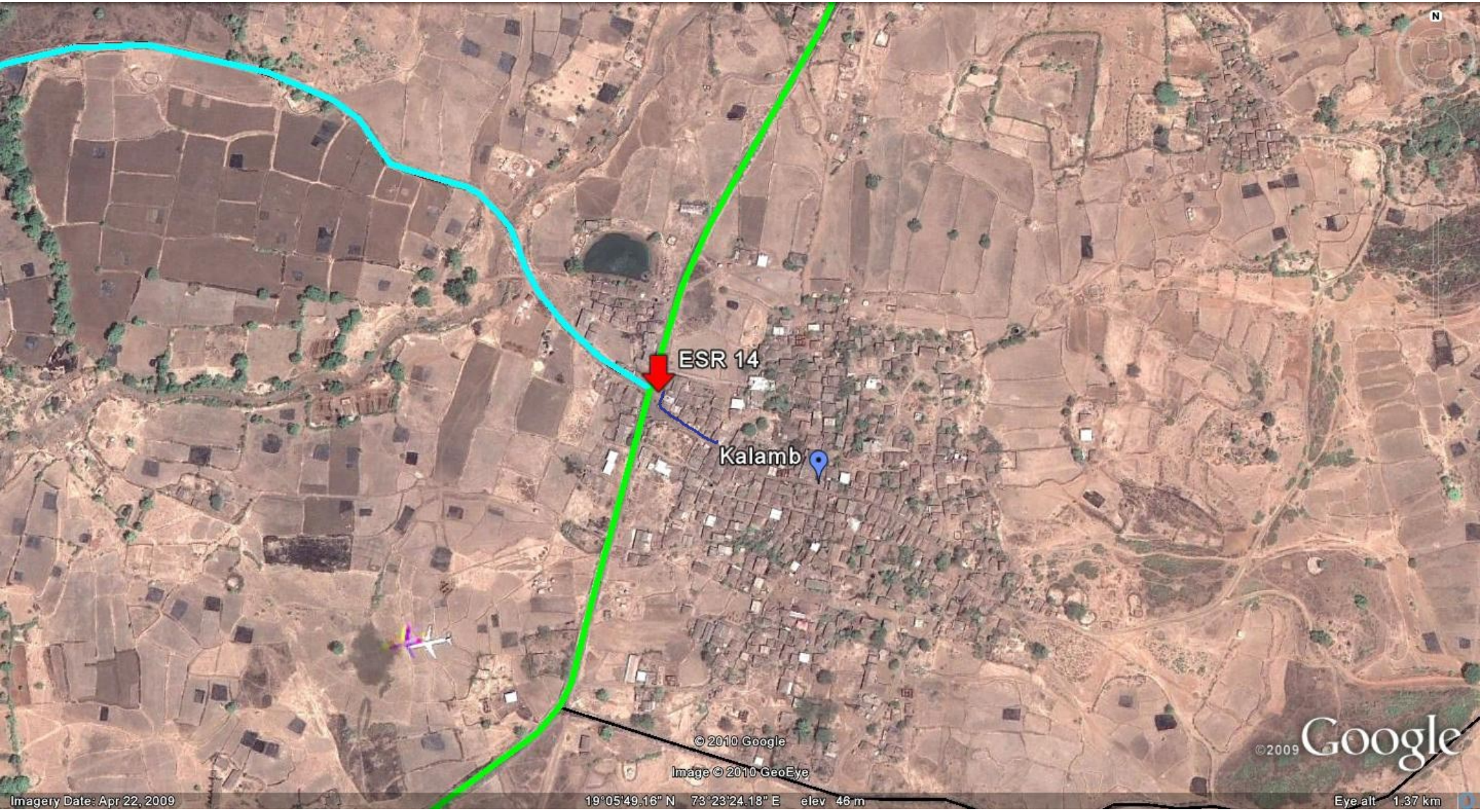
ESR 14 Design Details

Total Demand	1713605
ESR capacity Required	642602
ESR capacity Proposed	645000
Low level height	14
ESR elevation	43

HGL	ESR cost	Total	height
57	2300.84	2300.84	14

ESR capacity	645000
Optimum ESR height	14
ERS cost	2300.84
Total	2300.84
/person	322.25

ESR 14 - Kalamb


ESR 14
Kalamb
© 2010 Google
Image © 2010 GeoEye
©2009 Google
Imagery Date: Apr 22, 2009
19°05'49.16" N 73°23'24.18" E elev 46 m
Eye alt 1.37 km

ESR 15 – Salokh

S.No.	Village	Elevation		Population	
			2011	2026	2041
1	Salokh	47	1788	2165	2601
	Total		1788	2165	2601

Daily Water Demand at 200 LPCD					
		Demand(MLD)		Demand(LPS)	
S.No.	village	2011	2041	2011	2041
1	Salokh	0.429	0.624	19.867	28.900
	Total	0.429	0.624	19.867	28.900

ESR 15 Design Details

Total Demand	624240
ESR capacity Required	234090
ESR capacity Proposed	235000
Low level height	10
ESR elevation	47

HGL	ESR cost	Total	height
57	1098.26	1098.26	10

ESR capacity	72000
Optimum ESR height	12
ERS cost	1098.26
Total	1098.26
/person	422.25

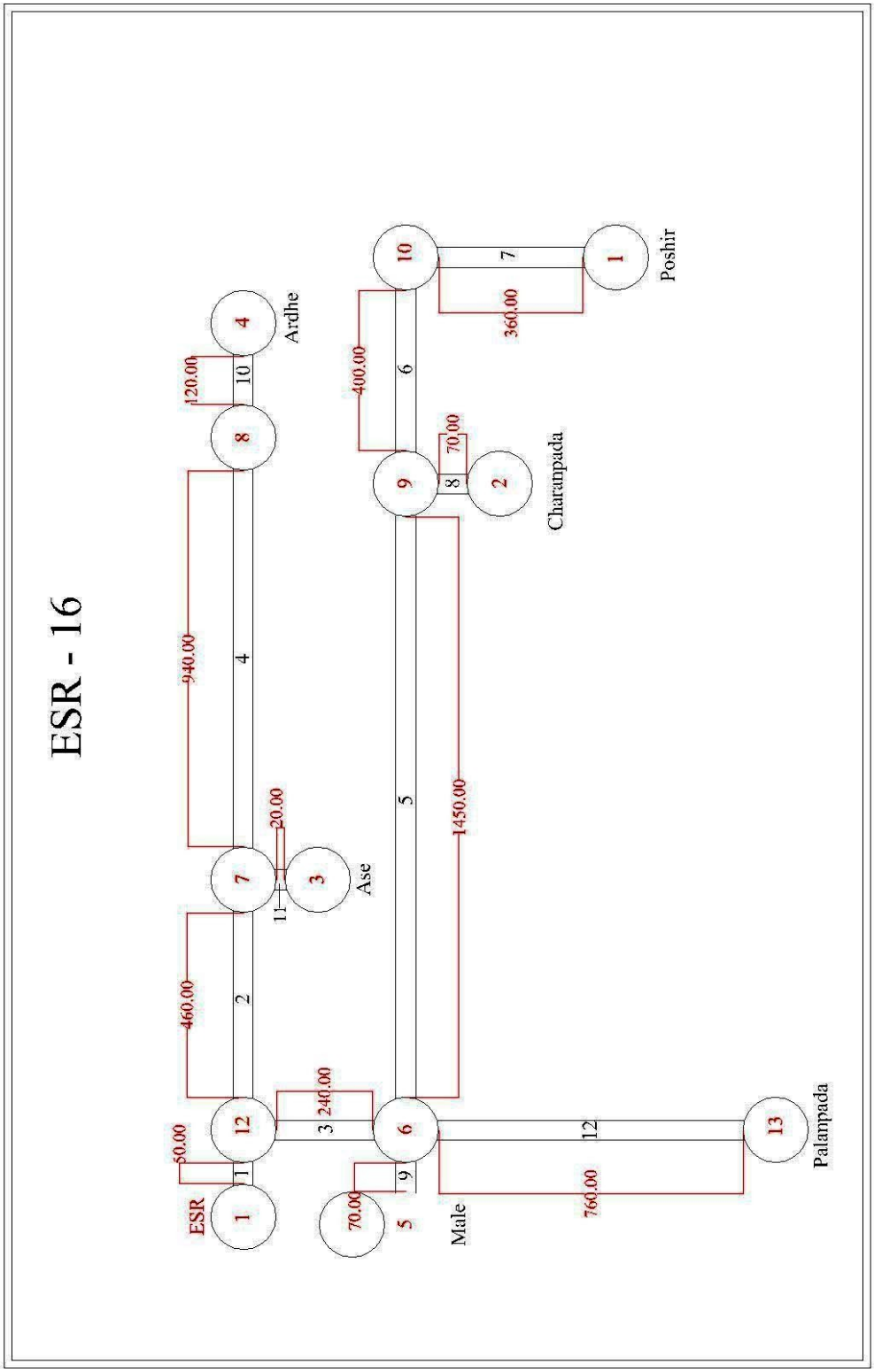
ESR 15 - Salokh



ESR 16 – Male

S.No.	Village	Elevation		Population	
			2011	2026	2041
1	Poshir	45	2624	2962	3332
2	Charnpada	40	480	600	800
3	Ase	43	215	303	427
4	Ardhe	59	854	1062	1308
5	Male	53	1573	1934	2370
6	Palanpada	48	480	600	800
	Total		6226	7461	9038

Daily Water Demand at 200 LPCD					
S.No.	Village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Poshir	0.630	0.800	29.151	37.026
2	Charnpada	0.115	0.192	5.333	8.889
3	Ase	0.052	0.103	2.389	4.749
4	Ardhe	0.205	0.314	9.491	14.532
5	Male	0.378	0.569	17.483	26.335
6	Palanpada	0.115	0.192	5.333	8.889
	Total	1.494	2.169	69.180	100.420


ESR - 16
ESR
Ardhe
Ase
Charanpada
Poshir
Male
Palampada
50.00
460.00
940.00
120.00
20.00
240.00
1450.00
400.00
360.00
70.00
70.00
760.00

ESR 16 - Male

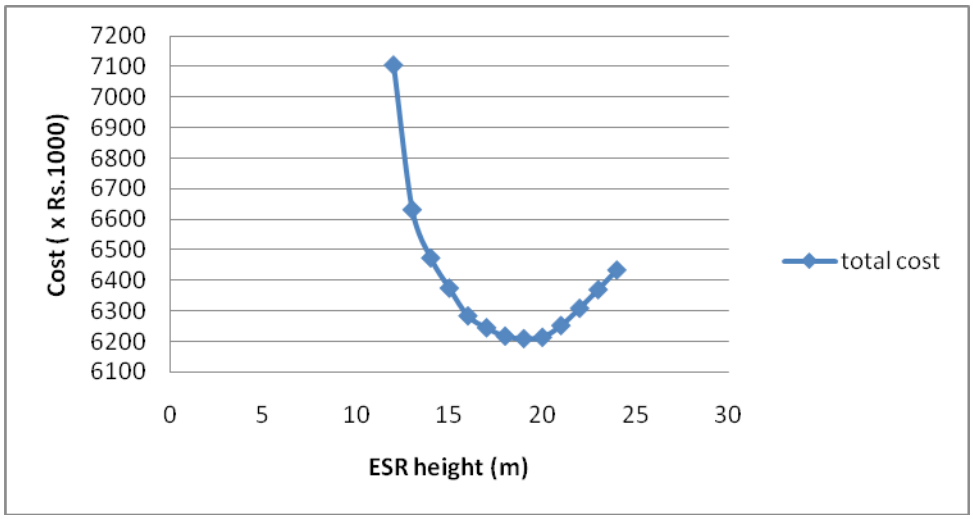


ESR 16 – Staging Height Optimization

Total Demand	2169080
ESR capacity Required	813405
ESR capacity Proposed	816000
Low level Height	68
ESR elevation	56

HGL	PIPE cost	ESR cost	Total	height
70	3707.03	2765.438	6472.468	14
71	3554.84	2818.62	6373.46	15
72	3410.71	2871.801	6282.511	16
73	3292.06	2951.573	6243.633	17
74	3184.76	3031.346	6216.106	18
75	**3096.82**	**3111.118**	**6207.938**	**19**
76	3021.43	3190.89	6212.32	20
77	2953.56	3297.253	6250.813	21
78	2903.74	3403.616	6307.356	22

ESR capacity	816000
Optimum ESR height	19
ERS cost	3111.12
Pipe cost	3096.82
Total	6207.94
/person	686.88



ESR 16 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 16
 Name of the User                        :
 Number of Pipes                         :  12
 Number of Nodes                         :  13
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m          mm       Const    (E/P)
------------------------------------------------------------
    1    11    12       50.00
    2    12     7      460.00
    3    12     6      240.00
    4     7     8      940.00
    5     6     9     1450.00
    6     9    10      400.00
    7    10     1      360.00
    8     9     2       70.00
    9     6     5       70.00
   10     8     4      130.00
```

11	7	3	20.00
12	6	13	760.00

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	-37.026	45.00	8.00	
2	1.00	-8.889	40.00	8.00	
3	1.00	-4.749	43.00	8.00	
4	1.00	-14.532	59.00	8.00	
5	1.00	-26.335	53.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
6	1.00	0.000	45.00	8.00	
7	1.00	0.000	41.00	8.00	
8	1.00	0.000	43.00	8.00	
9	1.00	0.000	27.00	8.00	
10	1.00	0.000	35.00	8.00	
11	1.00	0.000	56.00	8.00	
12	1.00	0.000	55.90	8.00	
13	1.00	-8.889	48.00	8.00	

Reference Node Data

Node No.	Grade Line m
11	75.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m	length

63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	11	12	100.420	280.0	140.00000	0.40	8.00	50.00	
2	12	7	19.281	160.0	140.00000	2.65	5.76	460.00	
3	12	6	81.139	225.0	140.00000	1.00	15.65	63.90	
				250.0	140.00000	1.65	9.37	176.10	
4	7	8	14.532	140.0	140.00000	1.87	6.53	286.30	
				160.0	140.00000	2.23	3.41	653.70	
5	6	9	45.915	200.0	140.00000	14.02	9.67	1450.00	
6	9	10	37.026	200.0	140.00000	2.60	6.50	400.00	
7	10	1	37.026	200.0	140.00000	2.34	6.50	360.00	
8	9	2	8.889	90.0	140.00000	1.59	22.71	70.00	
9	6	5	26.335	140.0	140.00000	1.37	19.57	70.00	
10	8	4	14.532	140.0	140.00000	0.85	6.54	130.00	
11	7	3	4.749	75.0	140.00000	0.35	17.50	20.00	
12	6	13	8.889	90.0	140.00000	15.20	22.65	671.08	
				110.0	140.00000	0.76	8.55	88.92	

Node Details

Node	Peak Flow	Elevation	H G L	Cal Pres	Spc Pres	Meet Res

No.		(lps)	(m)	(m)	(m)	(m)	Pres. (Y)
1	T	-37.026	45.00	53.00	8.00	8.00	
2	T	-8.889	40.00	56.35	16.35	8.00	
3	T	-4.749	43.00	71.61	28.61	8.00	
4	T	-14.532	59.00	67.00	8.00	8.00	
5	T	-26.335	53.00	70.58	17.58	8.00	
6		0.000	45.00	71.96	26.96	8.00	
7		0.000	41.00	71.95	30.95	8.00	
8		0.000	43.00	67.85	24.85	8.00	
9		0.000	27.00	57.94	30.94	8.00	
10		0.000	35.00	55.34	20.34	8.00	
11	S	100.420	56.00	75.00	19.00	8.00	
12		0.000	55.90	74.60	18.70	8.00	
13	T	-8.889	48.00	56.00	8.00	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
75.0	20.00	2.76	2.76
90.0	741.08	140.06	142.82
110.0	88.92	24.01	166.83
140.0	486.30	210.08	376.91
160.0	1113.70	619.22	996.13
200.0	2210.00	1743.69	2739.82
225.0	63.90	64.15	2803.97
250.0	176.10	216.25	3020.23
280.0	50.00	76.60	3096.83

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	280.0	50.00	76.60	76.60
2	160.0	460.00	255.76	332.36
3	225.0	63.90	64.16	396.52
	250.0	176.10	216.25	612.77
4	140.0	286.30	123.68	736.45
	160.0	653.70	363.46	1099.91
5	200.0	1450.00	1144.05	2243.96
6	200.0	400.00	315.60	2559.56

7	200.0	360.00	284.04	2843.60
8	90.0	70.00	13.23	2856.83
9	140.0	70.00	30.24	2887.07
10	140.0	130.00	56.16	2943.23
11	75.0	20.00	2.76	2945.99
12	90.0	671.08	126.83	3072.82
	110.0	88.92	24.01	3096.83

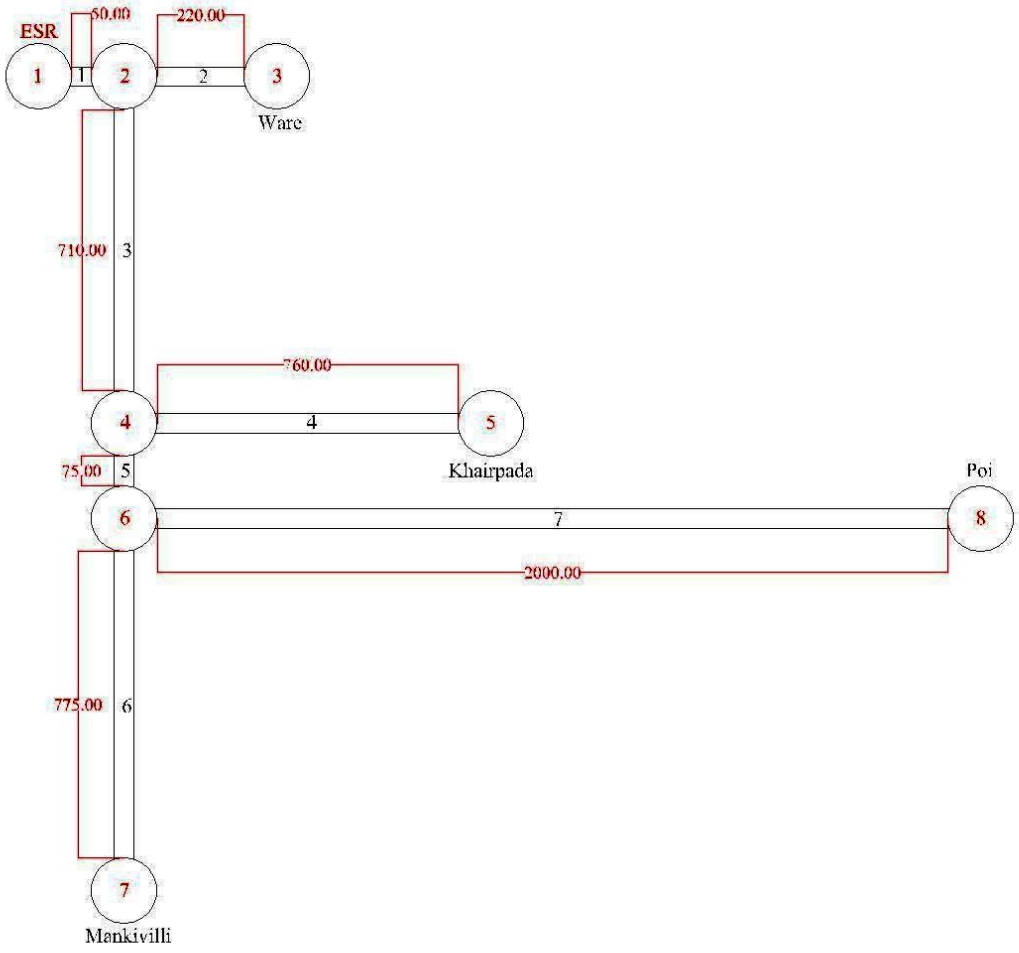
ESR 17 – Vara

S.No.	village	Elevation		Population	
			2011	2026	2041
1	ware	65	1755	2009	2286
2	khairpada	54	480	600	800
3	mankivili	56	480	600	800
4	poi	46	436	551	695
	Total		3151	3760	4581

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041

1	ware	0.421	0.549	19.495	25.405
2	khairpada	0.115	0.192	5.333	8.889
3	mankivili	0.115	0.192	5.333	8.889
4	poi	0.105	0.167	4.848	7.719
Total		0.756	1.099	35.010	50.902

ESR - 17


ESR
50.00
220.00
1
2
3
1
2
Ware
710.00
3
760.00
4
4
5
Khairpada
75.00
5
Poi
6
7
8
2000.00
775.00
6
7
Mankivilli

Mankivli
ESR 17
Ware
Khairpada
Poi
Google
© 2009
© 2010 Google
Image © 2010 GeoEye
19°04'54.05" N 73°23'09.89" E elev 62 m
Eye alt 4.48 km
Imagery Date: Apr 22, 2009

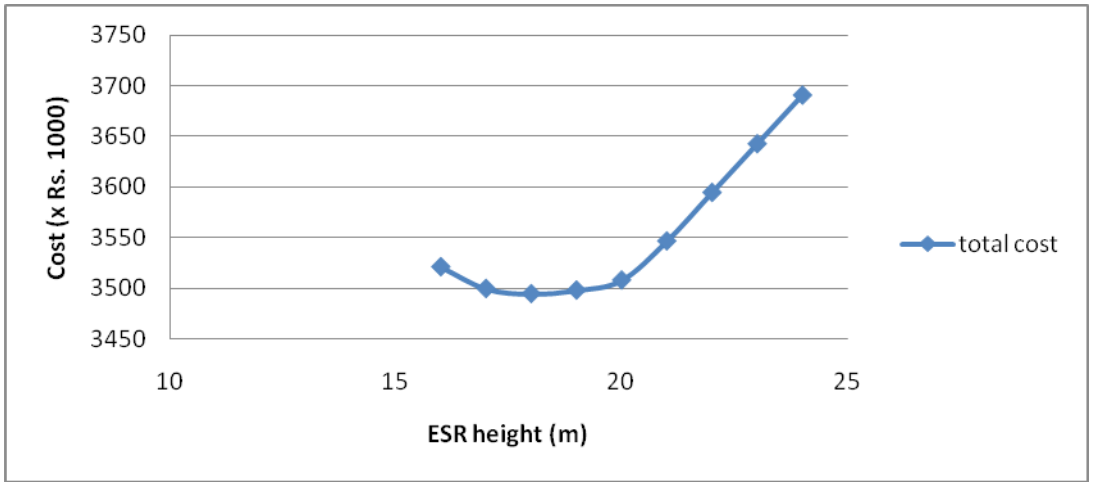
ESR 17 - Vara

ESR 17 – Staging Height Optimization

Total Demand	1099476
ESR capacity Required	412303
ESR capacity Proposed	413000
Low level Height	74
ESR elevation	58

HGL	PIPE cost	ESR cost	Total	height
74	1710.68	1810.231	3520.911	16
75	1638.9	1860.515	3499.415	17
76	1583.51	1910.8	3494.31	18
77	1536.72	1961.084	3497.804	19
78	1496.39	2011.368	3507.758	20
79	1468.02	2078.414	3546.434	21
80	1449.03	2145.459	3594.489	22
81	1430.11	2212.505	3642.615	23
82	1411.19	2279.55	3690.74	24

ESR capacity	413000
Optimum ESR height	18
ERS cost	1910.80
Pipe cost	1583.51
Total	3494.31
/person	762.76



ESR 17 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 17
 Name of the User                        :
 Number of Pipes                         :  7
 Number of Nodes                         :  8
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      1      2        50.00
    2      2      3       220.00
    3      2      4       710.00
    4      4      5       760.00
    5      4      6        75.00
    6      6      7       775.00
    7      6      8      2000.00
============================================================


 Node Data
-----------
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	58.00	8.00	
2	1.00	0.000	57.90	8.00	
3	1.00	-25.405	65.00	8.00	
4	1.00	0.000	50.00	8.00	
5	1.00	-8.889	54.00	8.00	
6	1.00	0.000	51.00	8.00	
7	1.00	-8.889	56.00	8.00	
8	1.00	-7.719	46.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	76.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	50.902	225.0	140.00000	0.33	6.60	50.00	
2	2	3	25.405	140.0	140.00000	1.17	18.34	63.80	
				160.0	140.00000	1.50	9.60	156.20	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
3	2	4	25.497	160.0	140.00000	6.85	9.65	710.00	
4	4	5	8.889	90.0	140.00000	0.54	22.54	23.96	
				110.0	140.00000	6.27	8.52	736.04	
5	4	6	16.608	140.0	140.00000	0.63	8.40	75.00	
6	6	7	8.889	110.0	140.00000	1.39	8.53	163.00	
				125.0	140.00000	2.80	4.58	612.00	
7	6	8	7.719	90.0	140.00000	1.70	17.46	97.38	
				110.0	140.00000	12.49	6.56	1902.62	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)
1 S	50.902	58.00	76.00	18.00	8.00	
2	0.000	57.90	75.67	17.77	8.00	
3 T	-25.405	65.00	73.00	8.00	8.00	
4	0.000	50.00	68.82	18.82	8.00	

5 T	-8.889	54.00	62.00	8.00	8.00
6	0.000	51.00	68.19	17.19	8.00
7 T	-8.889	56.00	64.00	8.00	8.00
8 T	-7.719	46.00	54.00	8.00	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	121.34	22.93	22.93
110.0	2801.66	756.45	779.38
125.0	612.00	212.36	991.75
140.0	138.80	59.96	1051.71
160.0	866.20	481.61	1533.31
225.0	50.00	50.20	1583.51

Pipe-wise Cost Summary

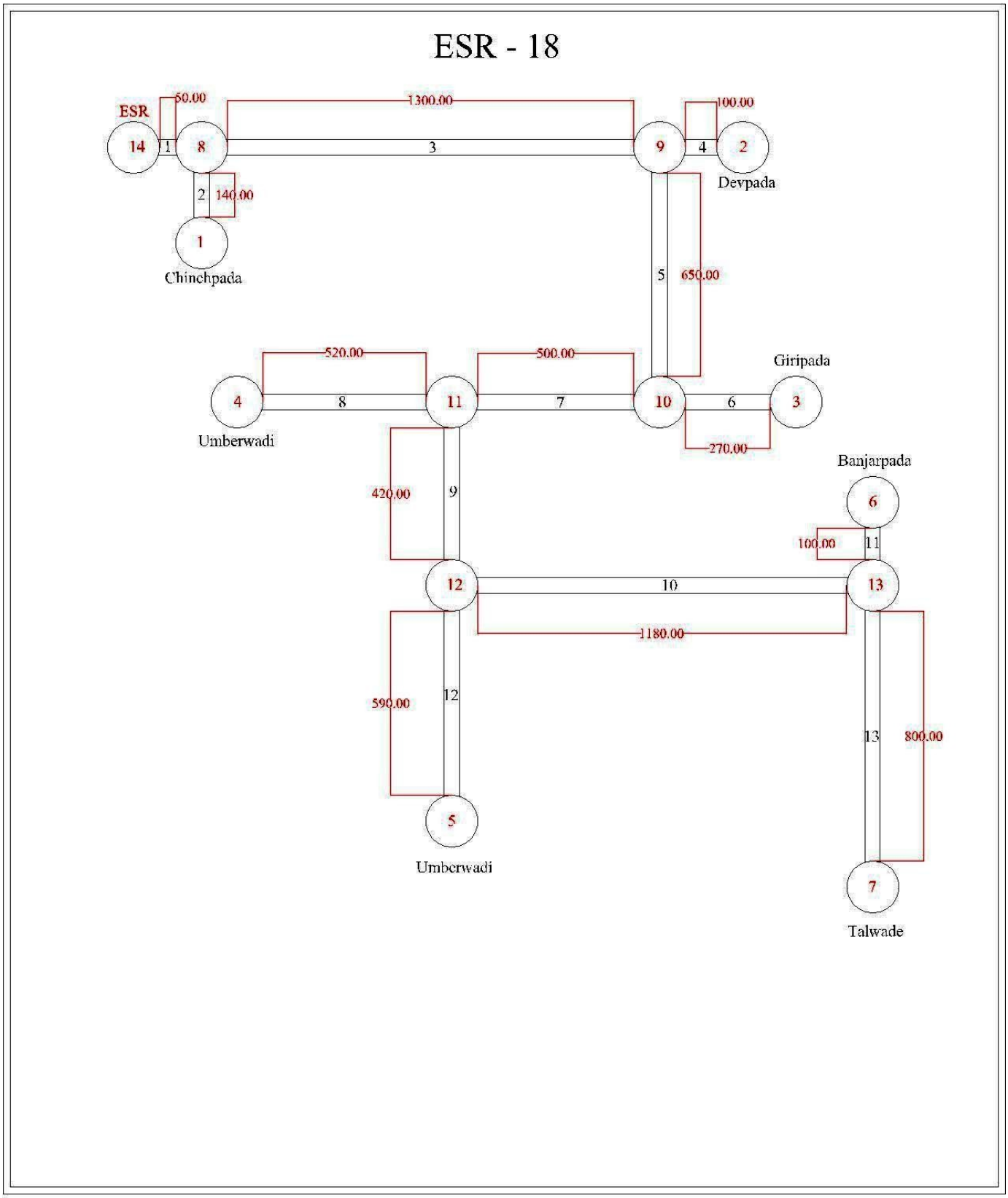
Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	225.0	50.00	50.20	50.20
2	140.0	63.80	27.56	77.76
	160.0	156.20	86.85	164.61
3	160.0	710.00	394.76	559.37
4	90.0	23.96	4.53	563.90
	110.0	736.04	198.73	762.63
5	140.0	75.00	32.40	795.03
6	110.0	163.00	44.01	839.04
	125.0	612.00	212.36	1051.40
7	90.0	97.38	18.40	1069.81
	110.0	1902.62	513.71	1583.51

ESR 18 – Chinchpada

S.No.	village	Elevation	Population 2011	Population 2026	Population 2041
1	Chinchpada	128	480	600	800
2	Devpada	87	480	600	800
3	Giripada	118	480	600	800
4	Umberwadi2	105	480	600	800
5	Umberwadi1	103	480	600	800
6	Banjarpada	61	480	600	800
7	Talwade Budruk	57	480	600	800
	Total		3360	4200	5600

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD) 2011	Demand(MLD) 2041	Demand(LPS) 2011	Demand(LPS) 2041
1	Chinchpada	0.115	0.192	5.333	8.889
2	Devpada	0.115	0.192	5.333	8.889

3	Giripada	0.115	0.192	5.333	8.889
4	Umberwadi2	0.115	0.192	5.333	8.889
5	Umberwadi1	0.115	0.192	5.333	8.889
6	Banjarpada	0.115	0.192	5.333	8.889
7	Talwade Budruk	0.115	0.192	5.333	8.889
	Total	0.806	1.344	37.333	62.222


ESR - 18
ESR
14
50.00
1
8
1300.00
3
9
100.00
4
2
Devpada
2
140.00
1
Chinchpada
5
650.00
520.00
500.00
Giripada
4
8
11
7
10
6
3
Umberwadi
270.00
Banjarpada
420.00
9
6
100.00
11
12
10
13
1180.00
590.00
12
13
800.00
5
Umberwadi
7
Talwade

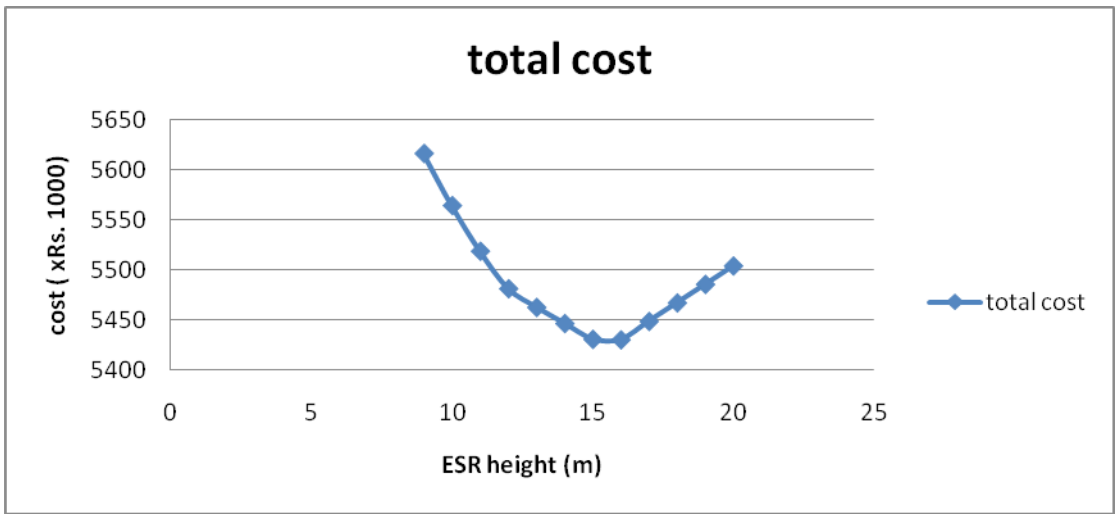
ESR 18 -
Chinchpada

ESR 18 – Staging Height Optimization

Total Demand	1344000
ESR capacity Required	504000
ESR capacity Proposed	504000
Low level Height	137
ESR elevation	128

HGL	PIPE cost	ESR cost	Total	height
139	3656.15	1862.715	5518.865	11
140	3580.82	1900.73	5481.55	12
141	3524.22	1938.745	5462.965	13
142	3470.12	1976.759	5446.879	14
143	3416.4	2014.774	5431.174	15
144	**3377.79**	**2052.788**	**5430.578**	**16**
145	3339.19	2109.81	5449	17
146	3300.57	2166.832	5467.402	18
147	3261.96	2223.854	5485.814	19
148	3223.35	2280.876	5504.226	20

ESR capacity	504000
Optimum ESR height	16
ERS cost	2052.79
Pipe cost	3377.79
Total	5430.58
/person	969.75



ESR 18 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 18
 Name of the User                        :
 Number of Pipes                         :  13
 Number of Nodes                         :  14
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1     14      8        50.00
    2      8      1       140.00
    3      8      9      1300.00
    4      9      2       100.00
    5      9     10       650.00
    6     10      3       270.00
    7     10     11       500.00
    8     11      4       520.00
    9     11     12       420.00
   10     12     13      1180.00
   11     13      6       100.00
   12     12      5       590.00
```

```
   13    13     7      800.00
============================================================


 Node Data
-----------

============================================================
 Node    Peak      Flow     Elevation  Res. Press  Meet Res.
 No.    Factor     lps         m           m      Pres (Y/N)?
------------------------------------------------------------
    1   1.00      -8.889      128.00       8.00
    2   1.00      -8.889       87.00       8.00
    3   1.00      -8.889      118.00       8.00
    4   1.00      -8.889      105.00       8.00


Node Data  cont`d
------------------

============================================================
 Node    Peak      Flow     Elevation  Res. Press  Meet Res.
 No.    Factor     lps         m           m      Pres (Y/N)?
------------------------------------------------------------
    5   1.00      -8.889      103.00       8.00
    6   1.00      -8.889       61.00       8.00
    7   1.00      -8.889       57.00       8.00
    8   1.00       0.000      127.80       8.00
    9   1.00       0.000       74.00       8.00
   10   1.00       0.000      109.00       8.00
   11   1.00       0.000      103.00       8.00
   12   1.00       0.000      108.00       8.00
   13   1.00       0.000       61.00       8.00
   14   1.00       0.000      128.00       8.00
============================================================


 Reference Node Data
---------------------

====================
 Node   Grade Line
  No.       m
--------------------
   14      144.00
====================


 Commercial Diameter Data
--------------------------

====================================
 Pipe Dia.   Hazen's    Unit Cost
 Int. (mm)   Const    Rs /m   length
```

