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Implementation of New Water Distribution Network In Village Saigaon (Rahimatpur)

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Abstract
This report presents the utilization of EpaNET software within the design of the water distribution network for the village Saigaon, Satara district. the most important purpose of providing a decent distribution network is to produce sufficient pressure at each node point with less loss. A water distribution network consists of pipes, valves, tanks, etc. EpaNET could be a bug that tracks the flow of water in each pipe, the pressure at each node, and therefore the height of water in ESR. this report was accustomed do the look and hydraulic analysis of the water distribution network using EpaNET software. the tactic of distribution used here is that the combined gravity and pumping system. it absolutely was obtained that the pressure in the slightest degree junctions and flow with their velocities in the least pipes are feasible. The analysis is disbursed supported various public demands, quantities of inflows, and outflows of the overhead reservoirs. This analysis provides information about various demands, losses, and uses of the general public. the planning of a replacement network of supply will make attentive to the new demands, rate of increase within the demands. the look is formed thanks to the growth rate, and also the developing village. The report presents the hydraulic analysis of the pipeline network of Saigaon village using EPANET 2.0. for a region of 1.2 sq Km area and 1210 Population □2050□. The water from the source well is taken via the network of pipes to the ESR Elevated Storage Reservoirs□ during the availability hours and water is supply to the world by gravity. the gap between the source well to ESR is 839 m. Simulation has been dispensed for hydraulic parameters like head pressure and flow.

Keywords: *distribution network, Epanet software, ESR tank, simulation.*

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I. INTRODUCTION

Water is that the most significant need of all living organisms. Water is employed for irrigation purposes, industrial purposes, and domestic purposes. a water distribution network should be designed in such the simplest way that it meets the demand of the increased population. An adequate installation can give better living standards. The water quality shouldn't get deteriorated within the distribution pipe. a decent water distribution network provides sufficient pressure at each point of distribution with less loss. a decent water distribution network satisfies the buyer demand at the desired time. the planning and analysis of water distribution networks may be a complex process. Water supply systems get water from a range of locations, including groundwater, surface water. The water is then, in most cases purified, disinfected through chlorination, and sometimes fluoridated. Treated water either flows by gravity or is pumped to a reservoir, which might be elevated like a reservoir or on the bottom. The water is then fed into the distribution. Water distribution system, hydraulic infrastructure contains elements like pipeline, tanks, basin, pumps, and valve, etc. is important to produce water to the consumer's elements of a distribution system include distribution mains, arterial mains, storage basin and system elements (valves, hydrants, mainline meters, service connections, and backflow preventers). Distribution main are the pipes that compose the distribution complex. Their purpose is to transmit water from water sources or treatment work to users. Service connection that connects either other plumbing systems or a private building to distribution system mains. The water distribution system consists of an interconnected series of pipelines storage facilities and elements that convey waters that are used for drinking and also meeting the hearth protection needs for cities, schools, homes, hospitals, industries, businesses, and other facilities.

II. LITERATURE REVIEW

Jagtap R. et all [1], This study is based on assessment of existing water distribution network using EPANET 2.0 software. The pipe network and junction network system is simulated to understand its behavior for different inputs using EPANET 2.0. Simulation has been carried out for hydraulic parameters such as head, pressure and flow rate. The results obtained verify that the pressures at all junctions and the flows with their velocities at all pipes are feasible enough to provide adequate water by the network of the study area.

G. ANISHA et all [2], This research is all about the analysis of the existing network and concludes about the reliability on the network for the future. The analysis is carried out based on various public demands, quantities of inflows and out flows of the over-head reservoirs. This analysis provides the information about various demands, losses, and uses of the public. The design of a new network of supply will make the municipality be aware of the new demands, rate of increase in the demands. The design is made keeping in view of the population growth rate, and the developing town. The design brings out an improvement in the existing network.

Dr. G. Venkata Ramana et all [3], This paper highlights only the effective design and distribution of network of pipes using EPANET tool. The residual head at each and every node was found out by having the elevation as input and thereby the corresponding flow quantities were derived like residual head, velocity and nodal demand etc.

III. OBJECTIVE

1) To design a water distribution network that can supply an adequate quantity of water to the consumer's end with sufficient pressure and 24*7 supply.

IV. METHODOLOGY

- Study area.
- Population forecasting.
- ESR capacity calculation.
- Analysis of distribution network with Epanet software.

4.1 Study Area.

Saigaon Gram panchayat is located in Koregoan tehsil of Satara district. Saigaon gram panchayat has an area of 1.3 sq. Km. Saigaon is located at a distance of 17 km to the southeast of Satara and 14 km south of Koregaon. The study area covers 7 zones of Saigaon village and some eastern parts of Dhamner village attached to Saigaon village. The current population of the study area is 840.

Table 4.1.1 Study Area Basic Information

The current population of study area	840
Total no of households in study area	150
No of shops in area	08
No of primary schools in area	01

4.2. Population Forecasting

Methods of population forecasting.

a. Arithmetical increase method.
b. Geometrical increase method.
c. Incremental increase method.

As Saigaon is a small village but the migration rate of population from Karnataka as daily wedge labor is more here. These migrated people work on construction sites or in MIDC AREA near Satara. So here we adopting a method for population forecasting is the "**Incremental Increase Method**".

The design period for proposed water distribution supply scheme is 30 years. so population forecasting have to be done for the year 2050.

