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Remodelling of Water Supply Scheme for Sriranagapatna Town-A Review

Sameena G. A[1] and Shivkumar B. P[2]

[1]*M.Tech Scholar, Department of Environmental Engineering, Sri Jayachamarajendra College of Engineering, Mysore- 570006, Karnataka, India*

[2]*Assistant Professor, Department of Environmental Engineering, Sri Jayachamarajendra College of Engineering, Mysore- 570006, Karnataka, India*

Abstract - In order to ensure the availability of sufficient quantity of good quality of water to the various section of community in accordance with the demand. Many computer tools were developed, out of all the tools available EPANET and WATERGEM become most popular and convenient for the effective design of complex pipe networks. This paper with the effective design and distribution of network of pipes using EPANET and WATERGEM tools, Water age and residual chlorine concentration of the network also is determined by the EPANET tool. The residual head at each and every node is found out by having the elevation as input and there by the corresponding flow quantities are derived [1].

Keywords – Distribution network; EAPNET; WATERGEM; Nodal Demand; Effective Design

I. Introduction

Water is a transparent fluid which forms the world's streams, lakes, oceans and rain. It is the major constituent of the fluids of organisms. About 71% of the earth's surface is covered with water. Of which, only 2.5% of the water is freshwater and 98.8% is in the form of ice and ground water.

Water distribution system is a hydraulic infrastructure consisting of elements such as pipes, tanks, reservoirs, pumps and valves etc. water distribution network serve many purposes in addition to the provision of water for human consumption [1].

Computation of flows and pressures in network pipes have been of great value and interest for those involved with designs, construction and maintenance of public water distribution systems. Analysis and design of pipes networks create a relatively complex problem, particularly if the network consists of range of pipes as frequently occurs in water distribution systems of large metropolitan areas. In the absence of significant fluid acceleration, the behavior of a network can be determined by a sequence of steady state conditions, which form a small but vital component for assessing the adequacy of a network. Such an analysis is needed each time changing pattern of consumption or delivery are significant or, added features such as supplying of water, addition of booster pumps, pressure regulating valves or storage tanks, change the system[2].

Srirangapatna town is situated a mere 15km from Mysore city, lies in the neighboring district of Mandya in Karnataka state. The entire town is enclosed by the river Cauvery to form a river island in the northern half. While the main river flows on the eastern side of the island, the Paschima vaahini segment of the same river flows to its west. It is located at 12º 41' N latitude and 76º 7' E longitude. It has an average elevation of 679m (2227 feet) above mean sea level. The city is well connected with good road network and railway line. The average temperature in srirangapatna is 24ºC. The annual average rainfall is about 613mm. The city covers an area of 8.6sq.km and the population as per 2011 census is 25061. The city is divided into 23 administrative wards by srirangapatna municipal council. The place has historic background and huge tourist inflow during peak seasons.

Though the town is supplied with good quantum of bulk potable water to meet the immediate requirement of core area, the existing distribution system is unable to distribute water equitably to all the core areas. Many industries were built across the town which poses an impact on water distribution system. The existing distribution mains are inadequate to meet the future flows. In light

of this to ensure the safe drinkable water the present investigation will be undertaken in remodeling the water supply avenue in srirangapatna town.

The main source of water supply to srirangapatna town is River Cauvery, located at a distance of 1.5 km from the town. Additionally, there are 58 tube wells located around the town. The town is divided into two parts – Srirangapatna fort and Ganjam. Ganjam is situated at a distance of about 2 km from the main town towards eastern side. Both Srirangapatna fort and Ganjam come under the same administration of town municipality. The initial water supply system to the town was started in the year 1934 and the first stage water supply scheme was commissioned in 1974. The existing distribution system consists of mixed pipe material which includes CI, PVC and Cast iron. Most of the distribution mains are of smaller diameter.

