

DESIGN OF WATER DISTRIBUTION SYSTEM FOR HUKUMPET VILLAGE USING EPANET

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Abstract:

Having a proper water supply network is a basic requirement behind the functioning and survival of every locality. Lack of this network, Hukumpet village in Andhra Pradesh is suffering adversely. Therefore, the Government of Andhra Pradesh is thoughtful on designing a network for water supply, to get rid of this problem. For which the suggested design strategy is designed by EPANET software in this project. This project works with high-end accuracy and simplicity. This project aims to design a simple and economical the water supply network based on Survey and Population Data of Hukumpet village using EPANET Software. Also, to enumerate the Hydraulic Parameters using the same software, and estimate the amount of water lost as Head loss using Hazen- William's Equation. Finally, to prepare a clear estimate, show casing the budget for practical construction of these networks in the individual villages. This research has been intensively worked to match the criteria of needs and also has been developed to intend to put forth to Government of Andhra Pradesh, to solve the catastrophic situation of the people there.

INTRODUCTION :

General:

Water is one of the most essential components for existence of life on our planet. The need for water to carry Domestic, Agricultural, Industrial, and many other activities is very high and prominent. IS:1172-1993[48], suggests 70-200lpcd (Liters per Capita per Day) of water is required for every individual to carry out all his activities. This value get influenced and varied due to factors like season, time, economics etc., depending on the topography. The availability of water is not consistent throughout the Globe. People depend on various sources which include Surface sources such as Rivers, Lakes, ponds etc., as shown in Fig:1, and under ground water which are Sub- surface sources like Aquifers, Aquicludes etc., as

shown in Fig:2, depending on their situation.

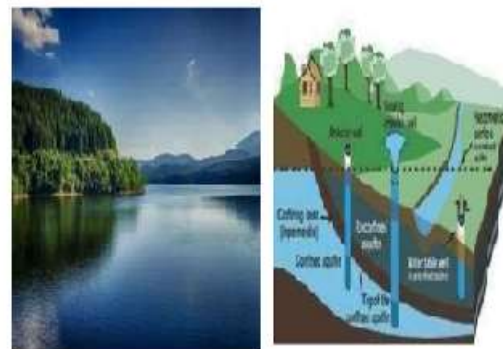


FIG:-1 & FIG:-2

The problem is that, majority of these sources are not perennial. They get perished or exhausted after some point of time. Also, water is one of the prevalent mediums for origin and spread of diseases including Amoebiasis, Dysentery, Hepatitis-A, Fluorosis etc., 2 | Page All

these diseases effect people if the water is directly consumed from the above stated sources without treating the properly.[47] There is another problem in the picture, that is transportation of water. Particularly in the case of Surface Sources, it is inevitable to either transport them manually or by pumps. Both of them are either tedious or expensive. Therefore, to suppress all these above problems, every village, town or city must have a specific Water Distribution or Supply Network. To begin with, this network starts with collecting the water from a source, transporting it to a treatment plant and processing the water against cynical matter and making it potable, and supplying to the citizens. A simple and typical Water Supply Layout looks similar to the Fig:1.3 below.

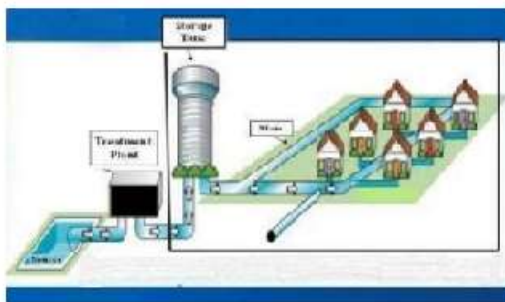


FIG:-3

OBJECTIVES:

- To design a good and proper Water Supply Network for the village Hukumpet which are actually lacking proper water supply network.
- To design the water supply networks using EPANET 2.0 software for these villages with minimal losses.
- To enumerate all the hydraulic parameters for the designed network using EPANET Software.
- To determine the quantity of water lost as Unit Head loss in

the Network of every village using Hazen-William's formula.

- To prepare a proper Cost Estimation for construction of the water supply network for these individual villages.