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00

Commercial Diameter Data cont`d

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	14	8	62.223	225.0	140.00000	0.48	9.60	50.00	
2	8	1	8.889	90.0	140.00000	3.17	22.64	140.00	
3	8	9	53.334	200.0	140.00000	2.35	12.77	184.08	
				225.0	140.00000	8.02	7.19	1115.92	
4	9	2	8.889	90.0	140.00000	2.26	22.60	100.00	
5	9	10	44.445	200.0	140.00000	5.92	9.11	650.00	
6	10	3	8.889	125.0	140.00000	1.23	4.56	270.00	
7	10	11	35.556	180.0	140.00000	5.03	10.06	500.00	
8	11	4	8.889	90.0	140.00000	7.65	22.65	337.77	
				110.0	140.00000	1.55	8.51	182.23	

9	11	12	26.667	140.0	140.00000	3.70	20.11	184.00
				160.0	140.00000	2.48	10.51	236.00
10	12	13	17.778	125.0	140.00000	19.45	16.48	1180.00
11	13	6	8.889	90.0	140.00000	2.26	22.60	100.00
12	12	5	8.889	110.0	140.00000	5.03	8.53	590.00
13	13	7	8.889	90.0	140.00000	18.12	22.65	800.00

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1	T	-8.889	128.00	140.35	12.35	8.00	
2	T	-8.889	87.00	130.89	43.89	8.00	

Node Details cont`d

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
3	T	-8.889	118.00	126.00	8.00	8.00	
4	T	-8.889	105.00	113.00	8.00	8.00	
5	T	-8.889	103.00	111.00	8.00	8.00	
6	T	-8.889	61.00	94.31	33.31	8.00	
7	T	-8.889	57.00	78.46	21.46	8.00	
8		0.000	127.80	143.52	15.72	8.00	
9		0.000	74.00	133.15	59.15	8.00	
10		0.000	109.00	127.23	18.23	8.00	
11		0.000	103.00	122.20	19.20	8.00	
12		0.000	108.00	116.03	8.03	8.00	
13		0.000	61.00	96.57	35.57	8.00	
14	S	62.223	128.00	144.00	16.00	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	1477.77	279.30	279.30
110.0	772.23	208.50	487.80
125.0	1450.00	503.15	990.95
140.0	184.00	79.49	1070.44
160.0	236.00	131.21	1201.65
180.0	500.00	347.50	1549.15
200.0	834.08	658.09	2207.25
225.0	1165.92	1170.58	3377.83

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	225.0	50.00	50.20	50.20
2	90.0	140.00	26.46	76.66
3	200.0	184.08	145.24	221.90
	225.0	1115.92	1120.38	1342.28
4	90.0	100.00	18.90	1361.18

Pipe-wise Cost Summary cont`d

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
5	200.0	650.00	512.85	1874.03
6	125.0	270.00	93.69	1967.72
7	180.0	500.00	347.50	2315.22
8	90.0	337.77	63.84	2379.06
	110.0	182.23	49.20	2428.26
9	140.0	184.00	79.49	2507.75
	160.0	236.00	131.22	2638.97
10	125.0	1180.00	409.46	3048.43
11	90.0	100.00	18.90	3067.33
12	110.0	590.00	159.30	3226.63
13	90.0	800.00	151.20	3377.83

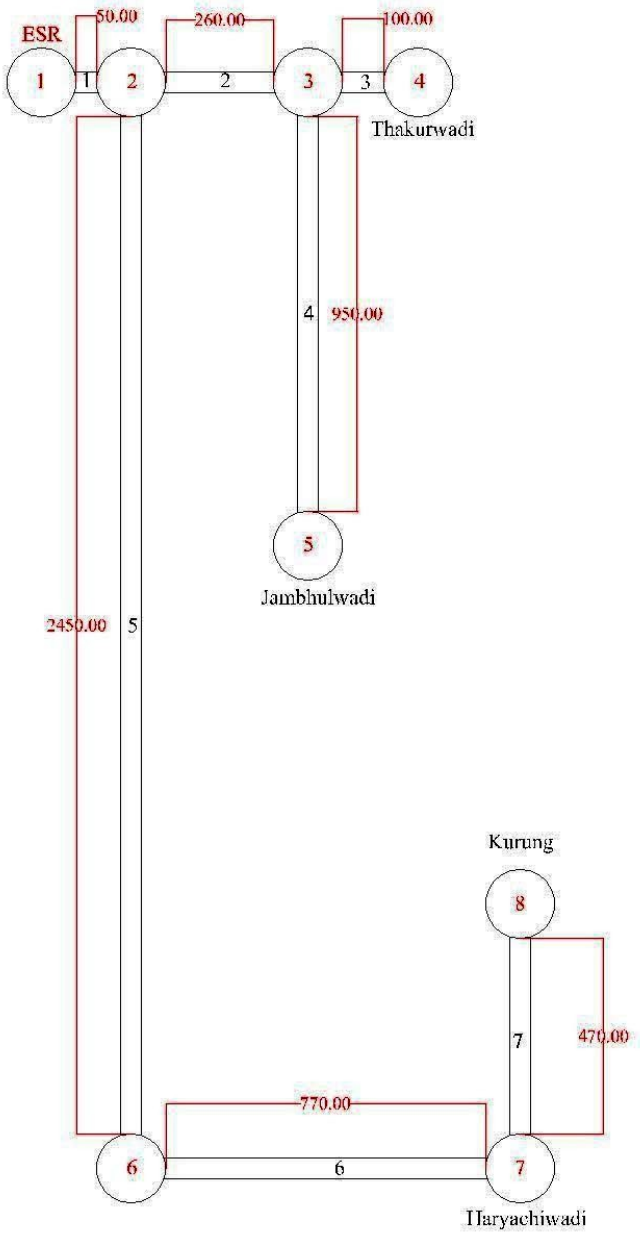
ESR 19 – Kurung

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Thakurwadi	111	480	600	800
2	Jambhulwadi	106	480	600	800
3	Haryachiwadi	121	480	600	800
4	Kurung	96	650	765	899
	Total		2090	2565	3299

Daily Water Demand at 200 LPCD					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Thakurwadi	0.115	0.192	5.333	8.889
2	Jambhulwadi	0.115	0.192	5.333	8.889
3	Haryachiwadi	0.115	0.192	5.333	8.889

4	Kurung	0.156	0.216	7.219	9.993
	Total	0.502	0.792	23.219	36.660

ESR - 19


ESR
50.00
260.00
100.00
1
1
2
2
3
3
4
Thakurwadi
4
950.00
5
Jambhulwadi
2450.00
5
Kurung
8
7
470.00
770.00
6
6
7
Haryachiwadi

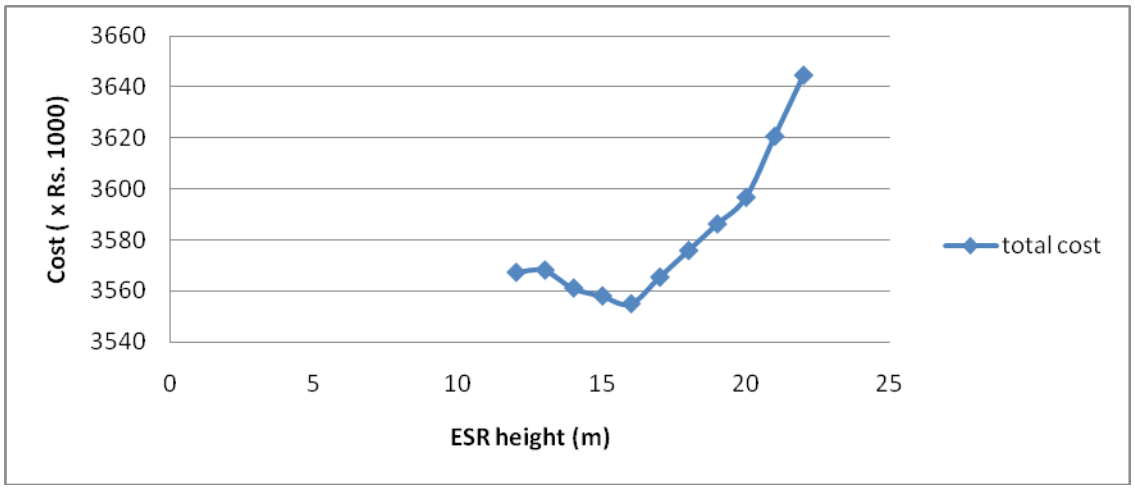
ESR 19 - Kurung

ESR 19 – Staging Height Optimization

Total Demand	791856
ESR capacity Required	296946
ESR capacity Proposed	300000
Low level Height	130
ESR elevation	118

HGL	PIPE cost	ESR cost	Total	height
130	2213.02	1354.21	3567.23	12
131	2186.82	1381.294	3568.114	13
132	2152.68	1408.378	3561.058	14
133	2122.51	1435.463	3557.973	15
134	2092.35	1462.547	3554.897	16
135	2062.17	1503.173	3565.343	17
136	2031.99	1543.799	3575.789	18
137	2001.82	1584.426	3586.246	19
138	1971.65	1625.052	3596.702	20
139	1941.48	1679.22	3620.7	21
140	1911.31	1733.389	3644.699	22

Optimum ESR height	16
ERS cost	1462.55
Pipe cost	2092.35
Total	3554.90
/person	1077



ESR 19 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 19
 Name of the User                        :
 Number of Pipes                         :  7
 Number of Nodes                         :  8
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      1      2       50.00
    2      2      3      260.00
    3      3      4      100.00
    4      3      5      950.00
    5      2      6     2450.00
    6      6      7      770.00
    7      7      8      470.00
============================================================


 Node Data
-----------
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	118.00	8.00	
2	1.00	0.000	117.90	8.00	
3	1.00	0.000	111.00	8.00	
4	1.00	-8.889	111.00	8.00	
5	1.00	-8.889	106.00	8.00	
6	1.00	0.000	74.00	8.00	
7	1.00	-8.889	121.00	8.00	
8	1.00	-9.993	96.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	134.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	36.660	200.0	140.00000	0.32	6.40	50.00	
2	2	3	17.778	125.0	140.00000	4.29	16.50	260.00	
3	3	4	8.889	90.0	140.00000	2.26	22.60	100.00	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
4	3	5	8.889	90.0	140.00000	11.70	22.64	516.74	
				110.0	140.00000	3.69	8.52	433.26	
5	2	6	18.882	140.0	140.00000	19.20	10.62	1808.69	
				160.0	140.00000	3.55	5.54	641.31	
6	6	7	18.882	160.0	140.00000	4.26	5.53	770.00	
7	7	8	9.993	125.0	140.00000	2.67	5.68	470.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1 S	36.660	118.00	134.00	16.00	8.00	
2	0.000	117.90	133.68	15.78	8.00	
3	0.000	111.00	129.39	18.39	8.00	
4 T	-8.889	111.00	127.13	16.13	8.00	
5 T	-8.889	106.00	114.00	8.00	8.00	
6	0.000	74.00	110.93	36.93	8.00	

7	-8.889	121.00	106.67	-14.33 *	8.00
8 T	-9.993	96.00	104.00	8.00	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
90.0	616.74	116.56	116.56
110.0	433.26	116.98	233.54
125.0	730.00	253.31	486.85
140.0	1808.69	781.35	1268.21
160.0	1411.31	784.69	2052.90
200.0	50.00	39.45	2092.35

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	200.0	50.00	39.45	39.45
2	125.0	260.00	90.22	129.67
3	90.0	100.00	18.90	148.57
4	90.0	516.74	97.66	246.23
	110.0	433.26	116.98	363.21
5	140.0	1808.69	781.35	1144.57
	160.0	641.31	356.57	1501.14
6	160.0	770.00	428.12	1929.26
7	125.0	470.00	163.09	2092.35

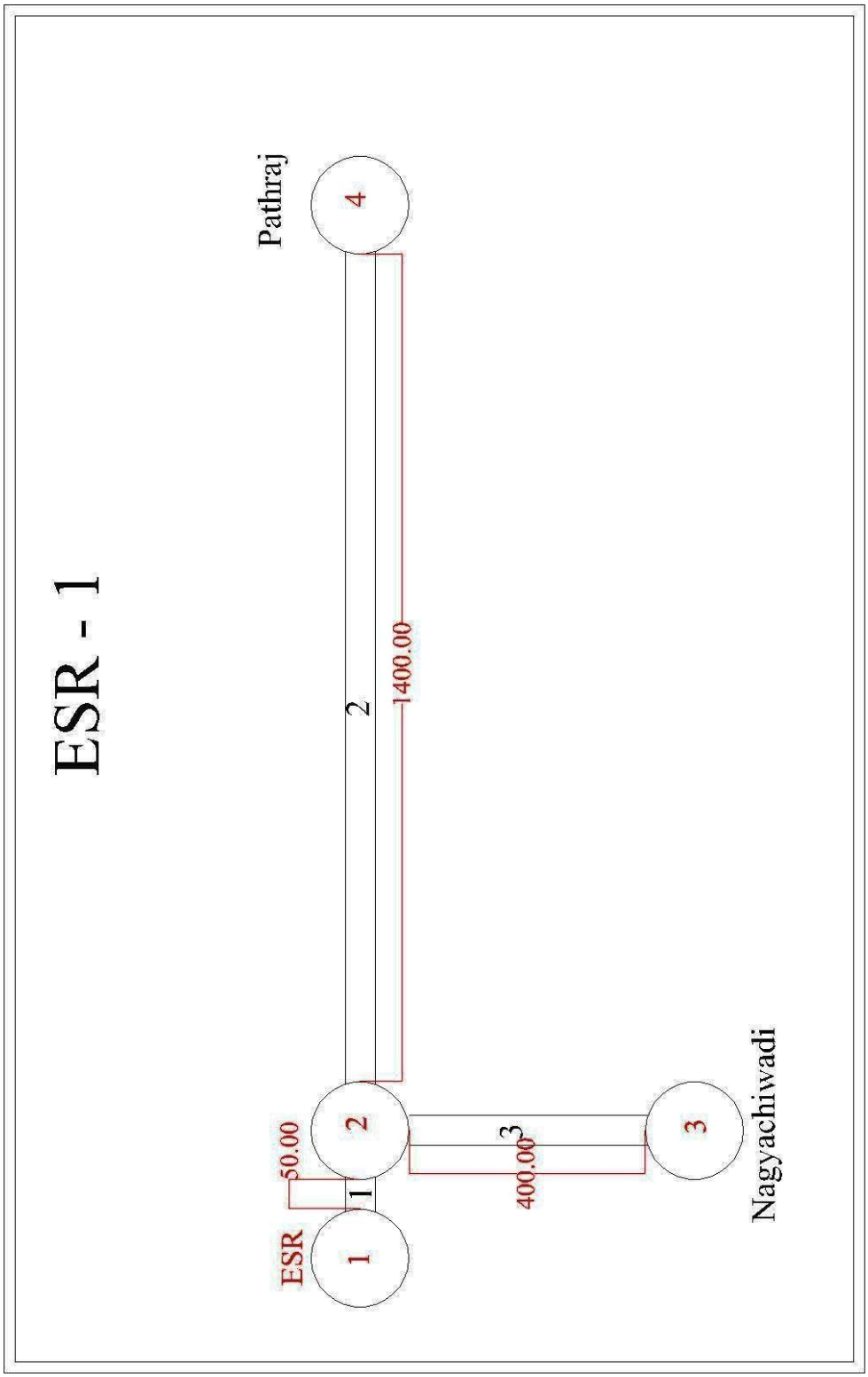
ESR Profiles

for 40 LPCD Design

ESR 1 – Shilar

S.No.	Village	Elevation	Population		
			2011	2026	2041
1	Shilar	138	737	912	1126
2	Unknown	119	480	600	800
3	Khadyrachiwadi	133	480	600	800
4	Kikur	91	480	600	800
5	Borwadi	90	480	600	800
	Total		**2657**	**3312**	**4326**

Daily Water Demand at 40 lpcd 40LPCD					
		Demand(MLD)		**Demand(LPS)**	
S.No.	**Village**	**2011**	**2041**	**2011**	**2041**
1	Shilar	0.128	0.208	5.904	9.613
2	Unknown	0.128	0.208	5.904	9.613
3	Khadyrachiwadi	0.128	0.208	5.904	9.613
4	Kikur	0.128	0.208	5.904	9.613
5	Borwadi	0.128	0.208	5.904	9.613
	Total	**0.128**	**0.208**	**5.904**	**9.613**


ESR - 1
Pathraj
4
2
1400.00
50.00
2
3
400.00
3
Nagyachivadi
1
ESR
1

Shilar
Shilar ESR- GL 136m
Khadyrachiwadi
Unknown
Kikur
borwadi
Google
© 2009
© 2010 Google
Image © 2010 GeoEye
19°01'38.16" N 73°26'28.44" E elev 130 m
Eye alt 4.27 km
Imagery Date: Apr 22, 2009

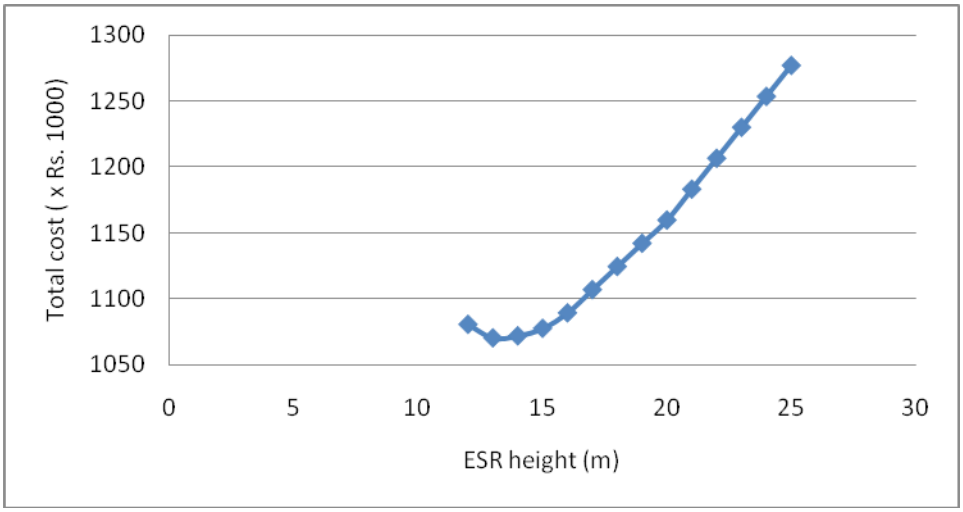
ESR 1 -
Shilar

ESR 1 – Staging Height Optimization

Total Demand	207648
ESR capacity Required	77868
ESR capacity Proposed	78000
Low level Height	147
ESR elevation	135

HGL	PIPE cost	ESR cost	Total	height
147	493.74	586.925	1080.665	12
148	471.7	598.6635	1070.3635	13
149	461.56	610.402	1071.962	14
150	455.51	622.1405	1077.6505	15
151	455.51	633.879	1089.389	16
152	455.51	651.48675	1106.99675	17
153	455.51	669.0945	1124.6045	18
154	455.51	686.70225	1142.21225	19
155	455.51	704.31	1159.82	20
156	455.51	727.787	1183.297	21
157	455.51	751.264	1206.774	22
158	455.51	774.741	1230.251	23
159	455.51	798.218	1253.728	24
160	455.51	821.695	1277.205	25

ESR capacity	78000
Optimum ESR height	13
ERS cost	598.66
Pipe cost	471.70
Total	1070.36
/person	247