Table 4.2.1 Past Increase in Population

Year	Population	Arithmetical Increase in Population	Incremental Increase in Population
1990	500		
2000	610	110	
2010	720	110	0
2020	840	120	10
		Avg. d=113.3	Avg. t=5

Table 4.2.2 Forecasted Population with Incremental Increase Method

Year	Forecasted Population
2030	959
2040	1082
2050	1210

4.3 ESR capacity calculation.

Water supply or distribution reservoirs are hydraulically an integral part of the water distribution system, and the proportion of water supply pipes leading to them is usually so high that they can supply water at a rate high enough to meet with the maximum 24 hours a day. Hourly demand that exceeds this ratio is supplied by storage.

Table 4.3.1 Total Daily Demand

Forecasted Population	Supply	Total Requirement
1210	70	84700 LTRS

Table 4.3.2 Average Hourly Demand

Total Demand	Supply Hours	Per Hour Demand
84700	24	3529.17 Ltrs

Table 4.3.3 Modified mass diagram for 70 LPCD supply

Start time	End time	hourly demand factor	cumulative demand (Ltrs)	cumulative pumping (Ltrs)	cumulative surplus or deficit (Ltrs)
0	1	0.20	705.83	0.0	-705.8
1	2	0.20	1411.67	0.0	-1411.7
2	3	0.20	2117.50	0.0	-2117.5
3	4	0.20	2823.33	0.0	-2823.3
4	5	0.40	4235.00	0.0	-4235.0
5	6	0.80	7058.33	0.0	-7058.3
6	7	2.25	14998.96	0.0	-14999.0
7	8	2.25	22939.59	0.0	-22939.6
8	9	2.25	30880.21	0.0	-30880.2
9	10	2.25	38820.84	10587.5	-28233.3
10	11	1.00	42350.00	21175.0	-21175.0
11	12	1.00	45879.17	31762.5	-14116.7
12	13	0.60	47996.67	42350.0	-5646.7
13	14	2.25	55937.30	52937.5	-2999.8
14	15	0.70	58407.71	63525.0	5117.3
15	16	0.70	60878.13	74112.5	13234.4
16	17	0.70	63348.55	84700.0	21351.5
17	18	2.25	71289.17	84700.0	13410.8
18	19	0.90	74465.42	84700.0	10234.6
19	20	0.90	77641.67	84700.0	7058.3
20	21	0.70	80112.09	84700.0	4587.9
21	22	0.70	82582.51	84700.0	2117.5
22	23	0.40	83994.17	84700.0	705.8
23	24	0.20	84700.01	84700.0	0.0
	maximum surplus			21351.5	
	maximum deficit			30880.2	
	ESR capacity required			52231.6	

Table 4.3.4 Design ESR Capacity

ESR min required	52231.6 ltrs
Reserve for breakdown (30 LPCD)	37769 ltrs
Firefighting reserve	10000 ltrs

So design ESR capacity is 100000 ltrs (1 lakh liters)

4.4 Distribution Network Analysis with Epanet 2.0

We are designing distribution network for next 30 years for the village Saigaon. We are going to use here HDPE pipe which has coefficient of roughness 150 and durability up to 50 years.

❖ **Distribution network design**

1. Gravity based distribution supply of water.
2. Dead end pipe network.
3. 27 x 7 supply

EpaNET 2.0

For the analysis of distribution network, we are going to use EpaNET 2.0 software. EpaNET is a computer program that performs extended period simulation of hydraulic and water quality behaviour within pressurized pipes.

Figure 4.4.1 Saigaon Village Satellite Image

Figure 4.4.2 Saigaon Village

Epanet analysis report

Network Table - Nodes at 9:00 Hrs

	ELEVATION	BASE DEMAND	DEMAND	HEAD	PRESSURE
Node ID	M	LPM	LPM	M	M
Junc n165	23.68	0.39	0.88	38.7	15
Junc n166	21.58	0.39	0.88	38.6	17.06
Junc n167	23.42	0.39	0.88	38.7	15.24
Junc n168	21.99	0.39	0.39	38.7	16.68
Junc n169	21.58	0.39	0.39	38.7	17.08
Junc n170	19.32	0.39	0.88	38.7	19.34
Junc n171	19.2	0.39	0.88	38.7	19.46
Junc n172	19.07	0.39	0.88	38.7	19.59
Junc n173	18.59	0.39	0.88	38.7	20.08
Junc n175	22.4	0.39	0.88	38.7	16.26
Junc n176	21.8	0.39	0.88	38.7	16.86
Junc n177	20.3	0.39	0.88	38.7	18.36
Junc n178	19.4	0.39	0.88	38.7	19.25
Junc n179	18.36	0.39	0.88	38.7	20.3
Junc n180	23.31	0.39	0.88	38.7	15.34
Junc n181	21.2	0.39	0.88	38.7	17.45
Junc n182	19.1	0.39	0.88	38.7	19.55
Junc n183	18.18	0.39	0.88	38.7	20.47
Junc n184	22.25	0.39	0.88	38.6	16.39
Junc n185	20.86	0.39	0.88	38.6	17.79
Junc n186	19.08	0.39	0.88	38.6	19.57
Junc n187	17.32	0.39	0.39	38.6	21.32
Junc n188	19.58	0.39	0.88	38.6	19.06
Junc n189	15.17	0.39	0.39	38.6	23.47
well	0	N/A	-251	0	0
ESR1	32.68	N/A	183	38.7	6

V. RESULTS AND DISCUSSION

The water distribution network has been designed and analyzed successfully using the EpaNET software. At the end of the analysis it was found that the resulting pressure at all junctions and the flows with their velocities at all pipes are adequate enough provide water to the proposed area.

In the analysis its found that residual pressure is greater than 15 m at each node. And IS 1172 recommends minimum residual pressure of 7m, so end user will get water with sufficient pressure.

Assumed internal diameter of 90 mm is sufficient to withstand for the pressure for the entire network.

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