ELUCIDATION OF METHODOLOGY:

- To begin with, the primary motive of this project is to provide the Drinking Water Supply Network using EPANET Software. For that, the villages actually lack them are selected. For the designing of the network in EPANET, 2 essentials are needed, i.e., Survey Report and Population Report of the village.
- Therefore, the village has to be surveyed or collect the surveyed data at the latest. It is preferred to use Digital Global Positioning System as a survey equipment to attain high end accuracy and ease.
- On the other hand, the population data shown also be in hand. It can be attained from Census Department or Andhra Pradesh Drinking Water Supply Corporation. This population would for the year 2011, since the latest population statistics are not taken from then.
- Now, the Survey Data of the village which is mainly done for the road networks of the village is fed into AutoCAD Software and primarily verify the lengths of roads with that of Google Earth. Now this file should be saved in (.dxf) or (.dwg) formats.
- This (.dxf) or (.dwg) file is fed into EPANET Software, where this file gets converted into (.NET) format, where this file can be opened and developed in EPANET Software. This (.NET) file is fed in EPANET Software and kept on hold.
- On the other hand, the population data is to be analyzed. Initially the population of



the village by the end of design period (30 years) is forecasted by Incremental Increase Method (IIM) (\because This method can be applied for slow growing cities and villages, while the other methods like Arithmetic and Geometric Increase Methods doesn't fit for this kind of villages). Then the demand for water, by the end of Design Period based on Per Water Capita Demand with respect to IS: 1172-1993 is calculated [47].

- Then coming back to EPANET, this quantity of water required or the ultimate demand is used to design the OHDR Tanks. It should be seen that the tank is situated at a possible higher elevation, to enable greater flow due to gravity.
- The diameters of pipes, size of tanks and other Hydraulic data is fed into EPANET.
- Then, the file applied to "Run" and the errors and losses are observed and minimized. This is a trial and error process, and the network is continuously re-designed, by altering the hydraulic parameters at required stages. Then if the Run is observed to be successful, then we proceed to further stages like Unit Head loss calculation and Cost Estimation.
- Don't forget to generate the full network report with all the hydraulic parameters of the network from EPANET.
- Determine the amount of water lost as Head loss based on Hazen William's Equation in the network.
- Then a proper Estimate is prepared considering all the resources needed for the project, and the costs involved for them with respect to Standard Schedule of Rates of AP (2019-20) [50].
- Report EPANET Report and Estimation Report of the village. This is the same process that we are going to apply for hukumpet village in

this project work. Also, 38 | Page Process of Laying the Water Supply Network on-site: After completing, the design and other administrative procedures, the main process that comes into picture is executing it on-site.

- Initially, the job begins, with construction of tanks at specified points in the diagram, with the specified guidelines.
- As this process is going on simultaneously, the pipe network construction begins. Where, the first activity begins with land and site clearance, where the construction work is proposed.
- Then comes Earth work Excavation. This process is done using Earth Movers. The excavated Earth is preserved safely.
- Since, the study area as adopted are from West Godavari District, so there is an existence of very loose soils, as stated in Chapter: 3. So, to have a strong base and stability, we have to add a layer of concrete of 200 mm thick.
- The grade of concrete and their quantities are specified in Chapter:5 clearly. This project proposes to use RMC Trucks for ease and speed in construction. Immediately after laying, the concrete layer has to be properly compacted, so using needle vibrators, the job becomes easy.
- After hardening, the concrete is prone to curing for a period of at least 5 days.
- Then, the distribution pipes are bought into the site. It should be ensured that, the pipes do not have any disturbances or any residual matter in them. They are simply hollow and clear. They are laid under utmost care and supervision.

RESULTS:

As mentioned in the objectives, this project primarily aims to design the water

supply network for Hukumpet village. Observing the methodology stated in the above chapter, in this Chapter, every village is individually designed with the network and a proper estimate.