ESR 1 – Branch Output

Echoing Input Variables

Title of the Project		: ESR 1(40 LPCD)
Name of the User		:
Number of Pipes		: 9
Number of Nodes		: 10
Number of Commercial Diameters		: 16
Peak Design Factor		: 1
Minimum Headloss in	m/km	: .1
Maximum Headloss in	m/km	: 25
Minimum Residual Pressure	m	: 8
Type of Formula		: Hazen's

Pipe Data

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Status (E/P)
1	1	2	50.00			
2	2	3	200.00			
3	3	4	50.00			
4	3	5	2050.00			
5	2	6	340.00			
6	6	7	50.00			
7	6	8	1400.00			
8	8	9	100.00			
9	8	10	100.00			

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	135.00	8.00	
2	1.00	0.000	134.90	8.00	
3	1.00	0.000	133.00	8.00	
4	1.00	-2.502	138.00	8.00	
5	1.00	-1.778	119.00	8.00	
6	1.00	0.000	133.00	8.00	
7	1.00	-1.778	133.00	8.00	
8	1.00	0.000	85.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
9	1.00	-1.778	91.00	8.00	
10	1.00	-1.778	90.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	148.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	9.614	110.0	140.00000	0.49	9.80	50.00	
2	2	3	4.280	75.0	140.00000	0.12	13.97	8.59	
				90.0	140.00000	1.12	5.85	191.41	
3	3	4	2.502	75.0	140.00000	0.26	5.20	50.00	
4	3	5	1.778	63.0	140.00000	13.43	6.55	2050.00	
5	2	6	5.334	75.0	140.00000	5.41	21.37	253.10	
				90.0	140.00000	0.77	8.86	86.90	
6	6	7	1.778	63.0	140.00000	0.33	6.60	50.00	
7	6	8	3.556	63.0	140.00000	33.07	23.62	1400.00	
8	8	9	1.778	63.0	140.00000	0.66	6.60	100.00	
9	8	10	1.778	63.0	140.00000	0.66	6.60	100.00	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)
1	S	9.614	135.00	148.00	13.00	8.00	
2		0.000	134.90	147.51	12.61	8.00	
3		0.000	133.00	146.26	13.26	8.00	
4	T	-2.502	138.00	146.00	8.00	8.00	
5	T	-1.778	119.00	132.83	13.83	8.00	
6		0.000	133.00	141.33	8.33	8.00	
7	T	-1.778	133.00	141.00	8.00	8.00	
8		0.000	85.00	108.26	23.26	8.00	
9	T	-1.778	91.00	107.60	16.60	8.00	
10	T	-1.778	90.00	107.60	17.60	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	3700.00	362.60	362.60
75.0	311.69	43.01	405.61
90.0	278.31	52.60	458.21
110.0	50.00	13.50	471.71

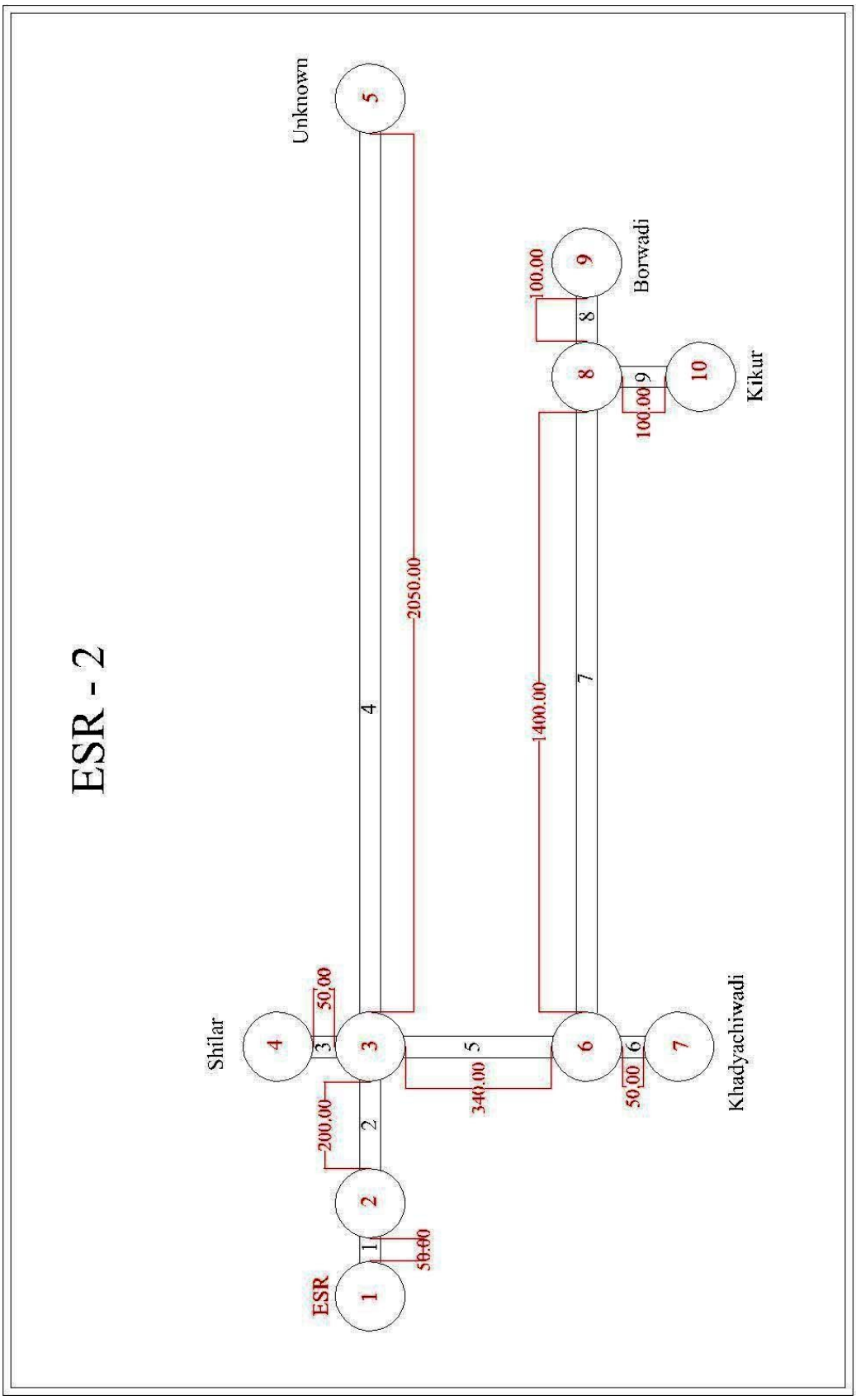
Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	110.0	50.00	13.50	13.50
2	75.0	8.59	1.19	14.69
	90.0	191.41	36.18	50.86
3	75.0	50.00	6.90	57.76
4	63.0	2050.00	200.90	258.66
5	75.0	253.10	34.93	293.59
	90.0	86.90	16.42	310.01
6	63.0	50.00	4.90	314.91
7	63.0	1400.00	137.20	452.11
8	63.0	100.00	9.80	461.91
9	63.0	100.00	9.80	471.71

ESR 2 – Pathraj

S.No.	Village	Elevation (m)	Population 2011	Population 2026	Population 2041
1	Pathraj	150	2058	2402	2773
2	Nagyachiwadi	158	480	600	800
	Total		2538	3002	3573

Daily Water Demand at 40 lpcd 40 lpcd					
S.No.	Village	Demand(MLD) 2011	Demand(MLD) 2041	Demand(LPS) 2011	Demand(LPS) 2041
1	Pathraj	0.099	0.133	4.573	6.162
2	Nagyachiwadi	0.023	0.038	1.067	1.778
	Total	0.122	0.172	5.640	7.940


ESR - 2
ESR
Shilar
Unknown
Borwadi
Kikur
Khadyachiwadi
1
2
3
4
5
6
7
8
9
10
50.00
200.00
50.00
2050.00
340.00
1400.00
50.00
100.00
100.00

ESR 2 -
Pathraj

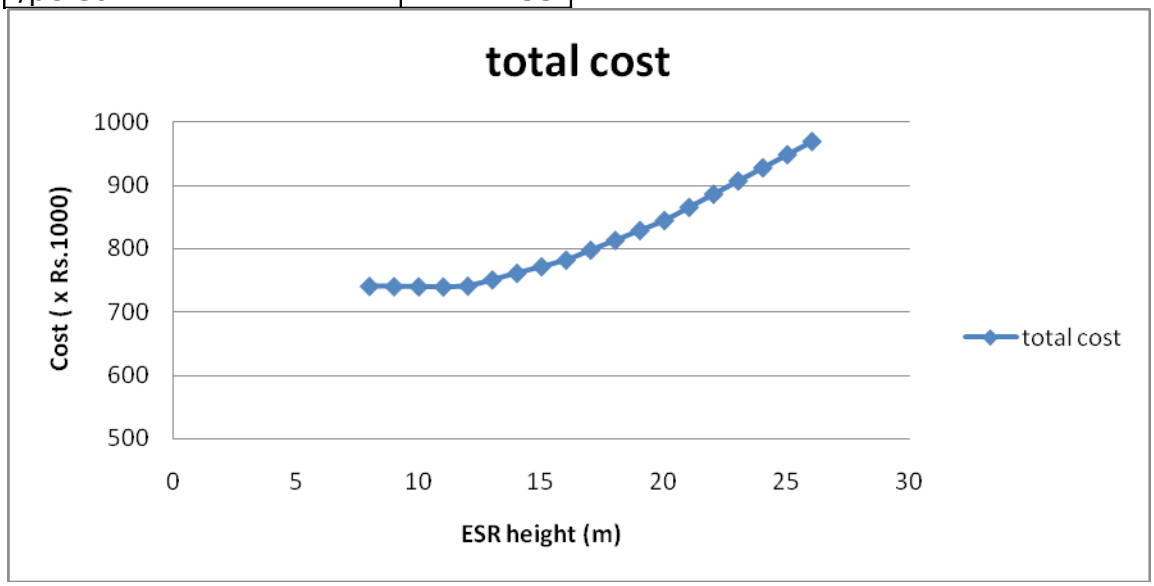
ESR 2 – Staging Height Optimization

Total Demand	171504
ESR capacity Required	64314
ESR capacity Proposed	65000
Low level Height	172
ESR elevation	164

HGL	PIPE cost	ESR cost	Total	height
172	263.84	477.2362	741.0762	8
173	253.17	487.6109	740.7809	9
174	242.5	497.9856	740.4856	10

175	**231.83**	**508.3603**	**740.1903**	**11**
176	222.9	518.735	741.635	12
177	222.25	529.1097	751.3597	13
178	222.25	539.4844	761.7344	14
179	222.25	549.8591	772.1091	15
180	222.25	560.2338	782.4838	16

ESR capacity	322000
Optimum ESR height	11
ERS cost	508.36
Pipe cost	231.83
Total	740.19
/person	207.162133



ESR 2 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 2(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  3
 Number of Nodes                         :  4
```

```
 Number of Commercial Diameters         :  15
 Peak Design Factor                     :  1
 Minimum Headloss in         m/km       :  .1
 Maximum Headloss in         m/km       :  25
 Minimum Residual Pressure   m          :  8
 Type of Formula                        : Hazen's
```

Pipe Data

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Status (E/P)
1	1	2	50.00			
2	2	3	400.00			
3	2	4	1400.00			

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	164.00	8.00	
2	1.00	0.000	163.90	8.00	
3	1.00	-6.162	150.00	8.00	
4	1.00	-1.778	158.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	175.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00

75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2215.00
400.0	140.00000	3147.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	7.940	110.0	140.00000	0.35	7.00	50.00	
2	2	3	6.162	90.0	140.00000	4.60	11.50	400.00	
3	2	4	1.778	63.0	140.00000	8.27	6.55	1261.69	
				75.0	140.00000	0.39	2.82	138.31	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres.	Res (Y)
1	S	7.940	164.00	175.00	11.00	8.00		
2		0.000	163.90	174.65	10.75	8.00		
3	T	-6.162	150.00	170.06	20.06	8.00		
4	T	-1.778	158.00	166.00	8.00	8.00		

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	1261.69	123.65	123.65
75.0	138.31	19.09	142.73
90.0	400.00	75.60	218.33
110.0	50.00	13.50	231.83

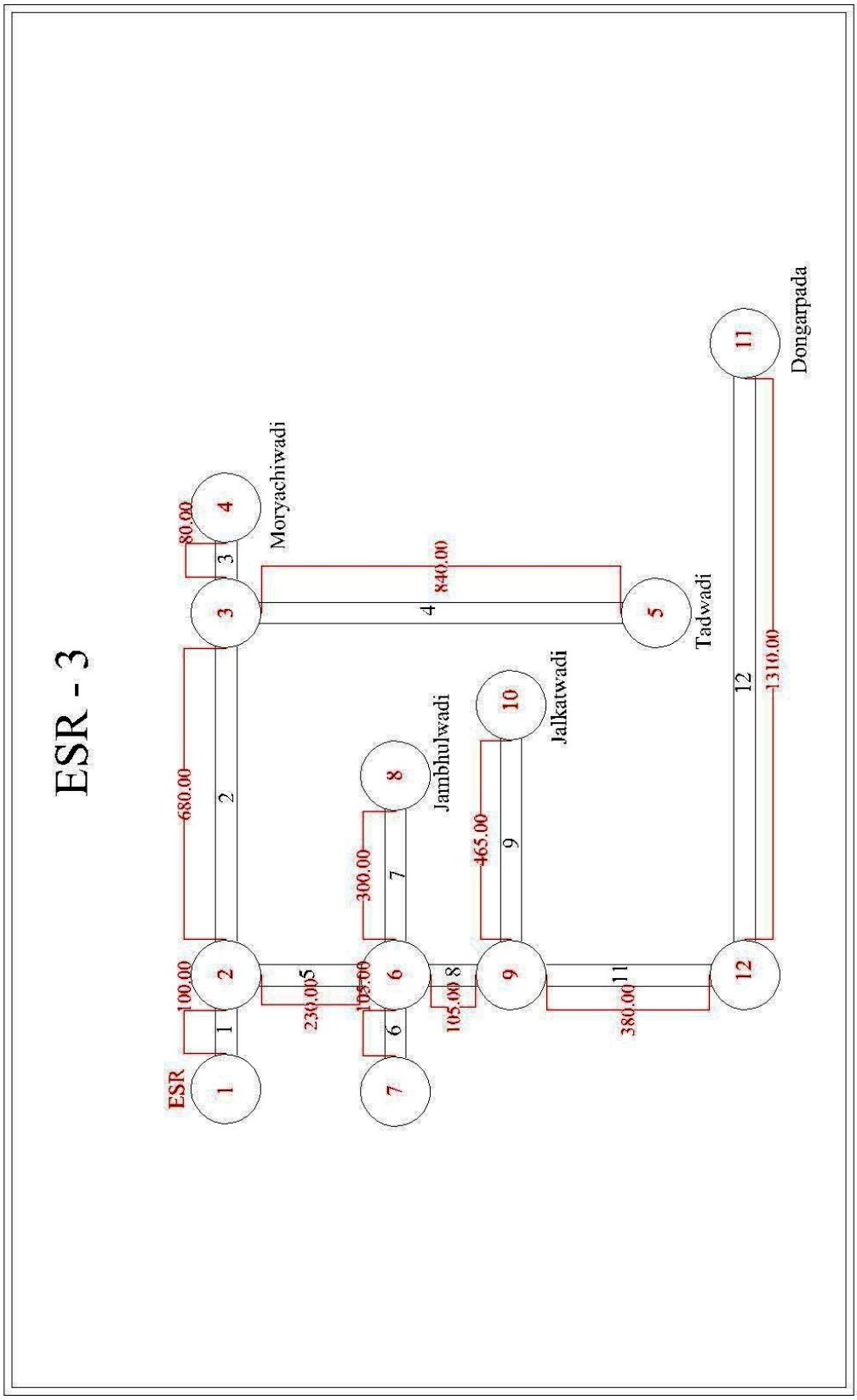
Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	110.0	50.00	13.50	13.50
2	90.0	400.00	75.60	89.10
3	63.0	1261.69	123.65	212.75
	75.0	138.31	19.09	231.83

ESR 3 – Tadwadi

S.No.	Village	Elevation	Population		
			2011	2026	2041
1	Morachiwadi	151	480	600	800
2	Tadwadi	144	827	985	1166
3	Margachiwadi	138	425	577	773
4	Jambhulwadi	137	480	600	800
5	Jalkatwadi	150	480	600	800
6	Dongarpada	165	480	600	800
	Total		3172	3962	5139

Daily Water Demand at 40 lpcd 40 lpcd					
		Demand(MLD)		Demand(LPS)	
S.No.	Village	2011	2041	2011	2041
1	Morachiwadi	0.023	0.038	1.067	1.778
2	Tadwadi	0.040	0.056	1.838	2.591
3	Margachiwadi	0.020	0.037	0.944	1.718
4	Jambhulwadi	0.023	0.038	1.067	1.778
5	Jalkatwadi	0.023	0.038	1.067	1.778
6	Dongarpada	0.023	0.038	1.067	1.778
	Total	0.152	0.247	7.049	11.420


ESR - 3
ESR
Moryachiwadi
Jambhulwadi
Jalkatwadi
Tadwadi
Dongarpada
100.00
680.00
80.00
840.00
300.00
465.00
105.00
230.00
380.00
1310.00
1
2
3
4
5
6
7
8
9
10
11
12

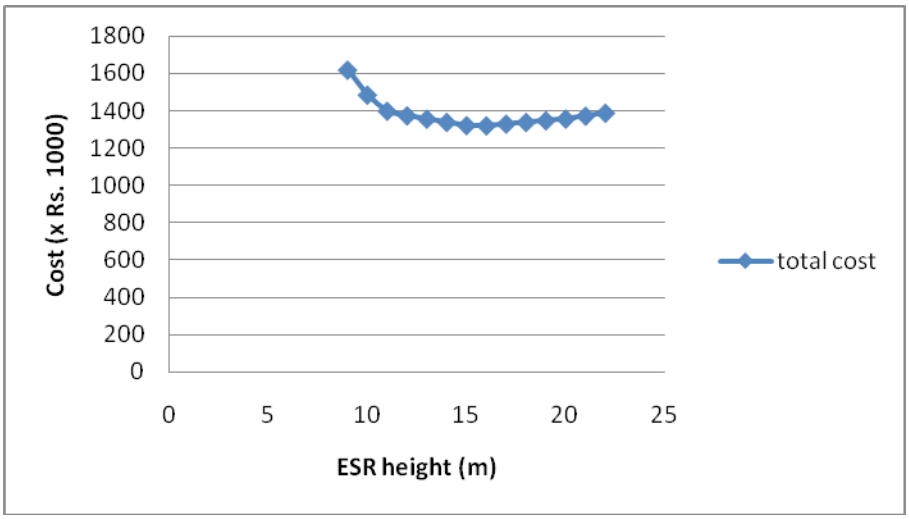
ESR 3 -
Tadwadi

ESR 3 – Staging Height Optimization

Total Demand	246672
ESR capacity Required	92502
ESR capacity Proposed	93000
Low level Height	174
ESR elevation	165

HGL	PIPE cost	ESR cost	Total	height
176	753.6	645.4525	1399.053	11
177	715.75	658.625	1374.375	12
178	684.83	671.7975	1356.628	13
179	653.91	684.97	1338.88	14
180	624.02	698.1425	1322.163	15
181	609.34	711.315	1320.655	16
182	598.68	731.0738	1329.754	17
183	588.01	750.8325	1338.843	18
184	577.34	770.5913	1347.931	19
185	566.67	790.35	1357.02	20

ESR capacity	463000
Optimum ESR height	16
ERS cost	711.32
Pipe cost	609.34
Total	1320.66
/person	256.986768



ESR 3 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR  3
 Name of the User                        :
 Number of Pipes                         :  11
 Number of Nodes                         :  12
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      1      2      100.00
    2      2      3      680.00
    3      3      4       80.00
    4      3      5      840.00
    5      2      6      230.00
    6      6      7      105.00
    7      6      8      300.00
    8      6      9      105.00
    9      9     10      465.00
   11      9     12      380.00
   12     12     11     1310.00
============================================================
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	165.00	8.00	
2	1.00	0.000	161.00	8.00	
3	1.00	0.000	151.00	8.00	
4	1.00	-1.778	151.00	8.00	
5	1.00	-2.591	144.00	8.00	
6	1.00	0.000	135.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
7	1.00	-1.718	138.00	8.00	
8	1.00	-1.778	137.00	8.00	
9	1.00	0.000	134.00	8.00	
10	1.00	-1.778	150.00	8.00	
11	1.00	-1.778	165.00	8.00	
12	1.00	0.000	127.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	181.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00

110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2215.00
400.0	140.00000	3147.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	11.421	110.0	140.00000	1.36	13.60	100.00	
2	2	3	4.369	75.0	140.00000	10.06	14.79	680.00	
3	3	4	1.778	63.0	140.00000	0.52	6.50	80.00	
4	3	5	2.591	63.0	140.00000	11.05	13.15	840.00	
5	2	6	7.052	110.0	140.00000	1.28	5.57	230.00	
6	6	7	1.718	63.0	140.00000	0.65	6.19	105.00	
7	6	8	1.778	63.0	140.00000	1.97	6.57	300.00	
8	6	9	3.556	90.0	140.00000	0.44	4.19	105.00	
9	9	10	1.778	63.0	140.00000	3.05	6.56	465.00	
11	9	12	1.778	75.0	140.00000	1.07	2.82	380.00	
12	12	11	1.778	63.0	140.00000	0.34	6.57	51.77	
				75.0	140.00000	3.53	2.81	1258.23	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1	S	11.421	165.00	181.00	16.00	8.00	
2		0.000	161.00	179.64	18.64	8.00	
3		0.000	151.00	169.59	18.59	8.00	
4	T	-1.778	151.00	169.06	18.06	8.00	
5	T	-2.591	144.00	158.54	14.54	8.00	
6		0.000	135.00	178.37	43.37	8.00	
7	T	-1.718	138.00	177.72	39.72	8.00	
8	T	-1.778	137.00	176.40	39.40	8.00	
9		0.000	134.00	177.93	43.93	8.00	
10	T	-1.778	150.00	174.88	24.88	8.00	
11	T	-1.778	165.00	173.00	8.00	8.00	
12		0.000	127.00	176.87	49.87	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	1841.77	180.49	180.49
75.0	2318.23	319.92	500.41
90.0	105.00	19.84	520.25
110.0	330.00	89.10	609.35

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	110.0	100.00	27.00	27.00
2	75.0	680.00	93.84	120.84
3	63.0	80.00	7.84	128.68
4	63.0	840.00	82.32	211.00
5	110.0	230.00	62.10	273.10

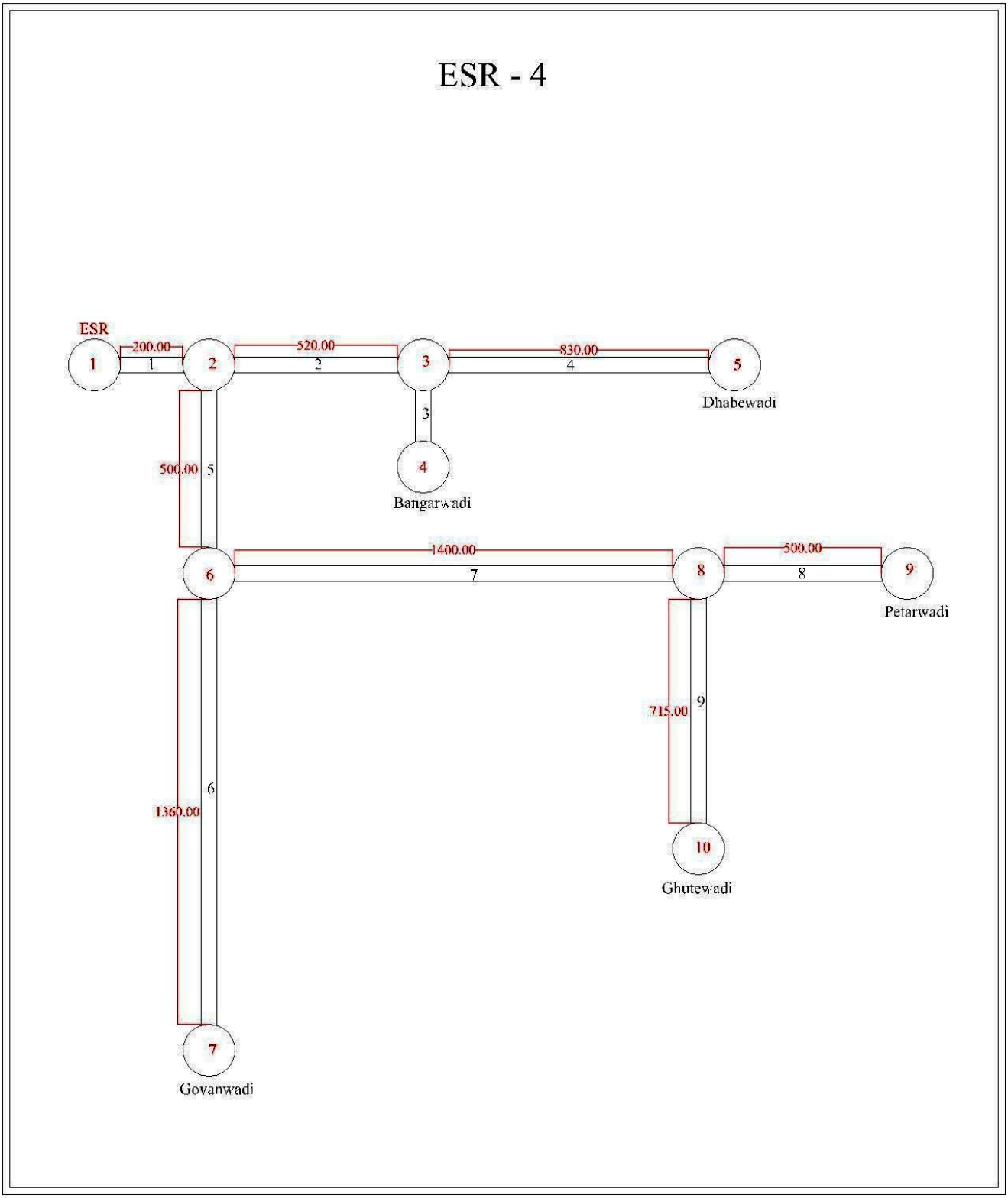
6	63.0	105.00	10.29	283.39
7	63.0	300.00	29.40	312.79
8	90.0	105.00	19.84	332.64
9	63.0	465.00	45.57	378.20
11	75.0	380.00	52.44	430.64
12	63.0	51.77	5.07	435.72
	75.0	1258.23	173.64	609.35

ESR 4 – Bangarwadi

			Population		
S.No.	Village	Elevation	2011	2026	2041
1	Bhangarwadi	159	480	600	800
2	Dhabewadi	161	480	600	800
3	Govanwadi	123	480	600	800
4	Petarwadi	136	480	600	800
5	Ghutewadi	121	480	600	800

	Total		2400	3000	4000

Daily Water Demand at 40 lpcd					
S.No.	Village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Bhangarwadi	0.023	0.038	1.067	1.778
2	Dhabewadi	0.023	0.038	1.067	1.778
3	Govanwadi	0.023	0.038	1.067	1.778
4	Petarwadi	0.023	0.038	1.067	1.778
5	Ghutewadi	0.023	0.038	1.067	1.778
	Total	0.115	0.192	5.333	8.889


ESR - 4
ESR
1
200.00
1
2
520.00
2
3
830.00
4
5
Dhabewadi
3
4
Bangarwadi
500.00
5
6
1400.00
7
8
500.00
8
9
Petarwadi
715.00
9
10
Ghutewadi
6
1360.00
7
Govanwadi

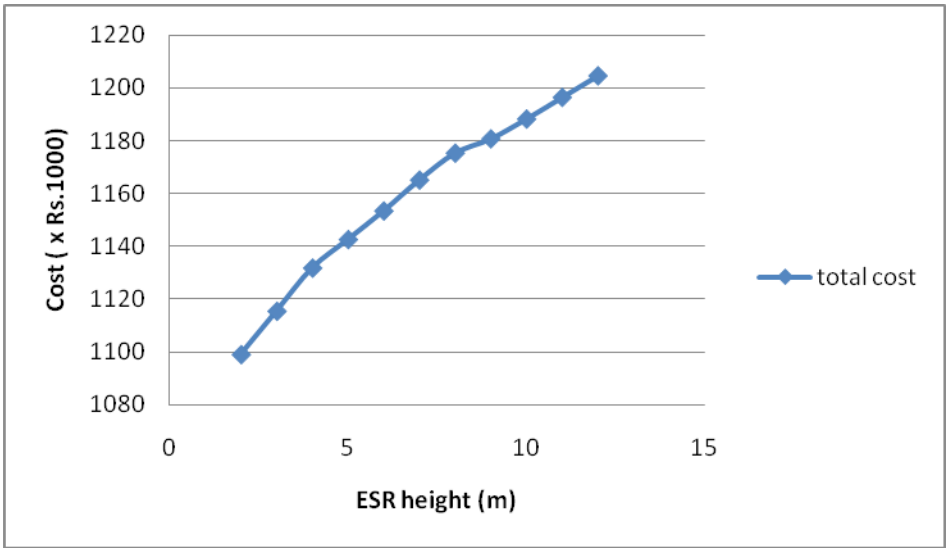
ESR 4 -
Bangarwadi

ESR 4 – Staging Height Optimization

Total Demand	192000
ESR capacity Required	72000
ESR capacity Proposed	72000
Low level Height	184
ESR elevation	182

HGL	PIPE cost	ESR cost	Total	height
184	698.55	400.6044	1099.154	2
185	692.64	422.8602	1115.5	3
186	686.71	445.116	1131.826	4
187	680.8	461.8079	1142.608	5
188	674.88	478.4997	1153.38	6
189	669.87	495.1916	1165.062	7
190	663.34	511.8834	1175.223	8
191	657.6	523.0113	1180.611	9

ESR capacity	72000
Optimum ESR height	2
ERS cost	400.60
Pipe cost	698.55
Total	1099.15
/person	274.7886



ESR 4 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 4(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  9
 Number of Nodes                         :  10
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      1      2       200.00
    2      2      3       520.00
    3      3      4       150.00
    4      3      5       830.00
    5      2      6       500.00
    6      6      7      1360.00
    7      6      8      1400.00
    8      8      9       500.00
    9      8     10       715.00
============================================================
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	182.00	8.00	
2	1.00	0.000	175.00	8.00	
3	1.00	0.000	157.00	8.00	
4	1.00	-1.778	159.00	8.00	
5	1.00	-1.778	161.00	8.00	
6	1.00	0.000	160.00	8.00	
7	1.00	-1.778	123.00	8.00	
8	1.00	0.000	137.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
9	1.00	-1.778	136.00	8.00	
10	1.00	-1.778	121.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	184.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00

160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2215.00
400.0	140.00000	3147.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	8.890	110.0	140.00000	1.70	8.50	200.00	
2	2	3	3.556	63.0	140.00000	4.55	23.63	192.57	
				75.0	140.00000	3.31	10.11	327.43	
3	3	4	1.778	63.0	140.00000	0.98	6.53	150.00	
4	3	5	1.778	63.0	140.00000	5.44	6.55	830.00	
5	2	6	5.334	75.0	140.00000	10.70	21.40	500.00	
6	6	7	1.778	63.0	140.00000	8.91	6.55	1360.00	
7	6	8	3.556	63.0	140.00000	17.78	23.61	752.93	
				75.0	140.00000	6.54	10.11	647.07	
8	8	9	1.778	63.0	140.00000	3.28	6.56	500.00	
9	8	10	1.778	63.0	140.00000	4.68	6.55	715.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1 S	8.890	182.00	184.00	2.00	8.00	
2	0.000	175.00	182.30	7.30 *	8.00	
3	0.000	157.00	174.44	17.44	8.00	
4 T	-1.778	159.00	173.46	14.46	8.00	
5 T	-1.778	161.00	169.00	8.00	8.00	
6	0.000	160.00	171.60	11.60	8.00	
7 T	-1.778	123.00	162.69	39.69	8.00	
8	0.000	137.00	147.28	10.28	8.00	
9 T	-1.778	136.00	144.00	8.00	8.00	
10 T	-1.778	121.00	142.59	21.59	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	4500.50	441.05	441.05
75.0	1474.50	203.48	644.53
110.0	200.00	54.00	698.53

Pipe-wise Cost Summary

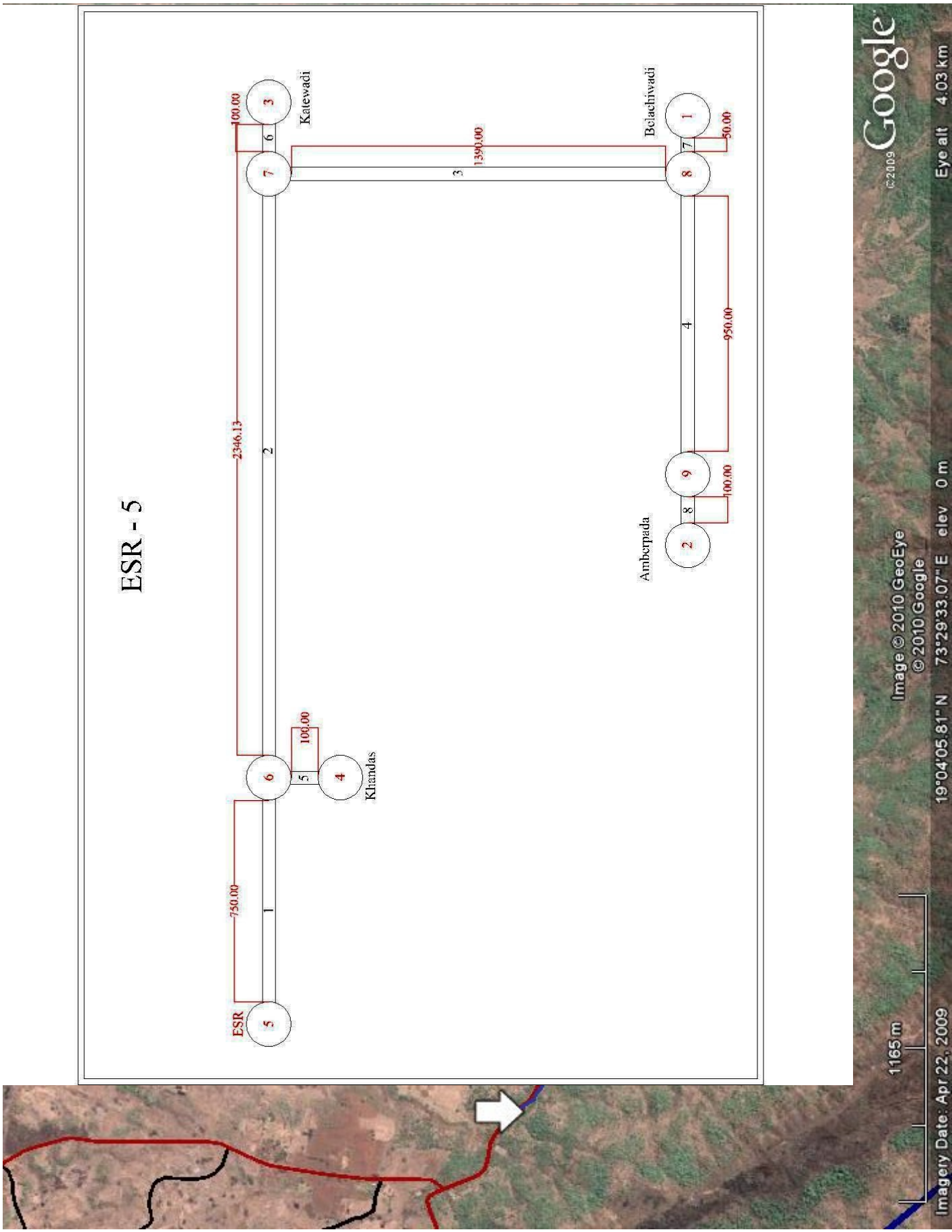
Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	110.0	200.00	54.00	54.00
2	63.0	192.57	18.87	72.87
	75.0	327.43	45.19	118.06
3	63.0	150.00	14.70	132.76
4	63.0	830.00	81.34	214.10
5	75.0	500.00	69.00	283.10
6	63.0	1360.00	133.28	416.38
7	63.0	752.93	73.79	490.16
	75.0	647.07	89.30	579.46
8	63.0	500.00	49.00	628.46
9	63.0	715.00	70.07	698.53

ESR 5 – Khandas

S.No.	Village	Elevation	Population		
			2011	2026	2041
1	Belachiwadi	174	480	600	800
2	Amberpada	166	480	600	800
3	Katewadi	163	480	600	800
4	Khandas	166	2637	2947	3285
	Total		4077	4747	5685

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Belachiwadi	0.02	0.03	1.067	1.778

		3	8		
2	Amberpada	0.023	0.038	1.067	1.778
3	Katewadi	0.023	0.038	1.067	1.778
4	Khandas	0.127	0.158	5.860	7.300
	Total	0.196	0.273	9.060	12.633


ESR - 5
ESR
Khandas
Katewadi
Belachiwadi
Amberpada
750.00
100.00
2346.13
100.00
1390.00
50.00
950.00
100.00
1
2
3
4
5
6
7
8
9
Image © 2010 GeoEye
© 2010 Google
Imagery Date: Apr 22, 2009
19°04'05.81" N 73°29'33.07" E elev 0 m
Eye alt 4.03 km
1165 m
©2009 Google

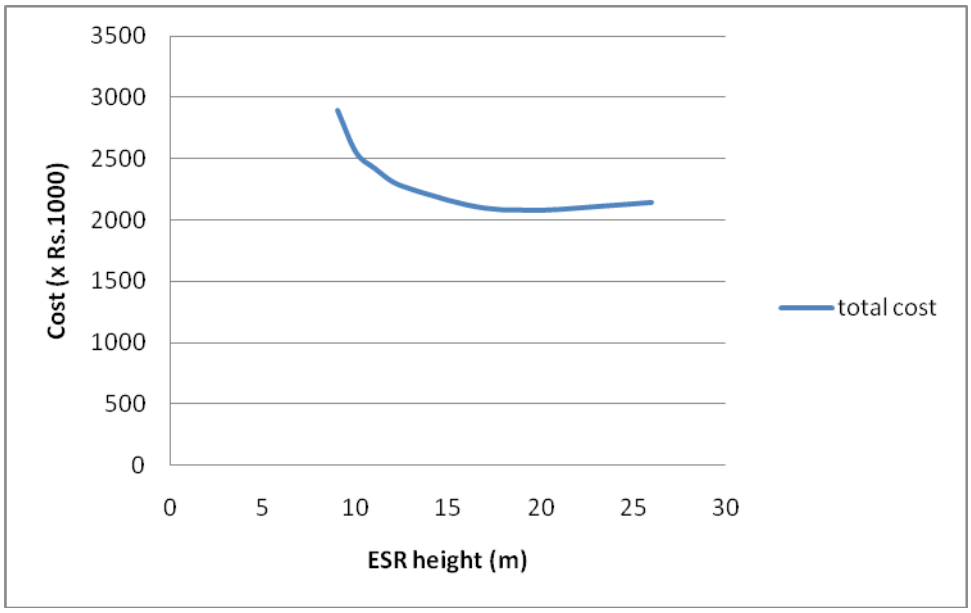
ESR 5 – Staging Height Optimization

Total Demand	272880
ESR capacity	103000
Low level Height	183
esr elevation	174

HGL	PIPE cost	ESR cost	Total	height
189	1415.69	745.7047	2161.395	15
190	1364.39	759.7746	2124.165	16
191	1316.59	780.8795	2097.469	17

192	1281.58	801.9843	2083.564	18
193	1258.72	823.0892	2081.809	19
194	1235.86	844.194	2080.054	20
195	1215.4	872.3338	2087.734	21
196	1198.56	900.4736	2099.034	22
197	1181.73	928.6134	2110.343	23

ESR capacity	103000
Esr height	20
esr cost	844.194
pipe cost	1235.86
total	2080.054
/Person cost	365.8846



ESR 5 - BRANCH Input and Output

```
 Echoing Input Variables
------------------------
```

Title of the Project		: ESR 5(40 LPCD)
Name of the User		:
Number of Pipes		: 8
Number of Nodes		: 9
Number of Commercial Diameters		: 16
Peak Design Factor		: 1
Minimum Headloss in	m/km	: .1
Maximum Headloss in	m/km	: 25
Minimum Residual Pressure	m	: 8
Type of Formula		: Hazen's

Pipe Data

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Status (E/P)
1	5	6	750.00			
2	6	7	2080.00			
3	7	8	1390.00			
4	8	9	950.00			
5	6	4	100.00			
6	7	3	100.00			
7	8	1	60.00			
8	9	2	100.00			

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	-1.778	174.00	8.00	
2	1.00	-1.778	166.00	8.00	
3	1.00	-1.778	163.00	8.00	
4	1.00	-7.300	166.00	8.00	
6	1.00	0.000	166.00	8.00	
7	1.00	0.000	163.00	8.00	
8	1.00	0.000	174.00	8.00	
9	1.00	0.000	166.00	8.00	
5	1.00	0.000	174.00	8.00	

Reference Node Data

Node	Grade Line

No.	m
5	194.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	5	7	12.634	125.0	140.00000	5.34	8.76	609.91	
				140.0	140.00000	0.71	5.07	140.09	
2	7	6	7.300	90.0	140.00000	0.10	16.21	6.17	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
				110.0	140.00000	12.28	5.92	2073.83	
3	7	8	3.556	90.0	140.00000	5.78	4.16	1390.00	
4	8	9	1.778	63.0	140.00000	6.22	6.55	950.00	
5	6	4	7.300	90.0	140.00000	1.57	15.70	100.00	
6	7	3	1.778	63.0	140.00000	0.66	6.60	100.00	
7	8	1	1.778	75.0	140.00000	0.17	2.83	60.00	
8	9	2	1.778	63.0	140.00000	0.66	6.60	100.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1 T	-1.778	174.00	182.00	8.00	8.00	
2 T	-1.778	166.00	175.29	9.29	8.00	
3 T	-1.778	163.00	187.29	24.29	8.00	
4 T	-7.300	166.00	174.00	8.00	8.00	
6	0.000	166.00	175.57	9.57	8.00	
7	0.000	163.00	187.95	24.95	8.00	
8	0.000	174.00	182.17	8.17	8.00	
9	0.000	166.00	175.94	9.94	8.00	
5 S	12.634	174.00	194.00	20.00	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	1150.00	112.70	112.70
75.0	60.00	8.28	120.98
90.0	1496.17	282.78	403.76
110.0	2073.83	559.93	963.69
125.0	609.91	211.64	1175.33
140.0	140.09	60.52	1235.85

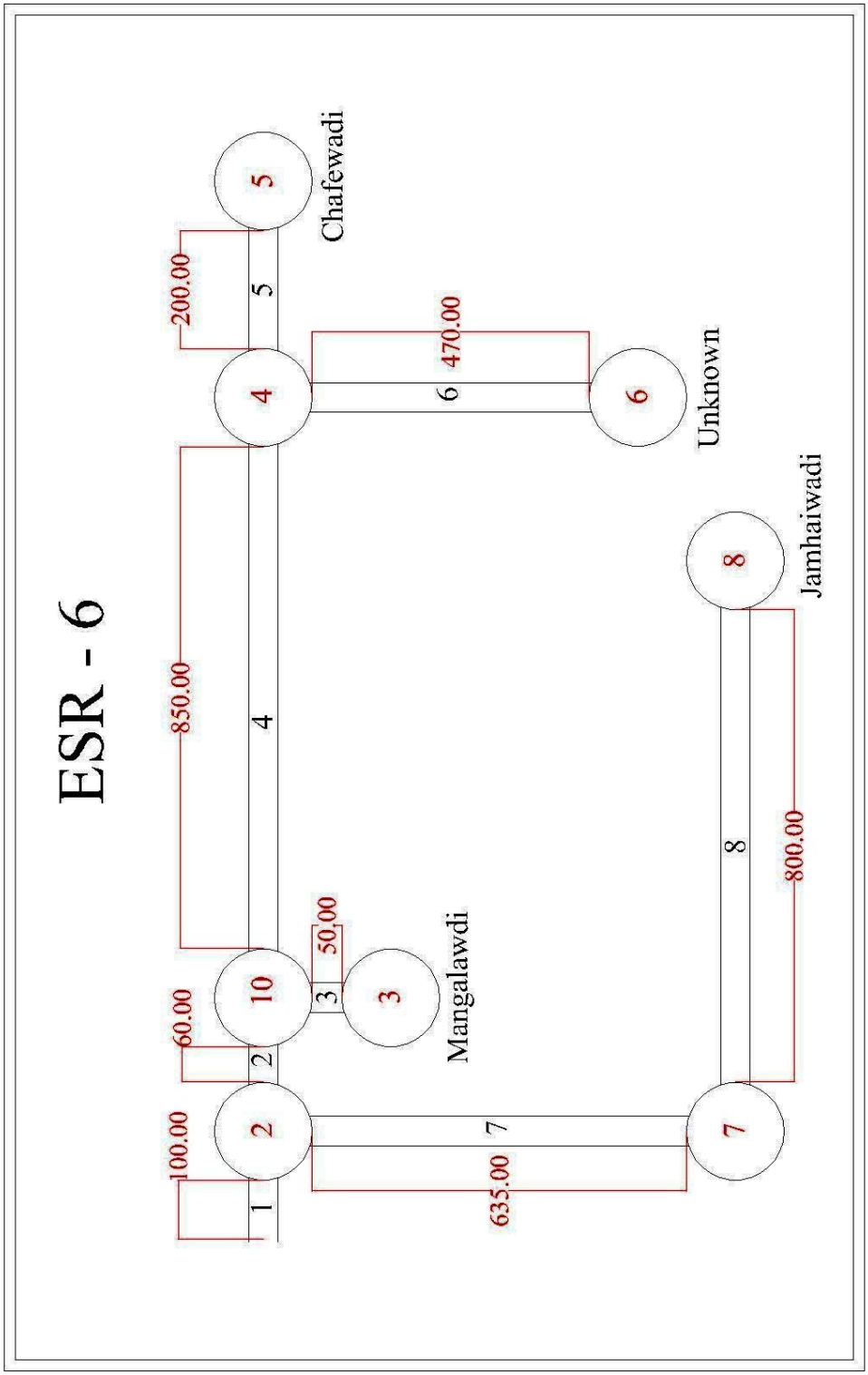
Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	125.0	609.91	211.64	211.64
	140.0	140.09	60.52	272.16
2	90.0	6.17	1.17	273.32
	110.0	2073.83	559.93	833.26
3	90.0	1390.00	262.71	1095.97
4	63.0	950.00	93.10	1189.07
5	90.0	100.00	18.90	1207.97
6	63.0	100.00	9.80	1217.77
7	75.0	60.00	8.28	1226.05
8	63.0	100.00	9.80	1235.85

ESR 6 – Mangalwadi

S.No.	Village	Elevation	Population		
			2011	2026	2041
1	Mangal	122	480	600	800
2	Chafewadi	129	1418	2117	3207
3	Unknown	113	480	600	800
4	Jamhaiwadi	133	480	600	800
	Total		2858	3917	5607

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Mangal	0.023	0.038	1.067	1.778
2	Chafewadi	0.068	0.154	3.151	7.127
3	Unknown	0.023	0.038	1.067	1.778
4	Jamhaiwadi	0.023	0.038	1.067	1.778
	Total	0.137	0.269	6.351	12.460


ESR - 6
Chafewadi
Unknown
Jamhaiwadi
Mangalawdi
200.00
470.00
850.00
50.00
60.00
100.00
635.00
800.00
1
2
3
4
5
6
7
8
10

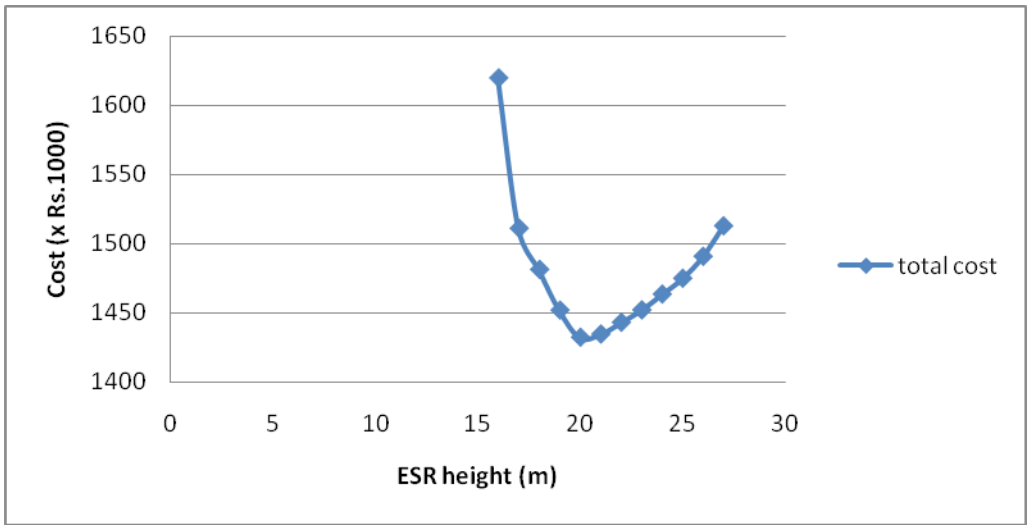
ESR 6 -
Mangalwadi

ESR 6 – Staging Height Optimization

Total Demand	269136
ESR capacity Required	100926
ESR capacity Proposed	101000
Low level Height	142
ESR elevation	126

HGL	PIPE cost	ESR cost	Total	height
142	868.1	751.6314	1619.731	16
143	738.3	772.5101	1510.81	17
144	687.6	793.3887	1480.989	18
145	637.26	814.2674	1451.527	19
146	**596.74**	**835.146**	**1431.886**	**20**
147	571.18	862.9842	1434.164	21
148	551.88	890.8224	1442.702	22
149	533.01	918.6606	1451.671	23
150	516.63	946.4988	1463.129	24

ESR capacity	101000
Optimum ESR height	20
ERS cost	835.15
Pipe cost	596.74
Total	1431.89
/person	255.37471



ESR 6 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 6(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  8
 Number of Nodes                         :  9
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m         mm       Const    (E/P)
------------------------------------------------------------
    1     1     2      100.00
    2     2    10       60.00
    3    10     3       50.00
    4    10     4      850.00
    5     4     5      200.00
    6     4     6      470.00
    7     2     7      635.00
    8     7     8      800.00
============================================================
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	126.00	8.00	
2	1.00	0.000	125.90	8.00	
3	1.00	-1.778	122.00	8.00	
4	1.00	0.000	126.00	8.00	
5	1.00	-7.127	129.00	8.00	
6	1.00	-1.778	113.00	8.00	
7	1.00	0.000	99.00	8.00	
8	1.00	-1.778	133.00	8.00	
10	1.00	0.000	122.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	146.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m	length
63.0	140.00000	98.00	
75.0	140.00000	138.00	
90.0	140.00000	189.00	
110.0	140.00000	270.00	
125.0	140.00000	347.00	
140.0	140.00000	432.00	
160.0	140.00000	556.00	
180.0	140.00000	695.00	
200.0	140.00000	789.00	
225.0	140.00000	1004.00	
250.0	140.00000	1228.00	
280.0	140.00000	1532.00	
315.0	140.00000	1932.00	
355.0	140.00000	2215.00	
400.0	140.00000	3147.00	

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	12.461	140.0	140.00000	0.49	4.90	100.00	
2	2	10	10.683	125.0	140.00000	0.39	6.50	60.00	
3	10	3	1.778	63.0	140.00000	0.33	6.60	50.00	
4	10	4	8.905	110.0	140.00000	6.67	8.55	779.69	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
				125.0	140.00000	0.32	4.55	70.31	
5	4	5	7.127	110.0	140.00000	1.13	5.65	200.00	
6	4	6	1.778	63.0	140.00000	3.08	6.55	470.00	
7	2	7	1.778	75.0	140.00000	1.78	2.80	635.00	
8	7	8	1.778	63.0	140.00000	0.85	6.56	129.60	
				75.0	140.00000	1.88	2.80	670.40	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)

1	S	12.461	126.00	146.00	20.00	8.00
2		0.000	125.90	145.51	19.61	8.00
3	T	-1.778	122.00	144.79	22.79	8.00
4		0.000	126.00	138.13	12.13	8.00
5	T	-7.127	129.00	137.00	8.00	8.00
6	T	-1.778	113.00	135.05	22.05	8.00
7		0.000	99.00	143.73	44.73	8.00
8	T	-1.778	133.00	141.00	8.00	8.00
10		0.000	122.00	145.12	23.12	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	649.60	63.66	63.66
75.0	1305.40	180.15	243.81
110.0	979.69	264.52	508.32
125.0	130.31	45.22	553.54
140.0	100.00	43.20	596.74

Pipe-wise Cost Summary

Pipe	Diameter	Length	Cost	Cum. Cost

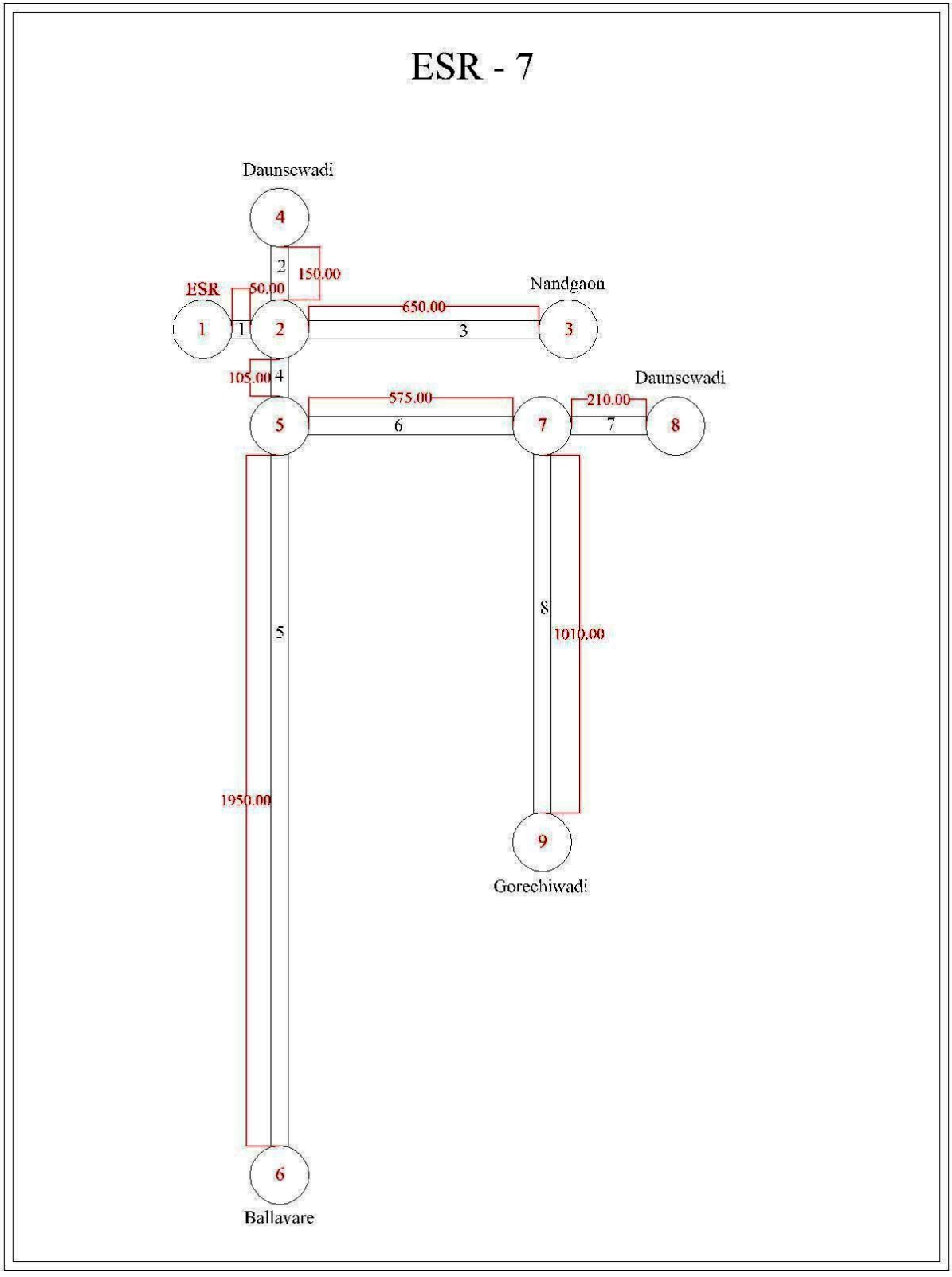
No	(mm)	(m)	(1000 Rs)	(1000 Rs)
1	140.0	100.00	43.20	43.20
2	125.0	60.00	20.82	64.02
3	63.0	50.00	4.90	68.92
4	110.0	779.69	210.52	279.44
	125.0	70.31	24.40	303.83
5	110.0	200.00	54.00	357.83
6	63.0	470.00	46.06	403.89
7	75.0	635.00	87.63	491.52
8	63.0	129.60	12.70	504.22
	75.0	670.40	92.52	596.74

ESR 7 – Nandgaon

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Nandgaon	120	865	995	1137
2	Daunsewadi1	116	480	600	800
3	Ballvare	117	1168	1477	1867
4	Daunsewa	110	480	600	800

	di2				
5	Gorechiwadi	108	480	600	800
	Total		3473	4272	5404

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Nandgaon	0.042	0.055	1.922	2.527
2	Daunsewadi1	0.023	0.038	1.067	1.778
3	Ballvare	0.056	0.090	2.596	4.149
4	Daunsewadi2	0.023	0.038	1.067	1.778
5	Gorechiwadi	0.023	0.038	1.067	1.778
	Total	0.167	0.259	7.718	12.009


ESR - 7
Daunsewadi
4
2
150.00
ESR
50.00
Nandgaon
650.00
1
1
2
3
3
105.00
4
Daunsewadi
575.00
210.00
5
6
7
7
8
8
5
1010.00
1950.00
9
Gorechiwadi
6
Ballavare

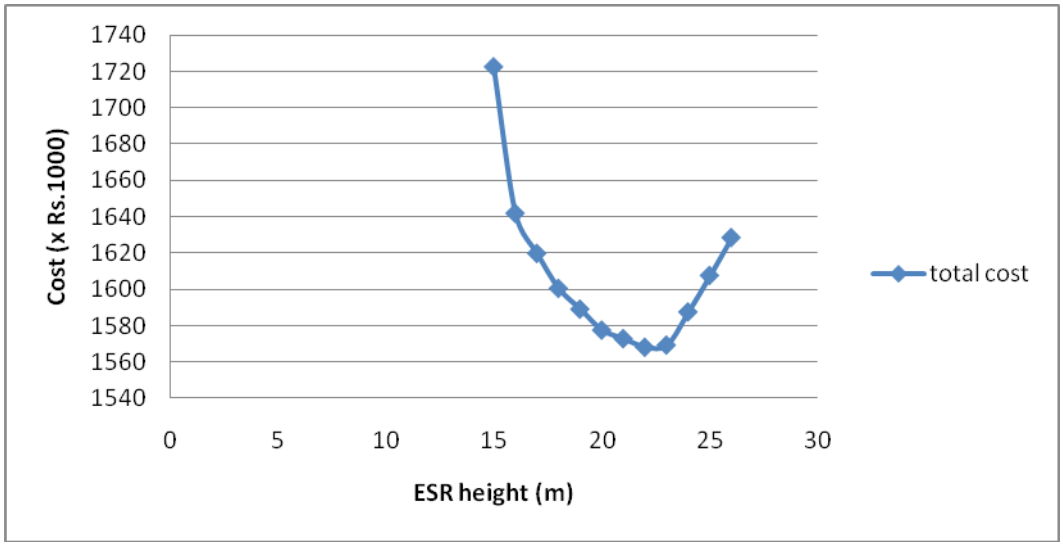
ESR 7 -
Nandgaon

ESR 7 – Staging Height Optimization

Total Demand	259392
ESR capacity Required	97272
ESR capacity Proposed	98000
Low level Height	129
ESR elevation	114

HGL	PIPE cost	ESR cost	Total	height
131	862.11	757.6028	1619.713	17
132	822.41	778.0785	1600.489	18
133	790.47	798.5543	1589.024	19
134	758.47	819.03	1577.5	20
135	726.46	846.331	1572.791	21
136	**694.44**	**873.632**	**1568.072**	**22**
137	668.34	900.933	1569.273	23
138	659.27	928.234	1587.504	24
139	652.04	955.535	1607.575	25

ESR capacity	487000
Optimum ESR height	22
ERS cost	873.63
Pipe cost	694.44
Total	1568.07
/person	290.168764



ESR 7 - BRANCH Input and Output