5 Design of Water Supply Network for Hukumpet Village:

Step:1 Population Analysis:

Population as per APDWSC census from 2011=3048 Citizens (Base Year) Adopting Incremental Increase Method (IIM), for Population Fore casting, Assuming the growth factor =1% According to IIM, Population in the village by the end of 2023=3048*1.01112=3476 Citizens (Base Year for the Design) Since, water supply network has to serve for a life period of 30 years, ∴ Ultimate year for this network is 2060. It means this network has to be capable of functioning till 2060. Therefore, Population of hukumpet by the end of 2060 = 3476*1.01137 =5211 Citizens

Step:2 Water Demand Analysis:

Assuming the per capita demand in the village as 200 lpcd [48]. ∴ Ultimate Demand of water by the end of 2060 =5211* 200 =10,42, 200liters per day =1042.2KL= 1042.2 m³ In the next step, the village is designed with the water supply network using EPANET and every individual layer is presented clearly.

Population at the end of “n” years=Population at the end of Base year*1.011ⁿ 41

Step:3 EPANET Analysis:

In the Fig:4 below, the Survey Report of Hukumpet Village is presented in Auto CAD format.

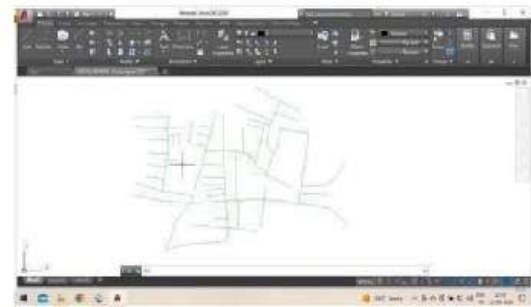


FIG:-4

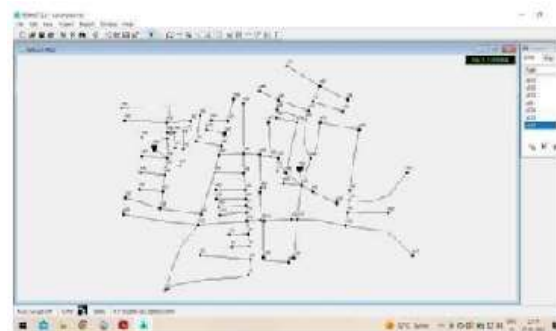


FIG:-5

Link - Node ID	Start Node	End Node	Length m	Diameter mm
p1	n2	n1	704	50.7
p2	n3	n2	83.12	50.2
p3	n5	n4	93.24	50.2
p4	n4	n5	1.25	50.2
p5	n6	n7	42.91	50.2
p6	n6	n8	41.25	50.2
p7	n8	n9	45.83	50.2
p8	n8	n6	29.79	50.2
p9	n10	n11	196.9	50.2
p10	n12	n13	179.9	50.2
p11	n12	n14	120.4	50.2
p12	n14	n8	31.29	50.2
p13	n13	n16	88.21	50.2
p14	n17	n16	92.12	50.2
p15	n17	n10	119.5	50.2
p16	n19	n15	69.16	50.2
p17	n18	n19	14.14	50.2
p18	n12	n20	186.6	50.2
p19	n21	n12	26.96	50.2
p20	n25	n14	21.09	50.2
p21	n25	n23	33.22	50.2
p22	n24	n25	101.1	50.2
p23	n26	n21	103.6	50.2
p24	n27	n28	67.17	50.2
p25	n27	n22	16.3	50.2
p26	n28	n29	28.21	50.2
p27	n29	n27	14.2	50.2
p28	n30	n31	71.21	50.2
p29	n31	n32	89.42	50.2
p30	n33	n34	66.67	50.2
p31	n35	n36	83.42	50.2
p32	n37	n36	40.31	50.2
p33	n38	n39	23.44	50.2
p34	n39	n30	21.63	50.2
p35	n39	n40	71.89	50.2

CONCLUSION:

Achievements of Objectives:

To begin with, the project has all started with a primary aim to Design a Proper Water Supply Network in hukumpet Village using EPANET Software.

- EPANET Software was thoroughly studied and explored before beginning the project.



- Firstly, the villages are completely explored and the features of every individual village is presented clearly in Chapter: 3.
- Using the Survey Report and Population Reports ,the villages are designed with the water supply networks.
- Under trial and error process, the losses and errors in the network are rectified and the finely polished networks of every are presented in Chapter: 5.
- Every Hydraulic Parameter is presented clearly shown in the layers and reports presented in Chapter: 5.
- Using Hazen William's Equation, the amount of Unit Head loss in the village are determined and the amount of water lost as losses is also calculated and presented.

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