```
Echoing Input Design Variables
-------------------------------

 Title of the Project                    : ESR 7
 Name of the User                        :
 Number of Pipes                         :  8
 Number of Nodes                         :  9
 Number of Commercial Diameters          :  15
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Branched Water Distribution Network Design OutPut
--------------------------------------------------



 Pipe Details
--------------

=============================================================================
==
 Pipe From  To    Peak Flow    Diam    Hazen's      HL     HL/1000   Length
Status
  No. Node Node     (lps)      (mm)     Const      (m )      (m )     (m )
(E/P)
-----------------------------------------------------------------------------
--
```

1	1	2	12.010	140.0	140.00000	0.23	4.60	50.00
2	2	4	1.778	63.0	140.00000	0.98	6.53	150.00
3	2	3	2.527	63.0	140.00000	7.48	12.56	595.65
				75.0	140.00000	0.29	5.34	54.35
4	2	5	7.705	125.0	140.00000	0.37	3.52	105.00
5	5	6	4.149	90.0	140.00000	10.17	5.53	1838.63
				110.0	140.00000	0.23	2.07	111.37
6	5	7	3.556	63.0	140.00000	12.19	23.62	516.02
				75.0	140.00000	0.60	10.17	58.98
7	7	8	1.778	63.0	140.00000	1.38	6.57	210.00
8	7	9	1.778	63.0	140.00000	6.62	6.55	1010.00

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1	S	12.010	114.00	136.00	22.00	8.00	
2		0.000	113.90	135.77	21.87	8.00	
3	T	-2.527	120.00	128.00	8.00	8.00	
4	T	-1.778	116.00	134.79	18.79	8.00	
5		0.000	114.00	135.40	21.40	8.00	
6	T	-4.149	117.00	125.00	8.00	8.00	
7		0.000	106.00	122.62	16.62	8.00	
8	T	-1.778	110.00	121.24	11.24	8.00	
9	T	-1.778	108.00	116.00	8.00	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	2481.66	243.20	243.20
75.0	113.34	15.64	258.84
90.0	1838.63	347.50	606.34
110.0	111.37	30.07	636.41
125.0	105.00	36.44	672.85
140.0	50.00	21.60	694.45

Pipe-wise Cost Summary

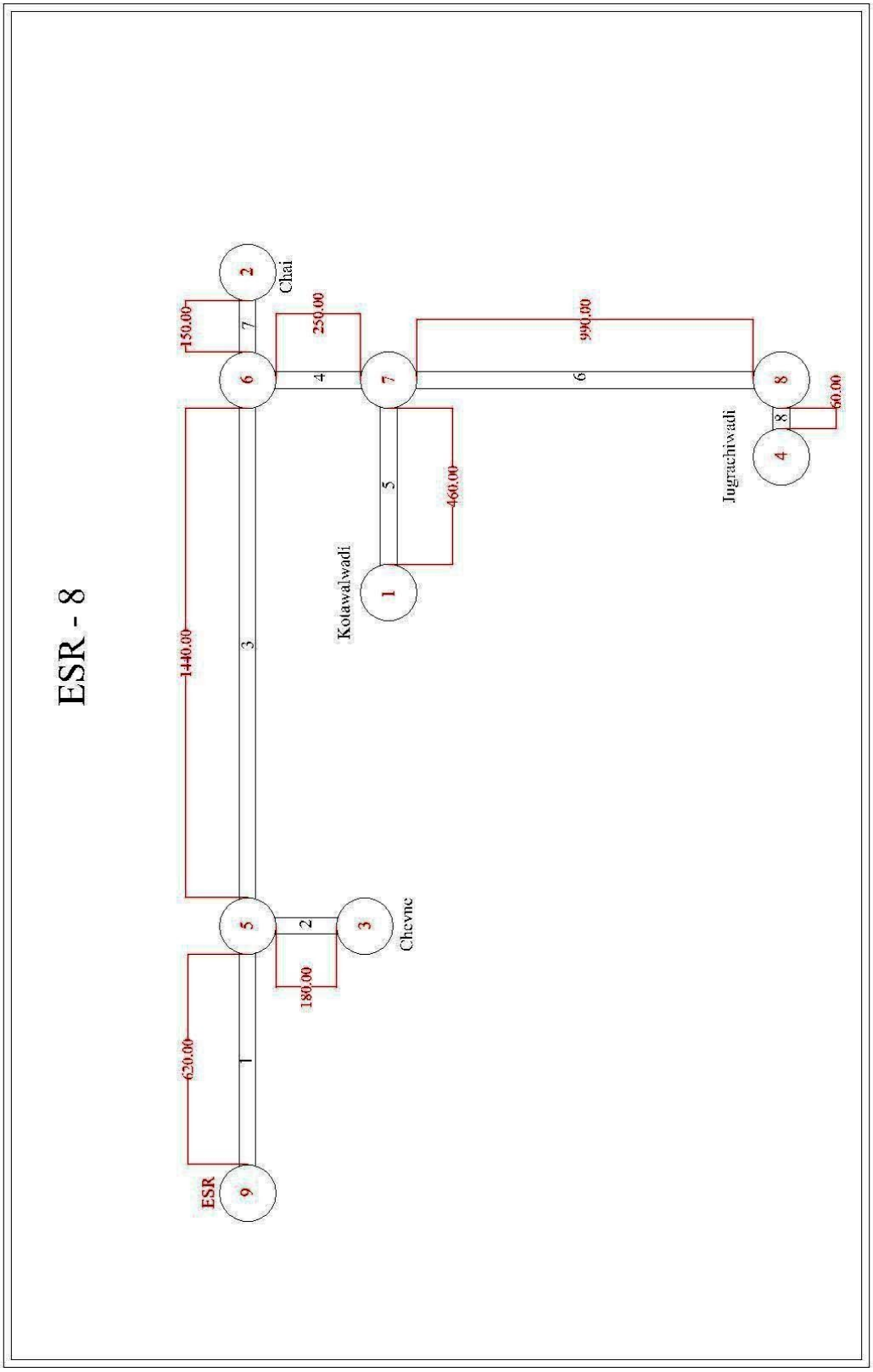
Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	140.0	50.00	21.60	21.60
2	63.0	150.00	14.70	36.30
3	63.0	595.65	58.37	94.67
	75.0	54.35	7.50	102.17
4	125.0	105.00	36.44	138.61
5	90.0	1838.63	347.50	486.11

	110.0	111.37	30.07	516.18
6	63.0	516.02	50.57	566.75
	75.0	58.98	8.14	574.89
7	63.0	210.00	20.58	595.47
8	63.0	1010.00	98.98	694.45

ESR 8 – Chai

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Chevne	87	542	660	795
2	Chai	105	902	1394	2173
3	Kotwalwadi	102	480	600	800
4	Zugarachiwadi	112	785	911	1047
	Total		2709	3565	4815

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Chevne	0.026	0.038	1.204	1.767
2	Chai	0.043	0.104	2.004	4.829
3	Kotwalwadi	0.023	0.038	1.067	1.778
4	Zugarachiwadi	0.038	0.050	1.744	2.327
Total		0.130	0.231	6.020	10.700


ESR - 8
ESR
Chai
Kolawalwadi
Jugrachiwadi
Chevne
150.00
250.00
990.00
60.00
460.00
1440.00
180.00
620.00
1
2
3
4
5
6
7
8
9

Zugarachiwadi
kotwalwadi
Chai
Chevane
ChaiESR
© 2010 Google
Image © 2010 GeoEye
19°07'15.39" N 73°28'30.03" E elev 90 m
Imagery Date: Apr 11, 2009
©2009 Google
Eye alt 4.42 km

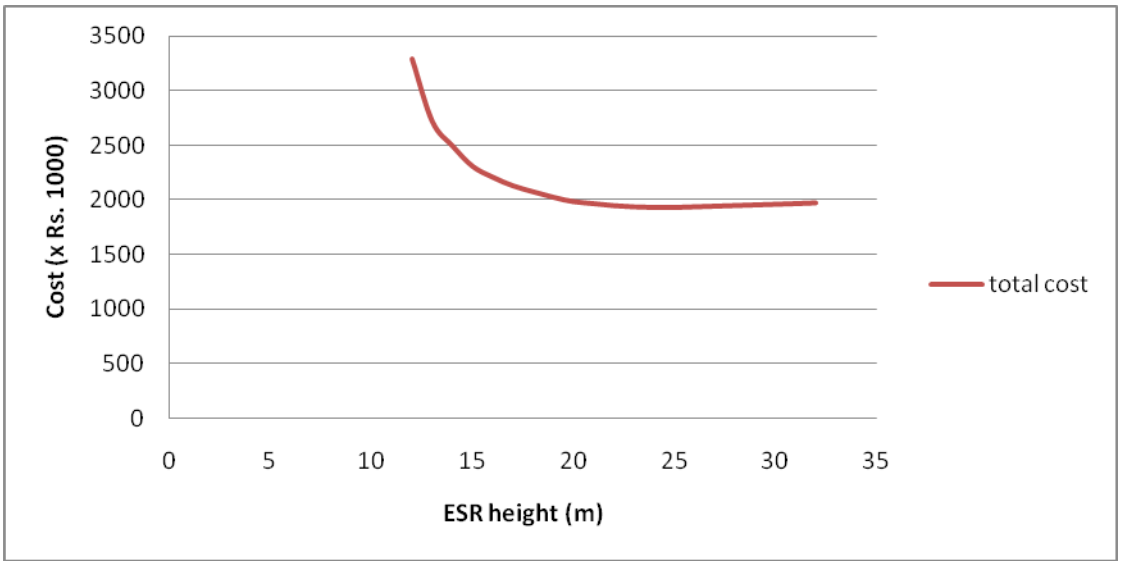
ESR 8 - Chai

ESR 8 – Staging Height Optimization

Total Demand	231120
ESR capacity Required	86670
ESR capacity Proposed	87000
Low level Height	121
ESR elevation	109

HGL	PIPE cost	ESR cost	Total	Height of ESR
128	1282.53	737.3867	2019.917	19
129	1223.31	756.294	1979.604	20
130	1179.89	781.5038	1961.394	21
131	1136.48	806.7136	1943.194	22
132	1099.83	831.9234	1931.753	23
133	**1068.74**	**857.1332**	**1925.873**	**24**
134	1043.79	882.343	1926.133	25
135	1024.47	907.5528	1932.023	26

ESR capacity	87000
Optimum ESR height	24
ERS cost	857.13
Pipe cost	1068.74
Total	1926



ESR 8 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    : ESR 8(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  8
 Number of Nodes                         :  9
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m         mm       Const    (E/P)
------------------------------------------------------------
    1     9     5      620.00
    2     5     3      180.00
    3     5     6     1440.00
    4     6     7      250.00
    5     7     1      460.00
    6     7     8      990.00
    7     6     2      150.00
    8     8     4       60.00
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	-1.778	102.00	8.00	
2	1.00	-4.829	105.00	8.00	
3	1.00	-1.767	87.00	8.00	
4	1.00	-2.327	112.00	8.00	
5	1.00	0.000	89.00	8.00	
6	1.00	0.000	89.00	8.00	
7	1.00	0.000	87.00	8.00	
8	1.00	0.000	112.00	8.00	
9	1.00	0.000	109.00	8.00	

Reference Node Data

Node No.	Grade Line m
9	133.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00

```
   400.0   140.00000     3147.00
   500.0   140.00000     4000.00
====================================


 Branched Water Distribution Network Design OutPut
--------------------------------------------------
  Pipe Details
--------------

=============================================================================
==
 Pipe From  To   Peak Flow   Diam   Hazen's     HL    HL/1000  Length
Status
  No. Node Node    (lps)     (mm)    Const     (m )     (m )    (m )
(E/P)
-----------------------------------------------------------------------------
--
   1    9    5      10.701   125.0 140.00000    3.65     6.44    566.58
                             140.0 140.00000    0.20     3.74     53.42
   2    5    3       1.767    63.0 140.00000    1.17     6.50    180.00



Pipe Details  cont`d
---------------------

=============================================================================
==
 Pipe From  To   Peak Flow   Diam   Hazen's     HL    HL/1000  Length
Status
  No. Node Node    (lps)     (mm)    Const     (m )     (m )    (m )
(E/P)
-----------------------------------------------------------------------------
--
   3    5    6       8.934   125.0 140.00000    6.65     4.62   1440.00
   4    6    7       4.105   110.0 140.00000    0.51     2.04    250.00
   5    7    1       1.778    63.0 140.00000    3.01     6.54    460.00
   6    7    8       2.327    90.0 140.00000    1.88     1.90    990.00
   7    6    2       4.829    75.0 140.00000    2.67    17.80    150.00
   8    8    4       2.327    90.0 140.00000    0.11     1.83     60.00
=============================================================================
==


 Node Details
--------------

=============================================================================
===
 Node    Peak Flow    Elevation    H G L    Cal Pres     Spc Pres   Meet
Res
```

No.	(lps)	(m)	(m)	(m)	(m)	Pres. (Y)
1 T	-1.778	102.00	118.98	16.98	8.00	
2 T	-4.829	105.00	119.83	14.83	8.00	
3 T	-1.767	87.00	127.98	40.98	8.00	
4 T	-2.327	112.00	120.00	8.00	8.00	
5	0.000	89.00	129.15	40.15	8.00	
6	0.000	89.00	122.50	33.50	8.00	
7	0.000	87.00	121.99	34.99	8.00	
8	0.000	112.00	120.11	8.11	8.00	
9 S	10.701	109.00	133.00	24.00	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	640.00	62.72	62.72
75.0	150.00	20.70	83.42
90.0	1050.00	198.45	281.87
110.0	250.00	67.50	349.37
125.0	2006.58	696.28	1045.65
140.0	53.42	23.08	1068.73

Pipe-wise Cost Summary

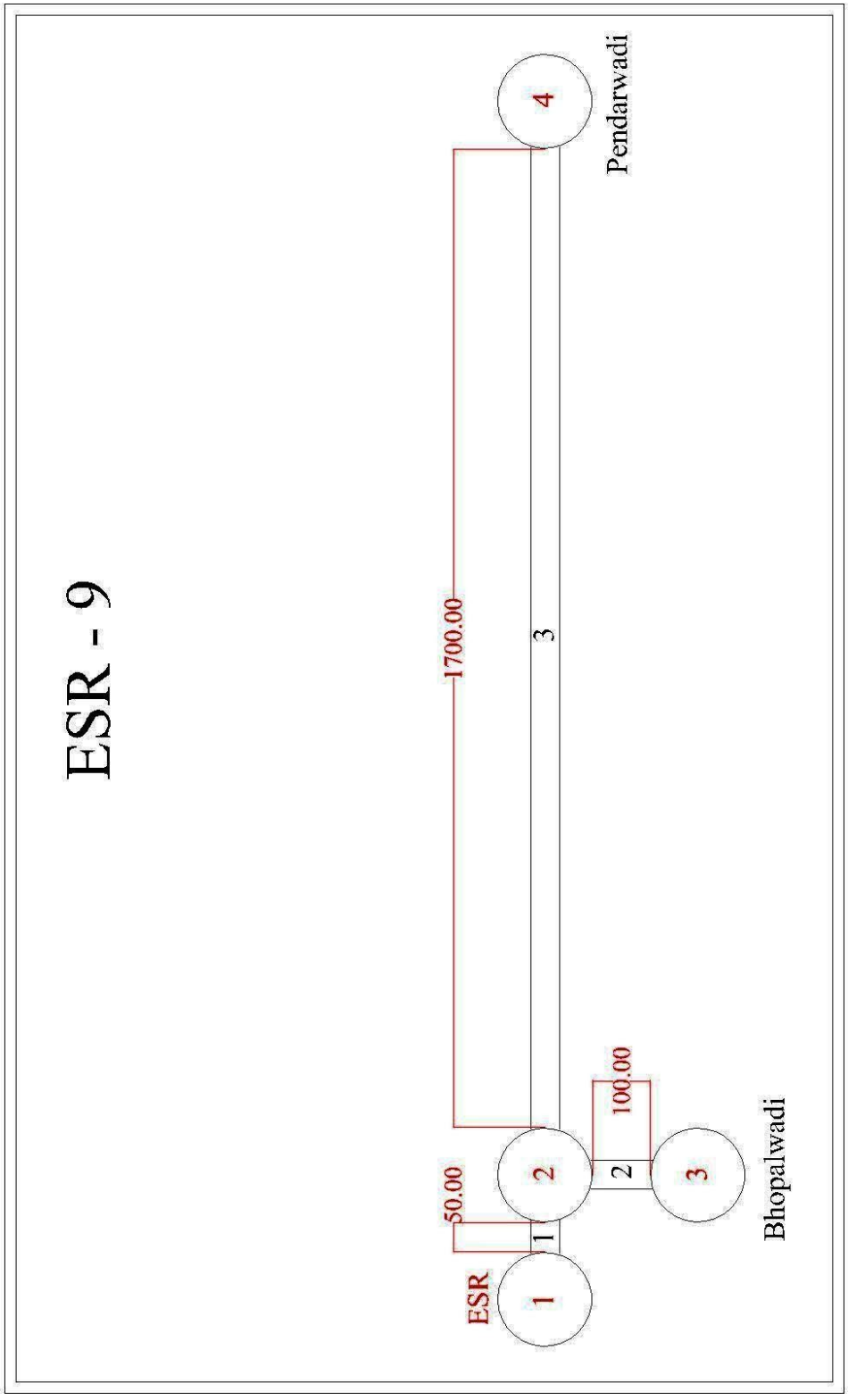
Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	125.0	566.58	196.60	196.60
	140.0	53.42	23.08	219.68
2	63.0	180.00	17.64	237.32
3	125.0	1440.00	499.68	737.00
4	110.0	250.00	67.50	804.50
5	63.0	460.00	45.08	849.58
6	90.0	990.00	187.11	1036.69
7	75.0	150.00	20.70	1057.39
8	90.0	60.00	11.34	1068.73

ESR 9 – Bhopalwadi

S.No.	Village	Elevation		Population	
			2011	2026	2041
1	Bhopalwadi	96	480	600	800
2	Pendarawadi	71	480	600	800
	Total		960	1200	1600

Daily Water Demand at 40 lpcd

S.No.	Village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Bhopalwadi	0.023	0.038	1.067	1.778
2	Pendarawadi	0.023	0.038	1.067	1.778
	Total	0.046	0.077	2.133	3.556


ESR - 9
ESR
1
50.00
1
2
1700.00
3
4
Pendarwadi
2
100.00
3
Bhopalwadi

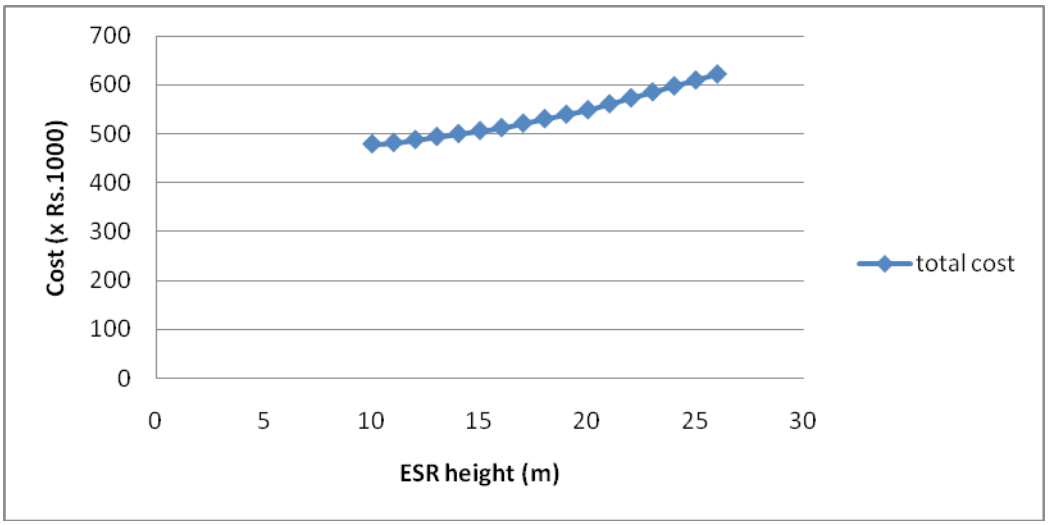
ESR 9 -
Bhopalwadi

ESR 9 – Staging Height Optimization

	76800
ESR capacity Required	28800
ESR capacity Proposed	29000
Low level Height	10
ESR elevation	95

HGL	PIPE cost	ESR cost	Total	height
105	**184.67**	**293.9328**	**478.6028**	**10**
106	181.3	300.0564	481.3564	11
107	181.3	306.18	487.48	12
108	181.3	312.3036	493.6036	13
109	181.3	318.4272	499.7272	14
110	181.3	324.5508	505.8508	15
111	181.3	330.6744	511.9744	16
112	181.3	339.8598	521.1598	17
113	181.3	349.0452	530.3452	18
114	181.3	358.2306	539.5306	19

ESR capacity	144000
Optimum ESR height	10
ERS cost	293.93
Pipe cost	184.67
Total	479
/person	299.12675



ESR 9 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 9(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  3
 Number of Nodes                         :  4
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter  Hazen's   Status
  No.   Node   Node        m          mm       Const    (E/P)
------------------------------------------------------------
    1      1      2       50.00
    2      2      3      100.00
    3      2      4     1700.00
============================================================


 Node Data
-----------

============================================================
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	95.00	8.00	
2	1.00	0.000	94.90	8.00	
3	1.00	-1.778	96.00	8.00	
4	1.00	-1.778	71.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	105.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	3.556	75.0	140.00000	0.23	9.99	23.02	
				90.0	140.00000	0.11	4.08	26.98	
2	2	3	1.778	63.0	140.00000	0.66	6.60	100.00	
3	2	4	1.778	63.0	140.00000	11.14	6.55	1700.00	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1	S	3.556	95.00	105.00	10.00	8.00	
2		0.000	94.90	104.66	9.76	8.00	
3	T	-1.778	96.00	104.00	8.00	8.00	
4	T	-1.778	71.00	93.52	22.52	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)

```
    63.0     1800.00        176.40        176.40
    75.0       23.02          3.18        179.58
    90.0       26.98          5.10        184.68
==================================================


 Pipe-wise Cost Summary
------------------------

============================================================
 Pipe    Diameter      Length         Cost       Cum. Cost
  No       (mm)         (m )       (1000 Rs )     (1000 Rs )
------------------------------------------------------------
   1        75.0         23.02           3.18           3.18
            90.0         26.98           5.10           8.28
   2        63.0        100.00           9.80          18.08
   3        63.0       1700.00         166.60         184.68
```

ESR 10 – Bondshet

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Bondshet	62	480	600	800
	Total		480	600	800

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Bondshet	0.023	0.038	1.067	1.778
	Total	0.023	0.038	1.067	1.778

ESR 10 Design Details

Total Demand	38400
ESR capacity Required	14400
ESR capacity Proposed	15000
Low level Height	10
ESR elevation	62

HGL	ESR cost	Total	height
72	161.86	161.86	10

ESR capacity	15000
Optimum ESR height	10
ERS cost	161.86
Total	161.86
/person	202.325

ESR 10 Bondshet

ESR 11 – Borgaon

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Borgaon	65	1095	1305	1545
	Total		1095	1305	1545

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Borgaon	0.053	0.074	2.433	3.433
	Total	0.053	0.074	2.433	3.433

ESR 11 Design Details

Total Demand	74160
ESR capacity Required	27810
ESR capacity Proposed	28000
Low level Height	10
ESR elevation	65

HGL	ESR cost	Total	height
75	287.91	287.91	10

ESR capacity	15000
Optimum ESR height	10
ERS cost	287.91
Total	287.91
/person	186.349515

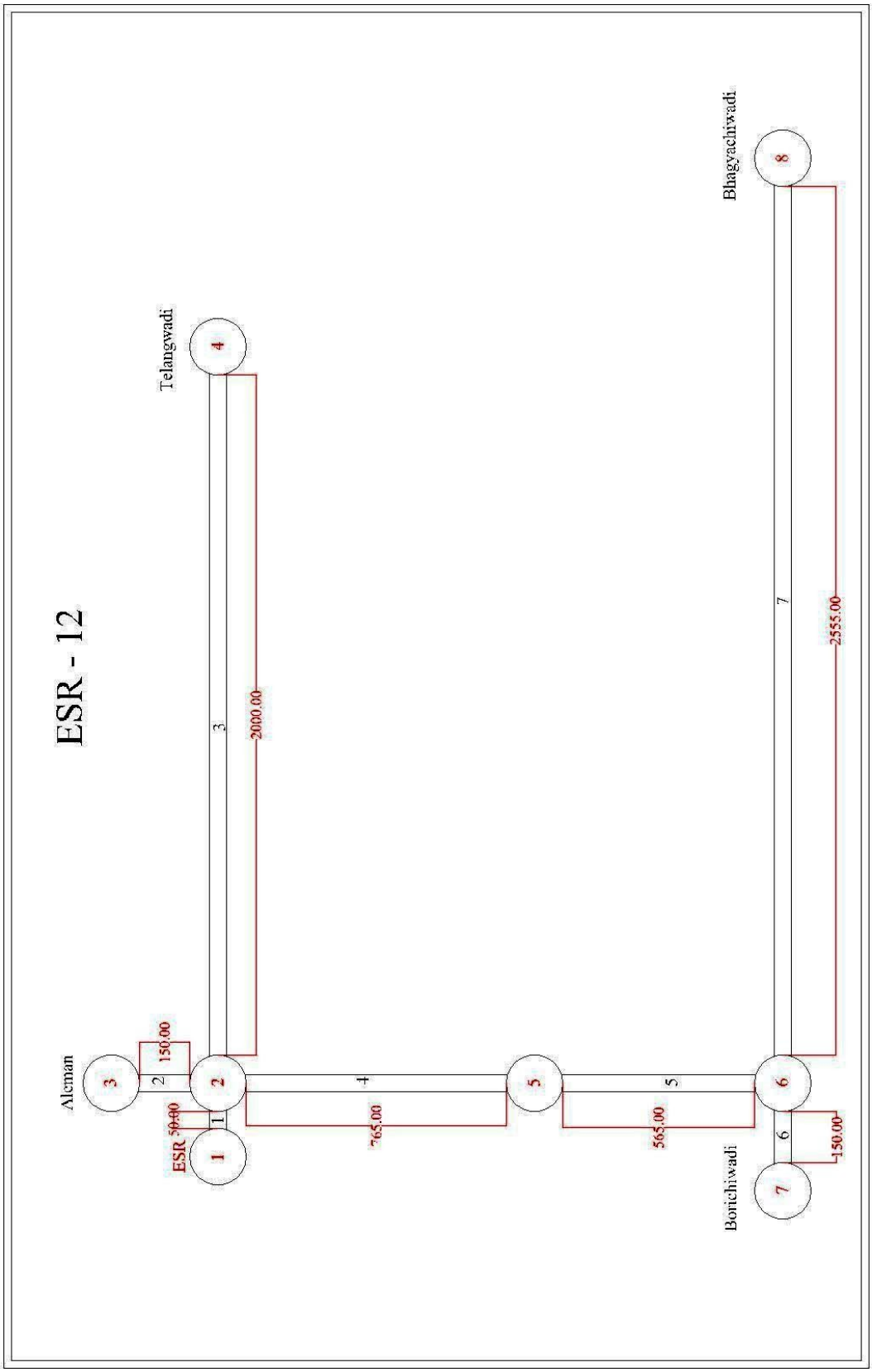
ESR 11 Borgaon



ESR 12 – Aleman

S.No.	village	Elevation	Population 2011	Population 2026	Population 2041
1	Aleman	162	1012	1274	1587
2	Telangwadi	132	480	600	800
3	Borichiwadi	161	480	600	800
4	Bhagyachiwadi	128	480	600	800
	Total		2452	3074	3987

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD) 2011	Demand(MLD) 2041	Demand(LPS) 2011	Demand(LPS) 2041
1	Aleman	0.049	0.076	2.250	3.526
2	Telangwadi	0.023	0.038	1.067	1.778
3	Borichiwadi	0.023	0.038	1.067	1.778
4	Bhagyachiwadi	0.023	0.038	1.067	1.778
	Total	0.118	0.191	5.450	8.859


ESR - 12
Telangwadi
Bhagyachiwadi
Aleman
Borichiwadi
ESR
150.00
765.00
565.00
2000.00
2555.00
150.00
1
2
3
4
5
6
7
8

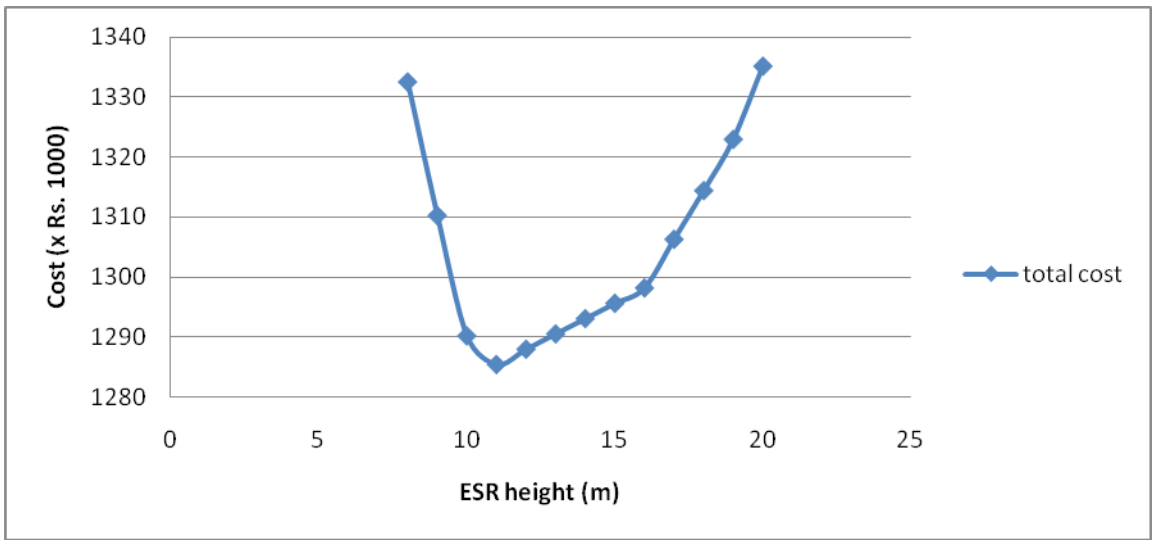
ESR 12 -
Aleman

ESR 12 – Staging Height Optimization

Total Demand	191355
ESR capacity Required	71758
ESR capacity Proposed	72000
Low level Height	173
ESR elevation	165

HGL	PIPE cost	ESR cost	Total	height
173	820.62	511.8834	1332.503	8
174	787.23	523.0113	1310.241	9
175	756.03	534.1392	1290.169	10
176	**740.12**	**545.2671**	**1285.387**	**11**
177	731.55	556.395	1287.945	12
178	722.98	567.5229	1290.503	13
179	714.39	578.6508	1293.041	14
180	705.82	589.7787	1295.599	15
181	697.25	600.9066	1298.157	16
182	688.66	617.5985	1306.258	17

Optimum ESR height	11
ERS cost	545.27
Pipe cost	740.12
Total	1285.39
/person	322



ESR 12 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 12(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  7
 Number of Nodes                         :  8
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m          mm       Const    (E/P)
------------------------------------------------------------
    1     1     2       50.00
    2     2     3      150.00
    3     2     4     2000.00
    4     2     5      765.00
    5     5     6      565.00
    6     6     7      150.00
    7     6     8     2555.00
============================================================
```

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	165.00	8.00	
2	1.00	0.000	164.90	8.00	
3	1.00	-3.526	162.00	8.00	
4	1.00	-1.778	132.00	8.00	
5	1.00	0.000	160.00	8.00	
6	1.00	0.000	161.00	8.00	
7	1.00	-1.778	161.00	8.00	
8	1.00	-1.778	128.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	176.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

==========

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	8.860	110.0	140.00000	0.42	8.40	50.00	
2	2	3	3.526	63.0	140.00000	3.49	23.27	150.00	
3	2	4	1.778	63.0	140.00000	13.10	6.55	2000.00	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
4	2	5	3.556	75.0	140.00000	0.11	10.34	10.64	
				90.0	140.00000	3.14	4.16	754.36	
5	5	6	3.556	90.0	140.00000	2.35	4.16	565.00	
6	6	7	1.778	63.0	140.00000	0.98	6.53	150.00	
7	6	8	1.778	63.0	140.00000	16.74	6.55	2555.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)

1	S	8.860	165.00	176.00	11.00	8.00
2		0.000	164.90	175.58	10.68	8.00
3	T	-3.526	162.00	172.09	10.09	8.00
4	T	-1.778	132.00	162.47	30.47	8.00
5		0.000	160.00	172.33	12.33	8.00
6		0.000	161.00	169.98	8.98	8.00
7	T	-1.778	161.00	169.00	8.00	8.00
8	T	-1.778	128.00	153.24	25.24	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	4855.00	475.79	475.79
75.0	10.64	1.47	477.26
90.0	1319.36	249.36	726.62
110.0	50.00	13.50	740.12

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)

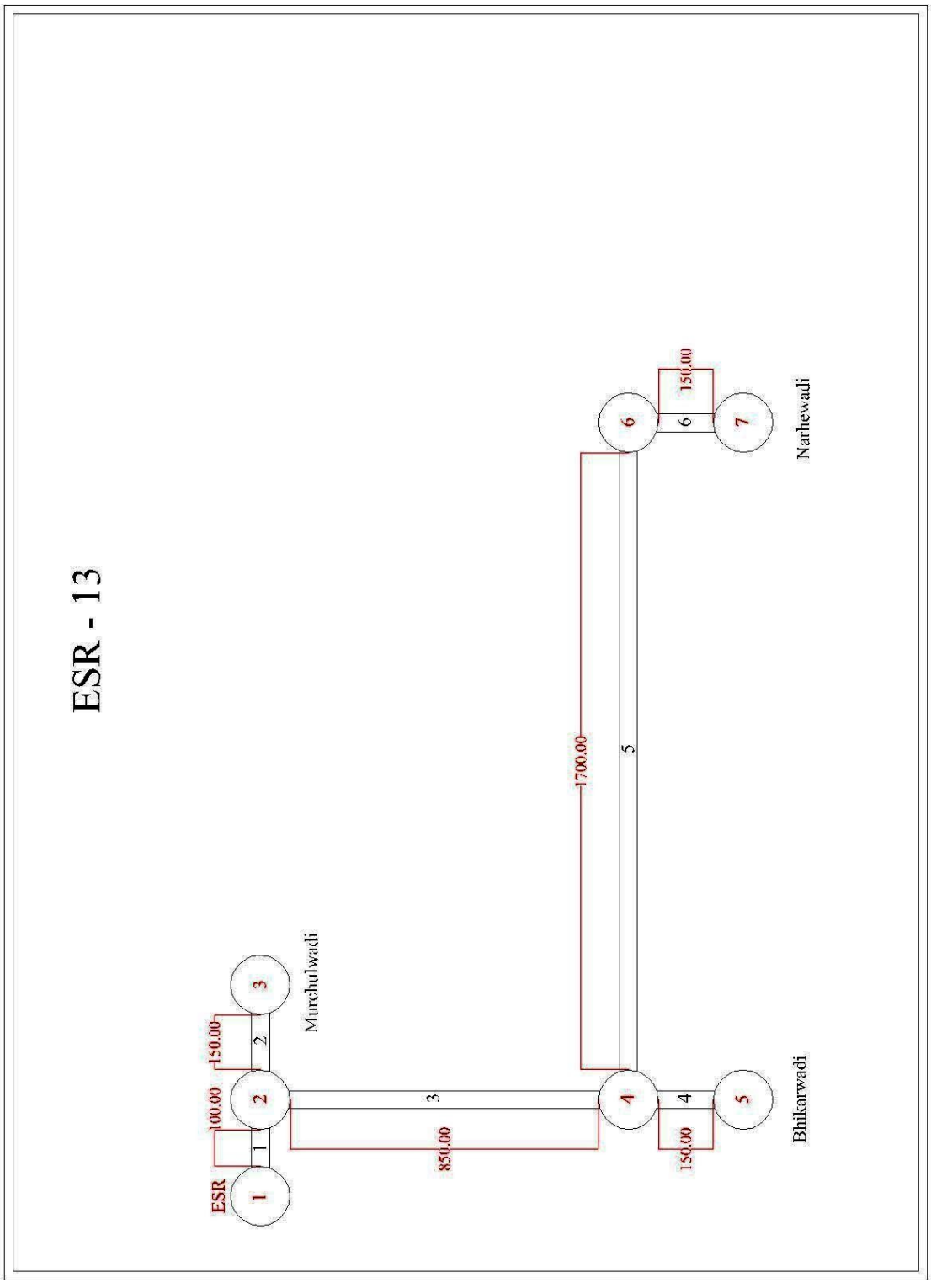
1	110.0	50.00	13.50	13.50
2	63.0	150.00	14.70	28.20
3	63.0	2000.00	196.00	224.20
4	75.0	10.64	1.47	225.67
	90.0	754.36	142.57	368.24
5	90.0	565.00	106.79	475.03
6	63.0	150.00	14.70	489.73
7	63.0	2555.00	250.39	740.12

ESR 13 – Murchulwadi

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Murchulwadi	153	480	600	800
2	Bhikarwadi	136	480	600	800
3	Narthewadi	119	480	600	800

	Total		1440	1800	2400

Daily Water Demand at 40 lpcd					
		Demand(MLD)		Demand(LPS)	
S.No.	village	2011	2041	2011	2041
1	Murchulwadi	0.115	0.192	5.333	8.889
2	Bhikarwadi	0.115	0.192	5.333	8.889
3	Narthewadi	0.115	0.192	5.333	8.889
	Total	0.346	0.576	16.000	26.667


ESR - 13
ESR
1
100.00
1
2
150.00
2
3
Murchulwadi
3
850.00
4
1700.00
5
4
150.00
5
Bhikarwadi
6
6
150.00
7
Narhewadi

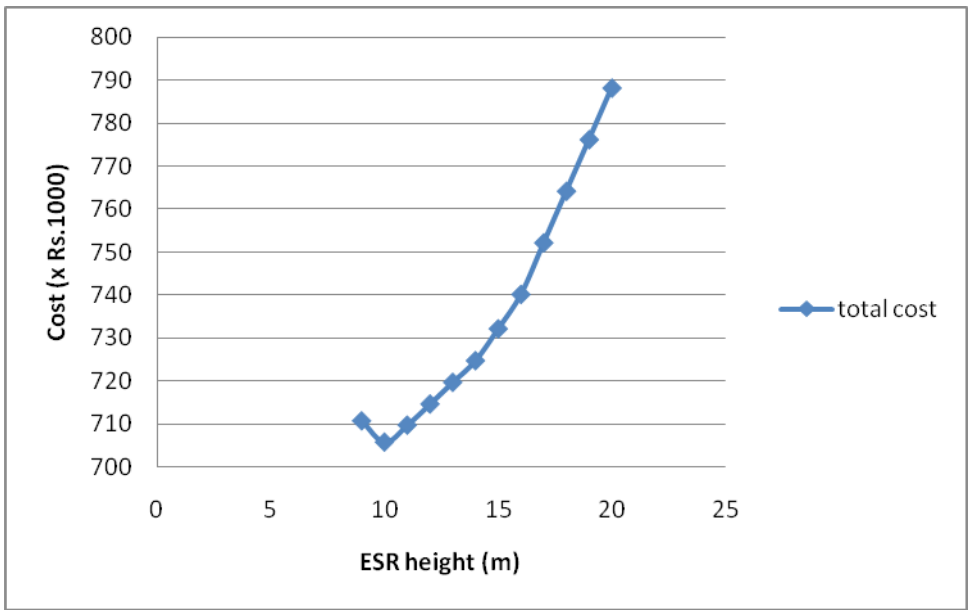
ESR 13 - Murchulwadi

ESR 13 – Staging Height Optimization

Total Demand	115200
ESR capacity Required	43200
ESR capacity Proposed	44000
Low level Height	162
ESR elevation	153

HGL	PIPE cost	ESR cost	Total	height
162	334.411	376.3572	710.7682	9
163	**321.46**	**384.3648**	**705.8248**	**10**
164	317.4	392.3724	709.7724	11
165	314.31	400.38	714.69	12
166	311.35	408.3876	719.7376	13
167	308.39	416.3952	724.7852	14
168	307.8	424.4028	732.2028	15
169	307.8	432.4104	740.2104	16
170	307.8	444.4218	752.2218	17

Optimum ESR height	10
ERS cost	384.36
Pipe cost	321.46
Total	705.82
/person	294



ESR 13 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 13(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  6
 Number of Nodes                         :  7
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To     Length    Diameter  Hazen's   Status
  No.  Node  Node       m         mm       Const    (E/P)
------------------------------------------------------------
    1     1     2      100.00
    2     2     3      150.00
    3     2     4      850.00
    4     4     5      150.00
    5     4     6     1700.00
    6     6     7      150.00
============================================================
 Node Data
-----------
```

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	153.00	8.00	
2	1.00	0.000	152.90	8.00	
3	1.00	-1.778	153.00	8.00	
4	1.00	0.000	134.00	8.00	
5	1.00	-1.778	136.00	8.00	
6	1.00	0.000	119.00	8.00	
7	1.00	-1.778	119.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	163.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	5.334	75.0	140.00000	0.23	21.16	10.87	
				90.0	140.00000	0.78	8.75	89.13	
2	2	3	1.778	63.0	140.00000	0.98	6.53	150.00	
3	2	4	3.556	63.0	140.00000	14.70	23.62	622.35	
				75.0	140.00000	2.30	10.10	227.65	
4	4	5	1.778	63.0	140.00000	0.98	6.53	150.00	
5	4	6	1.778	63.0	140.00000	11.14	6.55	1700.00	
6	6	7	1.778	63.0	140.00000	0.98	6.53	150.00	

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)
1	S	5.334	153.00	163.00	10.00	8.00	
2		0.000	152.90	161.98	9.08	8.00	
3	T	-1.778	153.00	161.00	8.00	8.00	
4		0.000	134.00	144.98	10.98	8.00	
5	T	-1.778	136.00	144.00	8.00	8.00	
6		0.000	119.00	133.84	14.84	8.00	
7	T	-1.778	119.00	132.86	13.86	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	2772.35	271.69	271.69
75.0	238.52	32.92	304.61

```
    90.0       89.13         16.85        321.45
================================================

 Pipe-wise Cost Summary
------------------------

============================================================
 Pipe    Diameter      Length         Cost       Cum. Cost
  No       (mm)         (m )       (1000 Rs )     (1000 Rs )
------------------------------------------------------------
   1        75.0         10.87          1.50          1.50
            90.0         89.13         16.85         18.35
   2        63.0        150.00         14.70         33.05
   3        63.0        622.35         60.99         94.04
            75.0        227.65         31.42        125.45
   4        63.0        150.00         14.70        140.15
   5        63.0       1700.00        166.60        306.75
   6        63.0        150.00         14.70        321.45
```

ESR 14 – Kalamb

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Kalamb	50	4691	5814	7140
	Total		4691	5814	7140

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Kalamb	0.225	0.343	10.425	15.867
	Total	0.225	0.343	10.425	15.867

ESR 14 Design Details

Total Demand	342721
ESR capacity Required	128520
ESR capacity Proposed	130000
Low level Height	14
ESR elevation	43

HGL	ESR cost	Total	height
57	837.5	837.5	14

ESR capacity	130000
Optimum ESR height	12
ERS cost	837.50
Total	837.50
/person	117.30

ESR 14 - Kalamb



ESR 15 – Salokh

S.No.	Village	Elevation	Population		
			2011	2026	2041
1	Salokh	47	1788	2165	2601
	Total		1788	2165	2601

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Salokh	0.086	0.125	3.973	5.780
	Total	0.086	0.125	3.973	5.780

ESR 15 Design Details

Total Demand	124848
ESR capacity Required	46818
ESR capacity Proposed	47000
Low level Height	10
ESR elevation	47

HGL	ESR cost	Total	height
57	419.22	419.22	10

ESR capacity	47000
Optimum ESR height	10
ERS cost	419.22
Total	419.22
/person	161.18

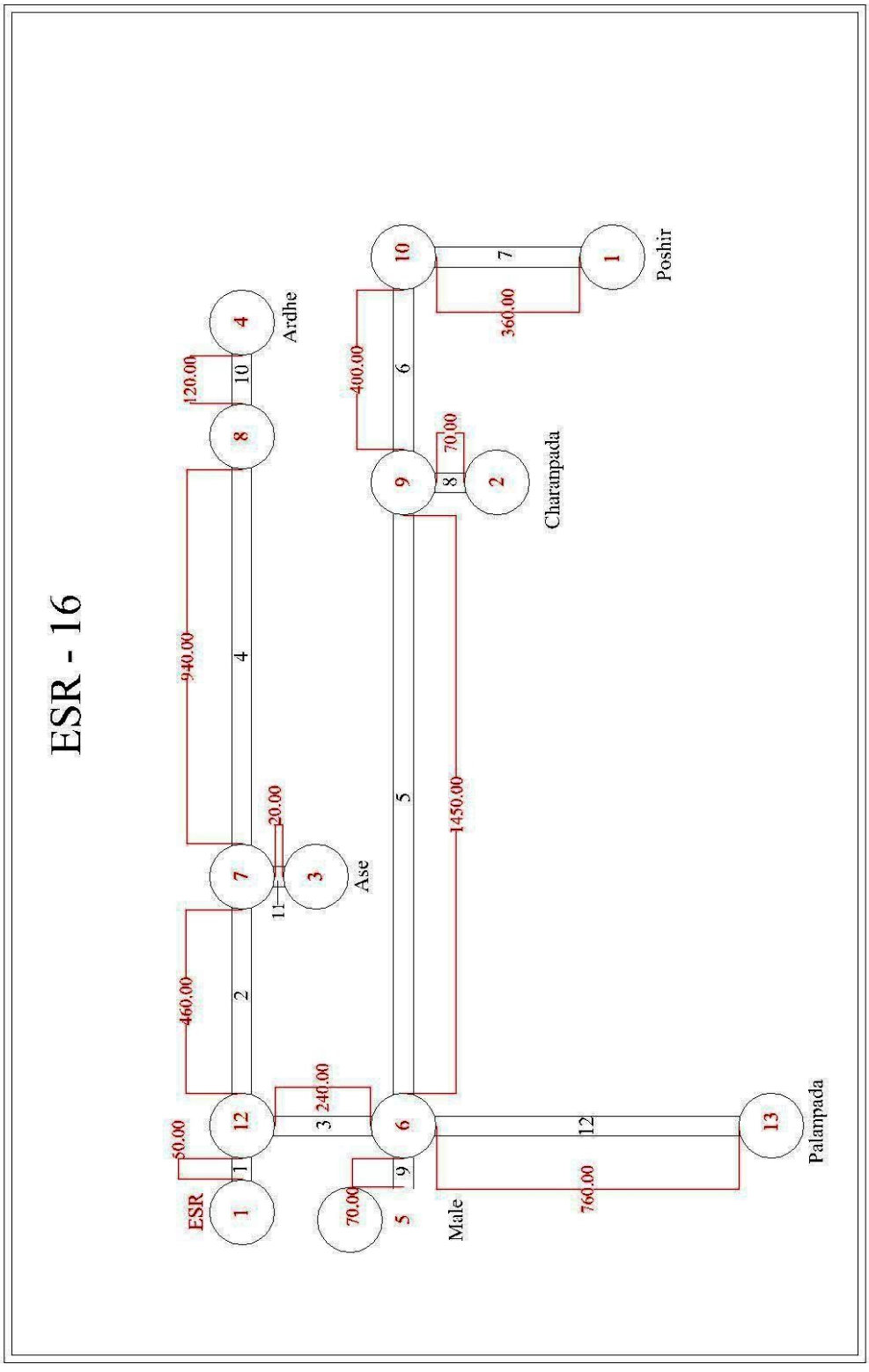
ESR 15 - Salokh



ESR 16 – Male

S.No.	Village	Elevation		Population	
			2011	2026	2041
1	Poshir	45	2624	2962	3332
2	Charnpada	40	480	600	800
3	Ase	43	215	303	427
4	Ardhe	59	854	1062	1308
5	Male	53	1573	1934	2370
6	Palanpada	48	480	600	800
	Total		6226	7461	9038

Daily Water Demand at 40 lpcd					
S.No.	Village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Poshir	0.126	0.160	5.830	7.405
2	Charnpada	0.023	0.038	1.067	1.778
3	Ase	0.010	0.021	0.478	0.950
4	Ardhe	0.041	0.063	1.898	2.906
5	Male	0.076	0.114	3.497	5.267
6	Palanpada	0.023	0.038	1.067	1.778
	Total	0.299	0.434	13.836	20.084


ESR - 16
ESR
Ardhe
Ase
Charanpada
Poshir
Male
Palampada
50.00
460.00
120.00
940.00
20.00
240.00
400.00
70.00
360.00
1450.00
70.00
760.00
1
2
3
4
5
6
7
8
9
10
11
12
13

ESR 16 - Male

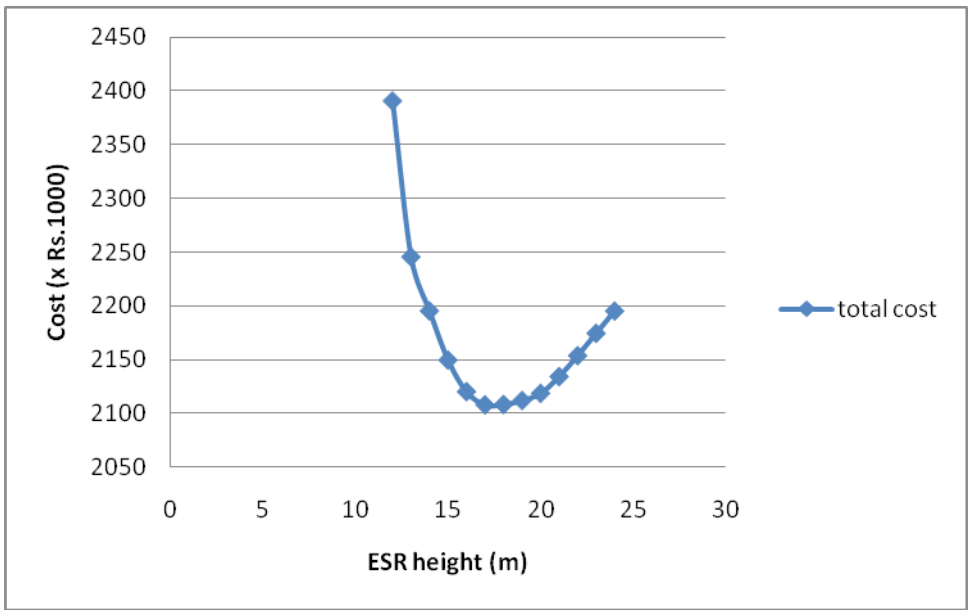


ESR 16 – Staging Height Optimization

Total Demand	433816
ESR capacity Required	162681
ESR capacity Proposed	165000
Low level Height	68
ESR elevation	56

HGL	PIPE cost	ESR cost	Total	height
72	1144.29	976.05	2120.34	16
73	**1104.99**	**1003.163**	**2108.153**	**17**
74	1078.12	1030.275	2108.395	18
75	1054.74	1057.388	2112.128	19
76	1034.26	1084.5	2118.76	20
77	1013.74	1120.65	2134.39	21
78	997.01	1156.8	2153.81	22

ESR capacity	165000
Optimum ESR height	17
ERS cost	1003
Pipe cost	1104.99
Total	2108
/person	233.26



ESR 16 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                    :ESR 16(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  12
 Number of Nodes                         :  13
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe  From   To      Length     Diameter  Hazen's   Status
  No.  Node  Node        m          mm       Const    (E/P)
------------------------------------------------------------
    1    11    12       50.00
    2    12     7      460.00
    3    12     6      240.00
    4     7     8      940.00
    5     6     9     1450.00
    6     9    10      400.00
    7    10     1      360.00
    8     9     2       70.00
    9     6     5       70.00
```

10	8	4	130.00
11	7	3	20.00
12	6	13	760.00

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	-7.405	45.00	8.00	
2	1.00	-1.778	40.00	8.00	
3	1.00	-0.950	43.00	8.00	
4	1.00	-2.906	59.00	8.00	
5	1.00	-5.267	53.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
6	1.00	0.000	45.00	8.00	
7	1.00	0.000	41.00	8.00	
8	1.00	0.000	43.00	8.00	
9	1.00	0.000	27.00	8.00	
10	1.00	0.000	35.00	8.00	
11	1.00	0.000	56.00	8.00	
12	1.00	0.000	55.90	8.00	
13	1.00	-1.778	48.00	8.00	

Reference Node Data

Node No.	Grade Line m
11	73.00

Commercial Diameter Data

Pipe Dia.	Hazen's	Unit Cost

Int. (mm)	Const	Rs /m	length
63.0	140.00000	98.00	
75.0	140.00000	138.00	
90.0	140.00000	189.00	
110.0	140.00000	270.00	
125.0	140.00000	347.00	
140.0	140.00000	432.00	
160.0	140.00000	556.00	
180.0	140.00000	695.00	
200.0	140.00000	789.00	
225.0	140.00000	1004.00	
250.0	140.00000	1228.00	
280.0	140.00000	1532.00	
315.0	140.00000	1932.00	
355.0	140.00000	2210.00	
400.0	140.00000	3147.00	
500.0	140.00000	4000.00	

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	11	12	20.084	160.0	140.00000	0.31	6.20	50.00	
2	12	7	3.856	90.0	140.00000	2.22	4.83	460.00	
3	12	6	16.228	125.0	140.00000	0.05	14.58	3.43	
				140.0	140.00000	1.90	8.03	236.57	
4	7	8	2.906	90.0	140.00000	2.69	2.86	940.00	
5	6	9	9.183	110.0	140.00000	13.12	9.05	1450.00	
6	9	10	7.405	110.0	140.00000	2.43	6.08	400.00	
7	10	1	7.405	110.0	140.00000	2.19	6.08	360.00	
8	9	2	1.778	63.0	140.00000	0.46	6.57	70.00	
9	6	5	5.267	75.0	140.00000	1.46	20.86	70.00	
10	8	4	2.906	75.0	140.00000	0.69	6.98	98.92	
				90.0	140.00000	0.09	2.90	31.08	
11	7	3	0.950	63.0	140.00000	0.04	2.00	20.00	
12	6	13	1.778	63.0	140.00000	4.98	6.55	760.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1 T	-7.405	45.00	53.00	8.00	8.00	
2 T	-1.778	40.00	57.16	17.16	8.00	
3 T	-0.950	43.00	70.43	27.43	8.00	
4 T	-2.906	59.00	67.00	8.00	8.00	
5 T	-5.267	53.00	69.28	16.28	8.00	
6	0.000	45.00	70.74	25.74	8.00	
7	0.000	41.00	70.47	29.47	8.00	
8	0.000	43.00	67.78	24.78	8.00	
9	0.000	27.00	57.62	30.62	8.00	
10	0.000	35.00	55.19	20.19	8.00	
11 S	20.084	56.00	73.00	17.00	8.00	
12	0.000	55.90	72.69	16.79	8.00	
13 T	-1.778	48.00	65.77	17.77	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	850.00	83.30	83.30
75.0	168.92	23.31	106.61
90.0	1431.08	270.47	377.08
110.0	2210.00	596.70	973.78
125.0	3.43	1.19	974.97
140.0	236.57	102.20	1077.17
160.0	50.00	27.80	1104.97

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)

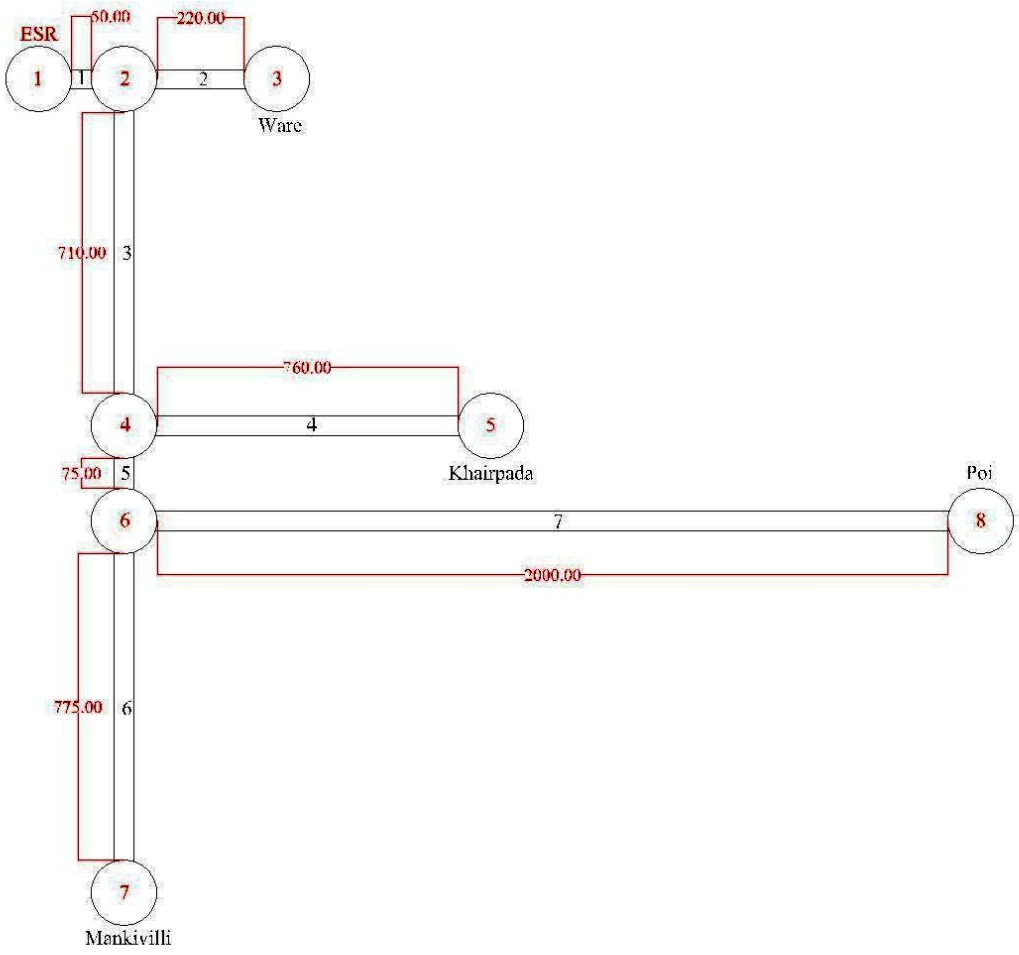
1	160.0	50.00	27.80	27.80
2	90.0	460.00	86.94	114.74
3	125.0	3.43	1.19	115.93
	140.0	236.57	102.20	218.13
4	90.0	940.00	177.66	395.79
5	110.0	1450.00	391.50	787.29
6	110.0	400.00	108.00	895.29
7	110.0	360.00	97.20	992.49
8	63.0	70.00	6.86	999.35
9	75.0	70.00	9.66	1009.01
10	75.0	98.92	13.65	1022.66
	90.0	31.08	5.87	1028.53
11	63.0	20.00	1.96	1030.49
12	63.0	760.00	74.48	1104.97

ESR 17 – Vara

S.No.	village	Elevation		Population	
			2011	2026	2041
1	ware	65	1755	2009	2286
2	khairpada	54	480	600	800
3	mankivili	56	480	600	800
4	poi	46	436	551	695
	Total		3151	3760	4581


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© 2009
Eye alt 4.48 km

ESR - 17

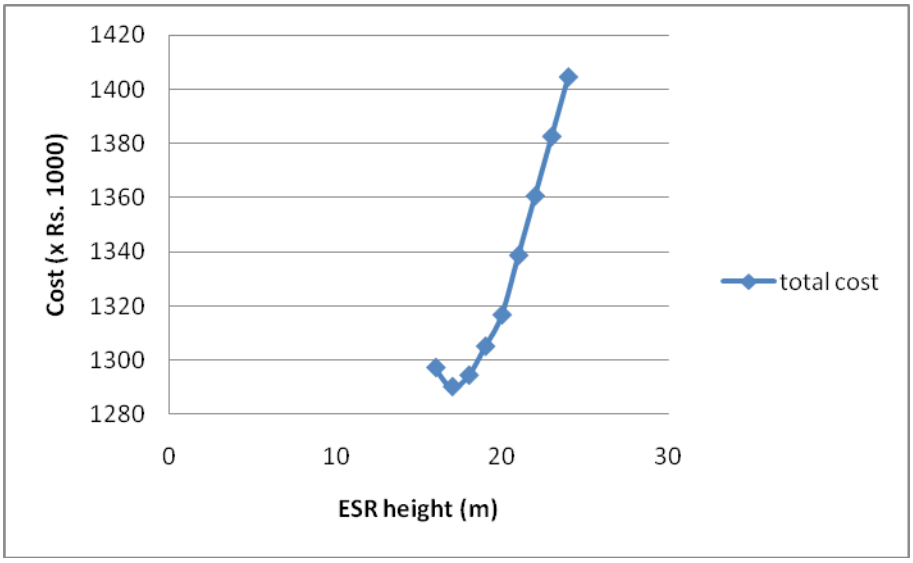

ESR
50.00
220.00
1
2
3
1
2
Ware
710.00
3
760.00
4
4
5
75.00
5
Khairpada
Poi
6
7
8
2000.00
775.00
6
7
Mankivilli

ESR 17 – Staging Height Optimization

Total Demand	219895
ESR capacity Required	82461
ESR capacity Proposed	83000
Low level Height	74
ESR elevation	58

HGL	PIPE cost	ESR cost	Total	height
74	585.83	711.315	1297.145	16
75	559.02	731.0738	1290.094	17
76	543.48	750.8325	1294.313	18
77	534.39	770.5913	1304.981	19
78	526.23	790.35	1316.58	20
79	521.83	816.695	1338.525	21
80	517.42	843.04	1360.46	22

ESR capacity	83000
Optimum ESR height	17
ERS cost	731
Pipe cost	559.02
Total	1290
/person	281.61



ESR 17 - BRANCH Input and Output

```
Echoing Input Variables
-----------------------

 Title of the Project                  :ESR 17(40 LPCD)
 Name of the User                      :
 Number of Pipes                       :  7
 Number of Nodes                       :  8
 Number of Commercial Diameters        :  16
 Peak Design Factor                    :  1
 Minimum Headloss in          m/km     :  .1
 Maximum Headloss in          m/km     :  25
 Minimum Residual Pressure    m        :  8
 Type of Formula                       : Hazen's


 Pipe Data
------------
```

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Status (E/P)
1	1	2	50.00			
2	2	3	220.00			
3	2	4	710.00			
4	4	5	760.00			
5	4	6	75.00			
6	6	7	775.00			
7	6	8	2000.00			

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	58.00	8.00	
2	1.00	0.000	57.90	8.00	
3	1.00	-5.081	65.00	8.00	
4	1.00	0.000	50.00	8.00	
5	1.00	-1.778	54.00	8.00	
6	1.00	0.000	51.00	8.00	
7	1.00	-1.778	56.00	8.00	
8	1.00	-1.544	46.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	75.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00

125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	10.181	125.0	140.00000	0.29	5.80	50.00	
2	2	3	5.081	90.0	140.00000	1.67	8.06	207.20	
				110.0	140.00000	0.04	3.13	12.80	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
3	2	4	5.100	90.0	140.00000	5.75	8.10	710.00	
4	4	5	1.778	63.0	140.00000	4.98	6.55	760.00	
5	4	6	3.322	90.0	140.00000	0.27	3.60	75.00	
6	6	7	1.778	63.0	140.00000	4.38	6.55	668.43	
				75.0	140.00000	0.30	2.82	106.57	
7	6	8	1.544	63.0	140.00000	10.09	5.05	2000.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1 S	10.181	58.00	75.00	17.00	8.00	
2	0.000	57.90	74.71	16.81	8.00	
3 T	-5.081	65.00	73.00	8.00	8.00	
4	0.000	50.00	68.95	18.95	8.00	
5 T	-1.778	54.00	63.97	9.97	8.00	
6	0.000	51.00	68.68	17.68	8.00	
7 T	-1.778	56.00	64.00	8.00	8.00	
8 T	-1.544	46.00	58.59	12.59	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	3428.43	335.99	335.99
75.0	106.57	14.71	350.69
90.0	992.20	187.53	538.22
110.0	12.80	3.46	541.67
125.0	50.00	17.35	559.02

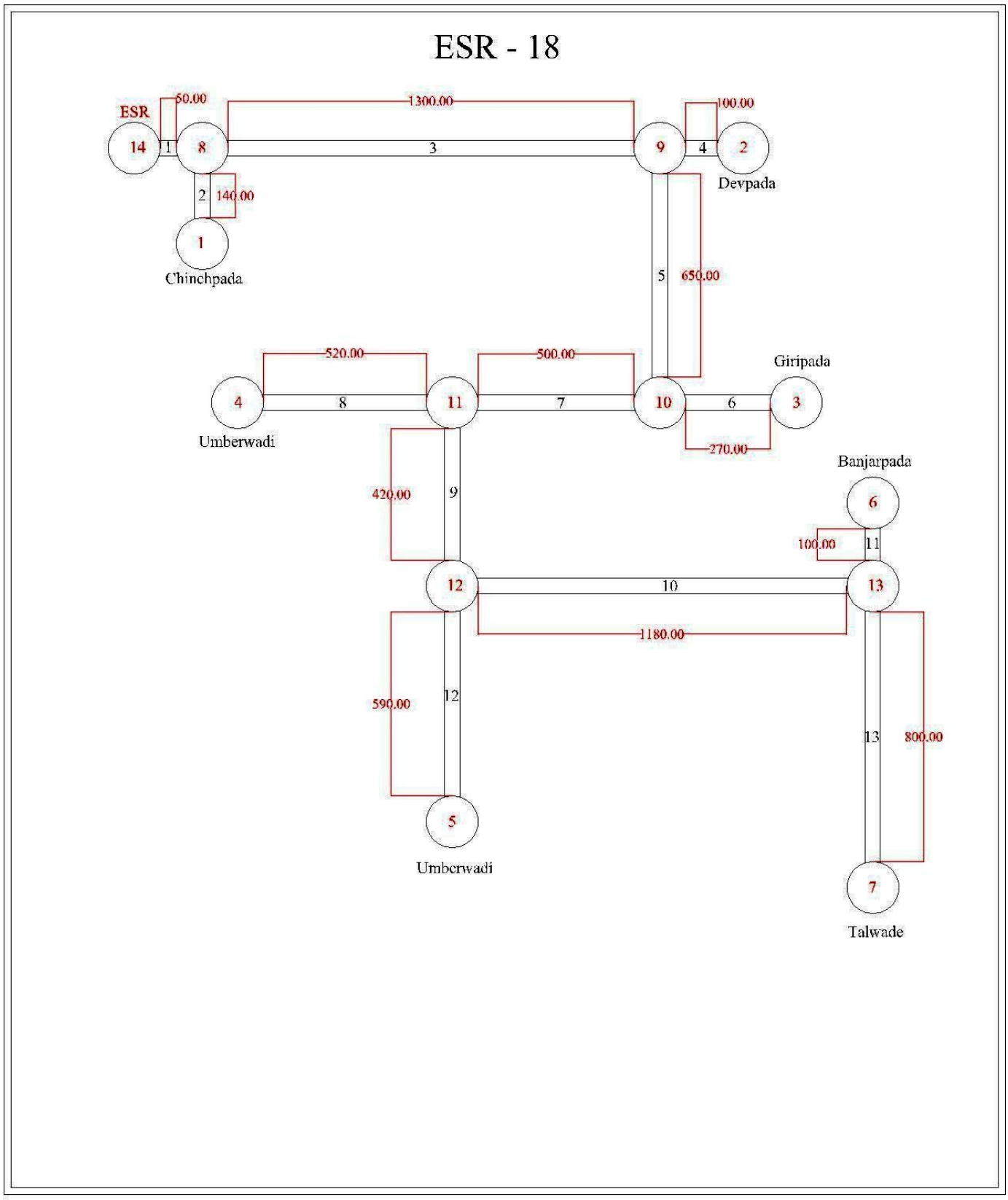
Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	125.0	50.00	17.35	17.35
2	90.0	207.20	39.16	56.51
	110.0	12.80	3.46	59.97
3	90.0	710.00	134.19	194.16
4	63.0	760.00	74.48	268.64
5	90.0	75.00	14.18	282.81
6	63.0	668.43	65.51	348.32
	75.0	106.57	14.71	363.02
7	63.0	2000.00	196.00	559.02

ESR 18 – Chinchpada

S.No.	village	Elevation	Population		
			2011	2026	2041
1	Chinchpada	128	480	600	800
2	Devpada	87	480	600	800
3	Giripada	118	480	600	800
4	Umberwadi2	105	480	600	800
5	Umberwadi1	103	480	600	800
6	Banjarpada	61	480	600	800
7	Talwade Budruk	57	480	600	800
	Total		3360	4200	5600

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Chinchpada				
2	Devpada				
3	Giripada				
4	Umberwadi2				
5	Umberwadi1				
6	Banjarpada				
7	Talwade Budruk				
	Total				


ESR - 18
ESR
50.00
1300.00
100.00
14
1
8
3
9
4
2
Devpada
2
140.00
1
Chinchpada
5
650.00
520.00
500.00
Giripada
4
8
11
7
10
6
3
270.00
Umberwadi
Banjarpada
420.00
9
6
100.00
11
12
10
13
1180.00
590.00
12
13
800.00
5
Umberwadi
7
Talwade

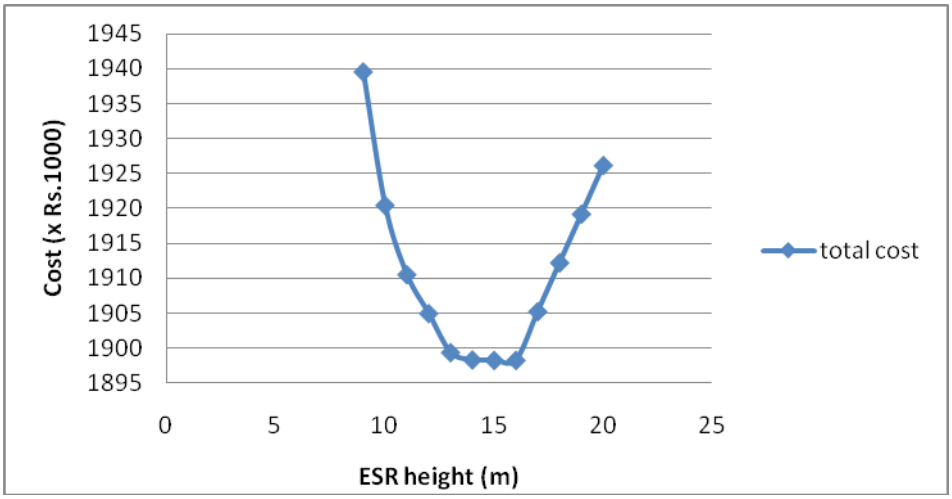
ESR 18 - Chinchpada

ESR 18 – Staging Height Optimization

Total Demand	268800
ESR capacity Required	100800
ESR capacity Proposed	101000
Low level Height	137
ESR elevation	128

HGL	PIPE cost	ESR cost	Total	height
139	1228.46	682.0359	1910.496	11
140	1208.97	695.955	1904.925	12
141	1189.48	709.8741	1899.354	13
142	1174.5	723.7932	1898.293	14
143	**1160.52**	**737.7123**	**1898.232**	**15**
144	1146.61	751.6314	1898.241	16
145	1132.7	772.5101	1905.21	17
146	1118.79	793.3887	1912.179	18

ESR capacity	101000
Optimum ESR height	15
ERS cost	738
Pipe cost	1160.52
Total	1898
/person	338.97



ESR 18 - BRANCH Input and Output

Echoing Input Variables

Title of the Project		:ESR 18(40 LPCD)
Name of the User		:
Number of Pipes		: 13
Number of Nodes		: 14
Number of Commercial Diameters		: 16
Peak Design Factor		: 1
Minimum Headloss in	m/km	: .1
Maximum Headloss in	m/km	: 25
Minimum Residual Pressure	m	: 8
Type of Formula		: Hazen's

Pipe Data

Pipe No.	From Node	To Node	Length m	Diameter mm	Hazen's Const	Status (E/P)
1	14	8	50.00			
2	8	1	140.00			
3	8	9	1300.00			
4	9	2	100.00			
5	9	10	650.00			
6	10	3	270.00			
7	10	11	500.00			
8	11	4	520.00			
9	11	12	420.00			

10	12	13	1180.00
11	13	6	100.00
12	12	5	590.00
13	13	7	800.00

Node Data

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	-1.778	128.00	8.00	
2	1.00	-1.778	87.00	8.00	
3	1.00	-1.778	118.00	8.00	
4	1.00	-1.778	105.00	8.00	

Node Data cont`d

Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
5	1.00	-1.778	103.00	8.00	
6	1.00	-1.778	61.00	8.00	
7	1.00	-1.778	57.00	8.00	
8	1.00	0.000	127.80	8.00	
9	1.00	0.000	74.00	8.00	
10	1.00	0.000	109.00	8.00	
11	1.00	0.000	103.00	8.00	
12	1.00	0.000	108.00	8.00	
13	1.00	0.000	61.00	8.00	
14	1.00	0.000	128.00	8.00	

Reference Node Data

Node No.	Grade Line m
14	143.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00

Commercial Diameter Data cont`d

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
400.0	140.00000	3147.00
500.0	140.00000	4000.00

Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	14	8	12.446	125.0	140.00000	0.43	8.60	50.00	
2	8	1	1.778	63.0	140.00000	0.92	6.57	140.00	
3	8	9	10.668	110.0	140.00000	2.01	11.93	168.42	
				125.0	140.00000	7.25	6.41	1131.58	
4	9	2	1.778	63.0	140.00000	0.66	6.60	100.00	
5	9	10	8.890	110.0	140.00000	5.54	8.52	650.00	

6	10	3	1.778	63.0	140.00000	1.77	6.56	270.00
7	10	11	7.112	90.0	140.00000	7.50	15.00	500.00
8	11	4	1.778	63.0	140.00000	3.41	6.56	520.00
9	11	12	5.334	75.0	140.00000	2.91	21.42	135.88
				90.0	140.00000	2.50	8.80	284.12
10	12	13	3.556	63.0	140.00000	27.87	23.62	1180.00
11	13	6	1.778	63.0	140.00000	0.66	6.60	100.00
12	12	5	1.778	63.0	140.00000	3.87	6.56	590.00
13	13	7	1.778	63.0	140.00000	5.24	6.55	800.00

Node Details

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
1	T	-1.778	128.00	141.66	13.66	8.00	
2	T	-1.778	87.00	132.65	45.65	8.00	
3	T	-1.778	118.00	126.00	8.00	8.00	

Node Details cont`d

Node No.		Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Res Pres. (Y)
4	T	-1.778	105.00	116.87	11.87	8.00	
5	T	-1.778	103.00	111.00	8.00	8.00	
6	T	-1.778	61.00	86.34	25.34	8.00	
7	T	-1.778	57.00	81.75	24.75	8.00	
8		0.000	127.80	142.57	14.77	8.00	
9		0.000	74.00	133.31	59.31	8.00	
10		0.000	109.00	127.77	18.77	8.00	
11		0.000	103.00	120.27	17.27	8.00	
12		0.000	108.00	114.87	6.87 *	8.00	
13		0.000	61.00	86.99	25.99	8.00	
14	S	12.446	128.00	143.00	15.00	8.00	

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	3700.00	362.60	362.60
75.0	135.88	18.75	381.35
90.0	784.12	148.20	529.55
110.0	818.42	220.97	750.52
125.0	1181.58	410.01	1160.53

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
1	125.0	50.00	17.35	17.35
2	63.0	140.00	13.72	31.07
3	110.0	168.42	45.47	76.54
	125.0	1131.58	392.66	469.20
4	63.0	100.00	9.80	479.00
5	110.0	650.00	175.50	654.50
6	63.0	270.00	26.46	680.96
7	90.0	500.00	94.50	775.46
8	63.0	520.00	50.96	826.42
9	75.0	135.88	18.75	845.17
	90.0	284.12	53.70	898.87
10	63.0	1180.00	115.64	1014.51

11	63.0	100.00	9.80	1024.31
12	63.0	590.00	57.82	1082.13
13	63.0	800.00	78.40	1160.53

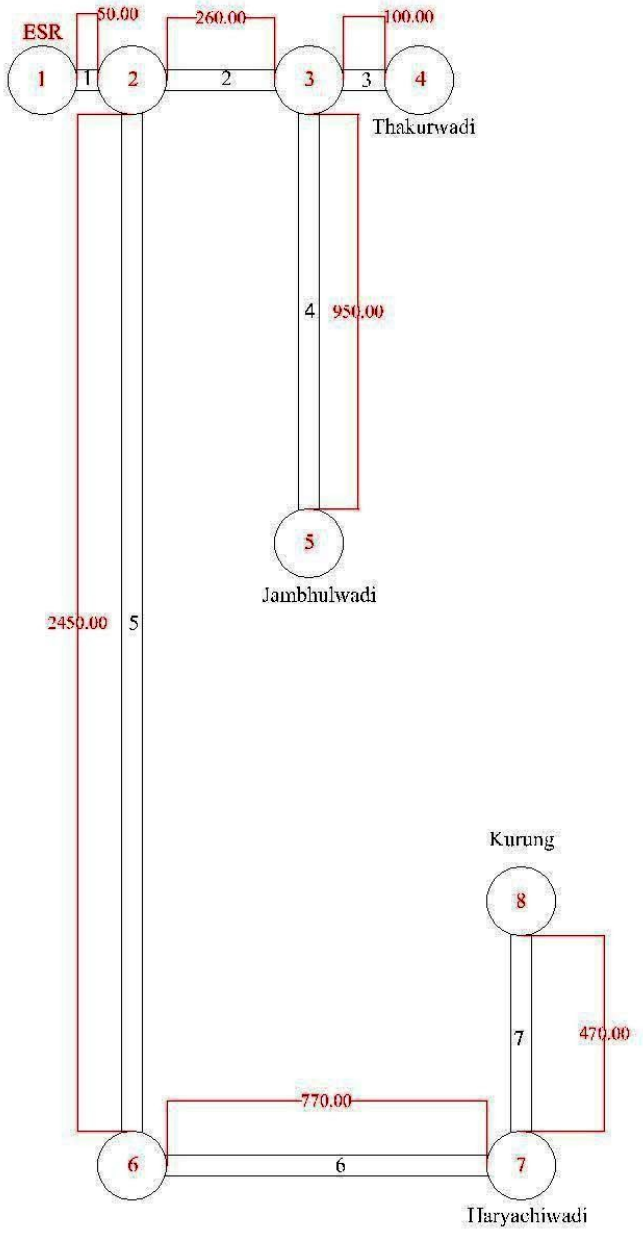
ESR 19 – Kurung

S.No.	village	Elevation		Population	
			2011	2026	2041
1	Thakurwadi	111	480	600	800
2	Jambhulwadi	106	480	600	800
3	Haryachiwadi	121	480	600	800
4	Kurung	96	650	765	899

	Total		2090	2565	3299

Daily Water Demand at 40 lpcd					
S.No.	village	Demand(MLD)		Demand(LPS)	
		2011	2041	2011	2041
1	Thakurwadi	0.023	0.038	1.067	1.778
2	Jambhulwadi	0.023	0.038	1.067	1.778
3	Haryachiwadi	0.023	0.038	1.067	1.778
4	Kurung	0.031	0.043	1.444	1.999
	Total	0.100	0.158	4.644	7.332

ESR - 19


ESR
50.00
260.00
100.00
1
2
3
4
1
2
3
Thakurwadi
4
950.00
5
Jambhulwadi
2450.00
5
Kurung
8
7
470.00
770.00
6
6
7
Haryachiwadi

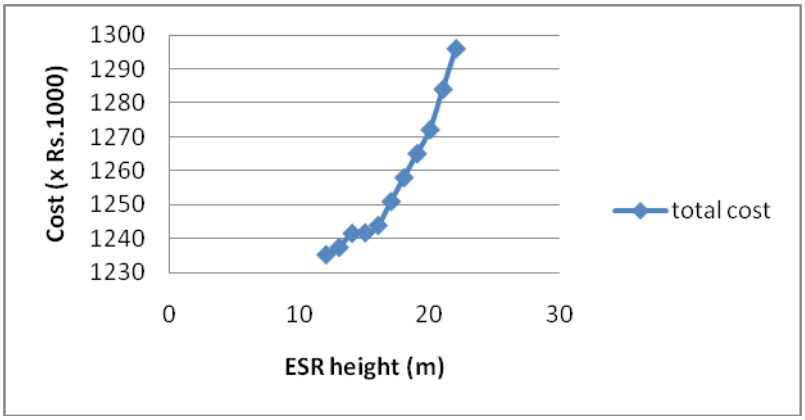
ESR 19 - Kurung

ESR 19 – Staging Height Optimization

Total Demand	158371
ESR capacity Required	59389
ESR capacity Proposed	60000
Low level Height	130
ESR elevation	118

HGL	PIPE cost	ESR cost	Total	height
130	**743.26**	**491.835**	**1235.095**	**12**
131	735.59	501.6717	1237.262	13
132	729.92	511.5084	1241.428	14
133	720.25	521.3451	1241.595	15
134	712.58	531.1818	1243.762	16
135	704.91	545.9369	1250.847	17
136	697.24	560.6919	1257.932	18
137	689.57	575.447	1265.017	19
138	681.9	590.202	1272.102	20
139	674.22	609.8754	1284.095	21
140	666.55	629.5488	1296.099	22

Optimum ESR height	12
ERS cost	491.84
Pipe cost	743.26
Total	1235.10
/person	374



ESR 19 - BRANCH Input and Output

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Echoing Input Variables
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 Title of the Project                    :ESR 19(40 LPCD)
 Name of the User                        :
 Number of Pipes                         :  7
 Number of Nodes                         :  8
 Number of Commercial Diameters          :  16
 Peak Design Factor                      :  1
 Minimum Headloss in          m/km       :  .1
 Maximum Headloss in          m/km       :  25
 Minimum Residual Pressure    m          :  8
 Type of Formula                         : Hazen's


 Pipe Data
------------

============================================================
 Pipe   From    To      Length     Diameter   Hazen's    Status
  No.   Node   Node        m          mm        Const     (E/P)
------------------------------------------------------------
    1      1      2        50.00
    2      2      3       260.00
    3      3      4       100.00
    4      3      5       950.00
    5      2      6      2450.00
    6      6      7       770.00
    7      7      8       470.00
============================================================


 Node Data
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Node No.	Peak Factor	Flow lps	Elevation m	Res. Press m	Meet Res. Pres (Y/N)?
1	1.00	0.000	118.00	8.00	
2	1.00	0.000	117.90	8.00	
3	1.00	0.000	111.00	8.00	
4	1.00	-1.778	111.00	8.00	
5	1.00	-1.778	106.00	8.00	
6	1.00	0.000	74.00	8.00	
7	1.00	-1.778	121.00	8.00	
8	1.00	-1.999	96.00	8.00	

Reference Node Data

Node No.	Grade Line m
1	130.00

Commercial Diameter Data

Pipe Dia. Int. (mm)	Hazen's Const	Unit Cost Rs /m length
63.0	140.00000	98.00
75.0	140.00000	138.00
90.0	140.00000	189.00
110.0	140.00000	270.00
125.0	140.00000	347.00
140.0	140.00000	432.00
160.0	140.00000	556.00
180.0	140.00000	695.00
200.0	140.00000	789.00
225.0	140.00000	1004.00
250.0	140.00000	1228.00
280.0	140.00000	1532.00
315.0	140.00000	1932.00
355.0	140.00000	2210.00
400.0	140.00000	3147.00
500.0	140.00000	4000.00

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Branched Water Distribution Network Design OutPut

Pipe Details

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
1	1	2	7.333	90.0	140.00000	0.79	15.80	50.00	
2	2	3	3.556	63.0	140.00000	6.14	23.62	260.00	
3	3	4	1.778	63.0	140.00000	0.66	6.60	100.00	

Pipe Details cont`d

Pipe No.	From Node	To Node	Peak Flow (lps)	Diam (mm)	Hazen's Const	HL (m)	HL/1000 (m)	Length (m)	Status (E/P)
4	3	5	1.778	63.0	140.00000	6.22	6.55	950.00	
5	2	6	3.777	75.0	140.00000	10.90	11.30	964.63	
				90.0	140.00000	6.91	4.65	1485.37	
6	6	7	3.777	90.0	140.00000	3.58	4.65	770.00	
7	7	8	1.999	63.0	140.00000	3.82	8.13	470.00	

Node Details

Node No.	Peak Flow (lps)	Elevation (m)	H G L (m)	Cal Pres (m)	Spc Pres (m)	Meet Pres. (Y)

1	S	7.333	118.00	130.00	12.00	8.00
2		0.000	117.90	129.21	11.31	8.00
3		0.000	111.00	123.07	12.07	8.00
4	T	-1.778	111.00	122.41	11.41	8.00
5	T	-1.778	106.00	116.84	10.84	8.00
6		0.000	74.00	111.40	37.40	8.00
7		-1.778	121.00	107.82	-13.18 *	8.00
8	T	-1.999	96.00	104.00	8.00	8.00

Cost Summary

Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)
63.0	1780.00	174.44	174.44
75.0	964.63	133.12	307.56
90.0	2305.37	435.72	743.27

Pipe-wise Cost Summary

Pipe No	Diameter (mm)	Length (m)	Cost (1000 Rs)	Cum. Cost (1000 Rs)

1	90.0	50.00	9.45	9.45
2	63.0	260.00	25.48	34.93
3	63.0	100.00	9.80	44.73
4	63.0	950.00	93.10	137.83
5	75.0	964.63	133.12	270.95
	90.0	1485.37	280.73	551.68
6	90.0	770.00	145.53	697.21
7	63.0	470.00	46.06	743.27

Appendix 8.4.1

ESR Construction Cost Details

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008	Rate (in Rs.) 2008-2009
1	2	3	4	5
1.	**XIX. RCC ESR** Designing (aesthetically), and constructing **RCC elevated service reservoirs** of following capacity with RCC staging consisting of columns, internal and external bracings spaced vertically not more than 4.5 meters centre to centre for ESR having Capacity upto 500 Cum. and not more than 6 m c/c for ESRs having capacity above 500 cum including excavation in all types of strata, foundation concrete, cement plaster with water proofing compound to the inside face of the container including refilling disposing of the surplus stuff within a lead of 50 meters, all labour and material charges including lowering, laying, erecting, hoisting and jointing of pipe assembly of inlet, outlet, washout, overflow and bypass arrangements as per departmental design, providing and fixing accessories such as M.S. ladder, C. I. manhole frame and covers water level indicatiors, lightening conductor, G. I. pipe railing around walk way and top slab, providing spiral staire case from ground level to roof level,M.S.grill gate of 2 mtr.height with locking arrangement of approved design. B.B. masonry chambers for all valves, ventilating shafts, providing and applying three coats of cement paint to the structure including roof slab epoxy painting to internal surface & anti termite treatment for underground parts of the structure. and giving satisfactory water tightness test as per I.S. code, The job to include painting the name of the scheme and other details on the reservoir as per the directions of Engineer-in-charge. **Note :** 1. The design of the structure be in accordance with relevant (I.S. 3370 - 1965 or revised.) 2. The design shall satisfy the stipulations as per IS 1893 -1984 and I.S. 13920 / 1993 for seismic force and I. S.-11682/1985 for R.C.C. staging of overhead tanks. 3. For design having more than 6 columns, provision of internal bracing is obligatory.External bracing is also obligatary. 4. The entire structure shall be in M-250 mix only. 5. Plain round mild steel bars grade - I confirming to I.S. 432 part-I or high yield strength deformed bars confirming to I.S. 1786 or I. S. 1139 shall be used, grade-II mild steel bars will not be allowed. 6. Irrespective of the type of foundation proposed inthe design, one set of bracing be provided at the ground level.			

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008	Rate (in Rs.) 2008-2009
1	2	3	4	5
	7) These rates include providing M.S. ladder for E.S.R's upto 2 lakh litres capacity and providing spiral staircase for E.S.R. above 2 lakh litres capacity. 8) Stagging shall have to be designed with stresses of M-200 for ESR. However all RCC construction should be done in M-250 9) These rates are including the cost of uplift pressure if any and entire dewatering during execution. In case of water logging area where water is struch at shallow depth extra provision of dewa-tering shall be made as per site condition. 10) All conditions given in the Member Secretary's Circular No.MJP / TS-I / 350 / 1668 dt. 2-8-97 and MJP / S-1/350/2127 dt. 13-7-99 shall be strictly followed and additional cost, if any, due to these conditions is included in the rates mentioned below. 11) 75% part rate shall be payable for reinforcement cocrete and plastering items of containers of E.S.R. till satisfactory hy-draulic testing for water tightness in given; and till that work shall be treated as incomplete. 12) The rates indicated in the table are excluding the cost of pipes, specials and valves required for inlet, outlet, washout,overflow and by-pass arrangement. The scope of work, howerver and includes cost of erecting, laying and jointing of pipes and valves including cost of jointing materials upto 5 M beyond outer face of outermost column. 13) For ESR upto 500 cum capacity C.I. Double flanged pipe upto 300 mm dia shall be provided and C.I. specials shall be used. For ESR above 500 cum capacity C.I. /M.S. pipe assembly with minimum 8 m.m. thick ness up to 500 mm dia. and minimum 10 mm. thickness above 500 mm.dia can be used with proper anti-corro sive epoxy teratment from inside and outside. 14) Below mentioned rates are for foundations, with individual footing with bearing capacity of 20 tonnes per square metre. For raft			

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008	Rate (in Rs.) 2008-2009
1	2	3	1	5
	foundations, these rates shall be increased by.7.5% Where safe bearing capacity (SBC) is 5 M.T. per sqm and by 5% where SBC is more than 5 MT/ sqm and upto 10 MT /Sqm. This % of 5% or 7.5 % is applicable for estimation of amount of L.S. item of ESR. For Extra Item due to change from individual foundation to raft, actual increase in concrete and steel be paid as per relevent DSR Item. 15. The rate shall be increased by 30% for bearing piles upto depth of 10 m & for further increased in depth by 5 M each, it shall be increased by another 10%. These rates are applicable where raft is not feasible for pile foundations sulphate resistant cement shall only be used. Single pile for the column is not permitted Group of piles shall be designed with pile cap for each column of ESR. 16. The rates are applicable for staging height of 12 M. These rates shall be increased or decreased for per metre variation in this staging height as below. 12 to 16 M staging - 2% per metre 16 to 20 M staging - 3% per metre 20 M and above - 4% per metre For 17 M Staging height percentage calculation will be like below. 12 to 16 M --- 4 X 2 = 8 % 16 X 17 M --- 1 X 3 = 3 % Total = 11 % For 21 M Staging height percentage calculation will be like below. 12 to 16 M --- 4 X 2 = 8 % 16 X 20 M --- 4 X 3 = 12 % 20 X 21 M --- 1 X 4 = 4 % Total = 24 % 17. Following rates are for seismic zone-III For zone-IV, these rates shall be increased by 5% and for zone - II, these rates shall be decreased by 5%. Concerned Executive Engineer shall confirm the seismic zone for the scheme from seismic zones plan before estimation and adopt appropriate rates as per actual seismic zones. (Seis mic maps attached in this C.S.R.)			

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008	Rate (in Rs.) 2008-2009
1	2	3	4	5
	Note : 1) Conditions from Sr. No. 1 to 11 of form a part and parcel of the tender shall be included in the draft tender papers for works of R.C.C.E.S.R. 2) Conditions from Sr. No.12to17 are for estimation purpose only and shall not be appear in the tender.			
	Sr. No. Capacity in litres	**Unit**	**for Seismic Zone-III Rate n Lakh Rs.**	
	1. Upto 25,000 litres	Per Lit.	11.24	
	2. Cost of 25,000 litres capacity E.S.R.	----	2,81,060.00	
	3. Add for capacity above 25,000 upto 50,000 litres	Per Lit.	6.28	
	4. Cost of 50,000 litres capacity E.S.R.	-----	4,38,035.00	
	5. Add for capacity above 50,000 upto 75,000 litres	Per Lit.	5.38	
	6. Cost of 75,000 litres capacity E.S.R.	-----	5,72,585.00	
	7. Add for capacity above 75,000 upto 1,00,000 litres	Per Lit.	4.78	
	8. Cost of 1,00,000 litres capacity E.S.R.	-----	6,92,185.00	
	9. Add for capacity above 1,00,000 upto 1,50,000 litres	Per Lit.	3.77	
	10. Cost of 1,50,000 litres capacity E.S.R.	-------	8,50,650.00	
	11. Add for capacity above 1,50,000 upto 2,00,000 litres	Per Lit.	3.54	
	12. Cost of 2,00,000 litres capacity E.S.R.	----	10,28,170.00	
	13. Add for capacity above 2,00,000 upto 2,50,000 litres	Per Lit.	3.31	
	14. Cost of 2,50,000 litres capacity E.S.R.	-----	11,94,050.00	

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008	Rate (in Rs.) 2008-2009
1	2	3	4	5
	Sr. No. Capacity in litres	**Unit**	**for Seismic Zone-III Rate n Lakh Rs.**	
	15. Add for capacity above 2,50,000 upto 3,00,000 litres	Per Lit.	3.20	
	16. Cost of 3,00,000 litres capacity E.S.R.	-----	32,54,210.00	
	17. Add for capacity above 3,00,000 upto 4,00,000 litres	Per Lit.	2.80	
	18. Cost of 4,00,000 litres capacity E.S.R.	----	16,43,510.00	
	19. Add for capacity above 4,00,000 upto 5,00,000 litres	Per Lit.	2.51	
	20. Cost of 5,00,000 litres capacity E.S.R.	-----	18,91,890.00	
	21. Add for capacity above 5,00,000 upto 7,50,000 litres	Per Lit.	2.21	
	22. Cost of 7,50,000 litres capacity E.S.R.	-----	25,31,035.00	
	23. Add for capacity above 7,50,000 upto 10,00,000 litres	Per Lit.	1.94	
	24. Cost of 10,00,000 litres capacity E.S.R.	-----	29,07,190.00	
	25. Add for capacity above 10,00,000 upto 15,00,000 litres	Per Lit.	1.83	
	26. Cost of 15,00,000 litres capacity E.S.R.	-------	38,22,390.00	
	27. Add for capacity above 15,00,000 upto 20,00,000 litres	Per Lit.	1.77	
	28. Cost of 20,00,000 litres capacity E.S.R.	----	47,08,990.00	
	29. Add for capacity above 20,00,000 upto 25,00,000 litres	Per Lit.	1.72	
	30. Cost of 25,00,000 litres capacity E.S.R.	-----	55,66,990.00	

Appendix 8.4.2

DHPE Piping Cost Details

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008		Rate (in Rs.) 2008-2009	
1	2	3	4		5	
	X. H. D. P. E. PIPES					
1.	**Providing and supplying in** standard lengths Polyethelene Pipes, confirming to IS 4984 / 14151 / 12786 / 13488 with nesessary jointing material like mechanical connector i. e. thread / insert joint / quick release coupler joint / compression fitting joint or flanged joint, including all local & central taxes, transportation and fright charges inspection charges, loading / unloading charges, conveyance to the departmental stores / site & stacking the same in closed shade duly protecting from sunrays & rains, etc. complete.					
A.)	PE-100		**With E.D.**	**Without E.D.**	**With E.D.**	**Without E.D.**
	a) 6 Kg/Sq. cm :					
	i) 63 mm	RMT	83.00	-		
	ii) 75 mm	RMT	119.00	-		
	iii) 90 mm	RMT	168.00	-		
	iv) 110 mm	RMT	247.00	-		
	v) 125 mm	RMT	319.00	-		
	vi) 140 mm	RMT	402.00	-		
	vii) 160 mm	RMT	523.00	-		
	viii) 180 mm	RMT	660.00	-		
	ix) 200 mm	RMT	-	748.00		
	x) 225 mm	RMT	-	960.00		
	xi) 250 mm	RMT	-	1,178.00		
	xii) 280 mm	RMT	-	1,478.00		
	xiii) 315 mm	RMT	-	1,872.00		
	xiv) 355 mm	RMT	-	2,149.00		
	xv) 400 mm	RMT	-	3,067.00		

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008		Rate (in Rs.) 2008-2009	
1	2	3	4		5	
	X. H. D. P. E. PIPES					
1.	**Providing and supplying in** standard lengths Polyethelene Pipes, confirming to IS 4984 / 14151 / 12786 / 13488 with nesessary jointing material like mechanical connector i. e. thread / insert joint / quick release coupler joint / compression fitting joint or flanged joint, including all local & central taxes, transportation and fright charges inspection charges, loading / unloading charges, conveyance to the departmental stores / site & stacking the same in closed shade duly protecting from sunrays & rains, etc. complete.					
A.)	PE-100		**With E.D.**	**Without E.D.**	**With E.D.**	**Without E.D.**
	a) 6 Kg/Sq. cm :					
	i) 63 mm	RMT	83.00	-		
	ii) 75 mm	RMT	119.00	-		
	iii) 90 mm	RMT	168.00	-		
	iv) 110 mm	RMT	247.00	-		
	v) 125 mm	RMT	319.00	-		
	vi) 140 mm	RMT	402.00	-		
	vii) 160 mm	RMT	523.00	-		
	viii) 180 mm	RMT	660.00	-		
	ix) 200 mm	RMT	-	748.00		
	x) 225 mm	RMT	-	960.00		
	xi) 250 mm	RMT	-	1,178.00		
	xii) 280 mm	RMT	-	1,478.00		
	xiii) 315 mm	RMT	-	1,872.00		
	xiv) 355 mm	RMT	-	2,149.00		
	xv) 400 mm	RMT	-	3,067.00		

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008.		Rate (in Rs.) 2008-2009.	
1	2	3	4		5	
			With E.D.	Without E.D.	With E.D.	Without E.D.
	b) 8 Kg/Sq. cm :					
	i) 63 mm	RMT	107.00	-		
	ii) 75 mm	RMT	150.00	-		
	iii) 90 mm	RMT	215.00	-		
	iv) 110 mm	RMT	319.00	-		
	v) 125 mm	RMT	413.00	-		
	vi) 140 mm	RMT	517.00	-		
	vii) 160 mm	RMT	673.00	-		
	viii) 180 mm	RMT	851.00	-		
	ix) 200 mm	RMT	-	974.00		
	x) 225 mm	RMT	-	1,235.00		
	xi) 250 mm	RMT	-	1,520.00		
	xii) 280 mm	RMT	-	1,907.00		
	xiii) 315 mm	RMT	-	2,411.00		
	xiv) 355 mm	RMT	-	3 ,052.00		
	xv) 400 mm	RMT	-	3,953.00		

	Description	Unit	Rate (in Rs.) 2007-2008.		Rate (in Rs.) 2008-2009.	
1	2	3	4		5	
			With E.D.	Without E.D.	With E.D.	Without E.D.
	c) 10 Kg/Sq. cm :					
	i) 63 mm	RMT	128.00	-		
	ii) 75 mm	RMT	182.00	-		
	iii) 90 mm	RMT	262.00	-		
	iv) 110 mm	RMT	386.00	-		
	v) 125 mm	RMT	497.00	-		
	vi) 140 mm	RMT	623.00	-		
	vii) 160 mm	RMT	812.00	-		
	viii) 180 mm	RMT	1,031.00	-		
	ix) 200 mm	RMT	-	1,182.00		
	x) 225 mm	RMT	-	1,492.00		
	xi) 250 mm	RMT	-	1,837.00		
	xii) 280 mm	RMT	-	2,300.00		
	xiii) 315 mm	RMT	-	2,904.00		
	xiv) 355 mm	RMT	-	3,707.00		
	xv) 400 mm	RMT	-	4,801.00		
	d) 12.5 Kg/Sq. cm :					
	i) 63 mm	RMT	154.00	-		
	ii) 75 mm	RMT	216.00	-		
	iii) 90 mm	RMT	313.00	-		
	iv) 110 mm	RMT	464.00	-		
	v) 125 mm	RMT	598.00	-		
	vi) 140 mm	RMT	750.00	-		
	vii) 160 mm	RMT	978.00	-		
	viii) 180 mm	RMT	1,237.00	-		
	ix) 200 mm	RMT	-	1,418.00		
	x) 225 mm	RMT	-	1796.00		
	xi) 250 mm	RMT	-	2,209.00		
	xii) 280 mm	RMT	-	2,771.00		
	xiii) 315 mm	RMT	-	3,508.00		
	xiv) 355 mm	RMT	-	4,453.00		
	xv) 400 mm	RMT	-	5,771.00		

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008		Rate (in Rs.) 2008-2009	
1	2	3	4		5	
			With E.D.	With out E.D.	With E.D.	With out E.D.
	e) 16 Kg/Sq. cm :					
	i) 63 mm	RMT	186.00	-		
	ii) 75 mm	RMT	263.00	-		
	iii) 90 mm	RMT	378.00	-		
	iv) 110 mm	RMT	562.00	-		
	v) 125 mm	RMT	725.00	-		
	vi) 140 mm	RMT	907.00	-		
	vii) 160 mm	RMT	1,188.00	-		
	viii) 180 mm	RMT	1,499.00	-		
	ix) 200 mm	RMT	-	1,721.00		
	x) 225 mm	RMT	-	2,176.00		
	xi) 250 mm	RMT	-	2,684.00		
	xii) 280 mm	RMT	-	3,366.00		
	xiii) 315 mm	RMT	-	4,265.00		
	xiv) 355 mm	RMT	-	5,396.00		
	xv) 400 mm	RMT	-	6,992.00		

Sr. No.	Description	Unit	Rate (in Rs.) 2007-2008		Rate (in Rs.) 2008-2009
1	2	3	4		5
2.	**Lowering, Laying and Jointing H. D. P. E. pipes by heating to the ends of pipes** with the help of tefflon coated electric mirror / heater to the required temparature and then pressing the ends togather against each other, to form a monolithic & leak proof joint by thermosetting process. The pressing may be required to be done with Jacks/ Hydraulic Jacks/Butt fusion machine etc. complete with all materials labours as directed by Engineer - in - charge, including, given satisfactory hydraulic test.				
	For all classes.		**With ED**	**Without ED**	
	i) 63 mm	Rmt.	15.00	17.00	
	ii) 75 mm	Rmt.	19.00	21.00	
	iii) 90 mm	Rmt.	21.00	23.00	
	iv) 110 mm	Rmt.	23.00	26.00	
	v) 125 mm	Rmt.	28.00	30.00	
	vi) 140 mm	Rmt.	30.00	32.00	
	vii) 160 mm	Rmt.	33.00	35.00	
	viii) 180 mm	Rmt.	35.00	37.00	
	ix) 200 mm	Rmt.	37.00	41.00	
	x) 225 mm	Rmt.	41.00	44.00	
	xi) 250 mm	Rmt.	48.00	50.00	
	xii) 280 mm	Rmt.	52.00	54.00	
	xiii) 315 mm	Rmt.	56.00	60.00	
	xiv) 355 mm	Rmt.	63.00	66.00	
	xv) 400 mm	Rmt.	72.00	80.00	
	xvi) 450 mm	Rmt.	100.00	103.00	
	xvii) 500 mm	Rmt.	121.00	124.00	
	xviii) 560 mm	Rmt.	145.00	153.00	
	xix) 630 mm	Rmt.	166.00	170.00	