The main problem associated with existing distribution system are meager intake structure, unequitable supply, non-availability of adequate pressure in distribution mains, inadequate size of distribution mains, old and dilapidated pipelines, adoption of inappropriate design methodology, old components of water treatment plants etc.

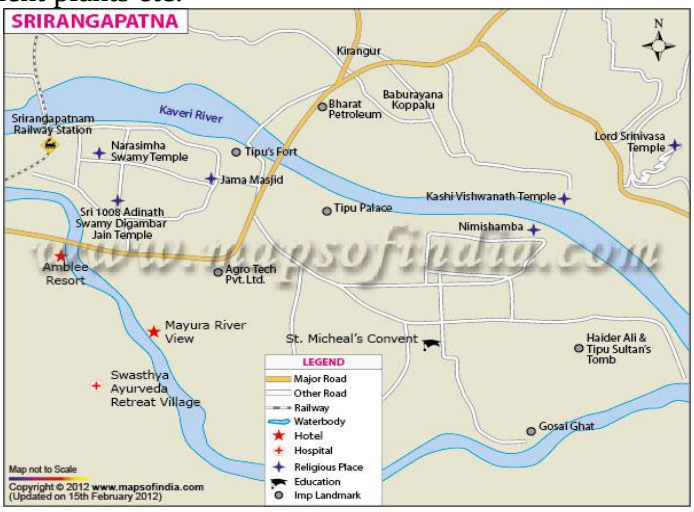

Fig 1: Image of Srirangapatna Town

II. Methodology

MATERIALS

The materials used for this study includes; topographical map, contour map, then water distribution parameters such as; water demand, population, and also distribution network parameters such as; elevations, pipe diameter, pipe length, finally EPANET and WATERGEM software's.

EPANET METHOD

The demand is obtained after considering the population of the study area, also the study area falls under the category of urban settlement, as a result of this development, the standard from the Federal Ministry of Water Resources manual on water demand is used, for this research 150 L/C/D was considered. We obtained a demand at particular junction by dividing (the total population by the number of Junctions and multiplying by 150L/C/D.

After that, the following steps were carried out to analyze the water distribution network:

1. Draw a network representation of your distribution system or import a basic description of the network.
2. Edit the properties of the objects that make up the system
3. Select a set of analysis options
4. Run a hydraulic analysis

E P A N E T' S W O R K S P A C E

The basic EPANET workspace is pictured below. It consists of the following user interface elements: a Menu Bar, two Toolbars, a Status Bar, the Network Map window, a Browser window, and a Property Editor window.

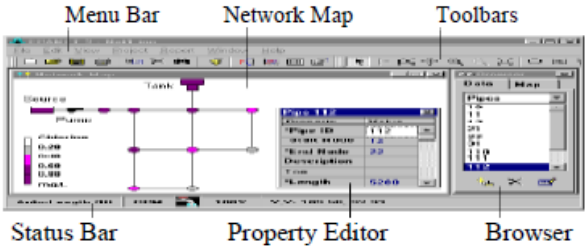

Fig 2: EPANET'S Workspace

Table 1: PIPE HEADLOSS FORMULA'S FOR FULL FLOW

Formula	*Resistance coefficient (a)*	*Flow exponent (b)*
Hazen-Williams	$4.727c^{-1.852}d^{-4.781}1$	1.852
Darcy-Weisbach	$0.0252f(\varepsilon,d,q)d^{-5}1$	2
Chezy-Manning	$4.66n^{2}d^{-5.33}1$	2

Notes:

c = Hazen-Williams roughness coefficient

ε = Darcy-Weisbach roughness coefficient (ft)

f = friction factor (dependent on ε, d, and q)

n = Manning roughness coefficient

d = pipe diameter (ft)

L = pipe length (ft)

q = flow rate (cfs)

WATERGEM METHOD

1. Analysis of water distribution system aims at demarcating the project boundary based on the contour levels. Such levels were derived the existing toposheets of Srirangapatna corporation. Levels of contour will be the criteria for water distribution system.

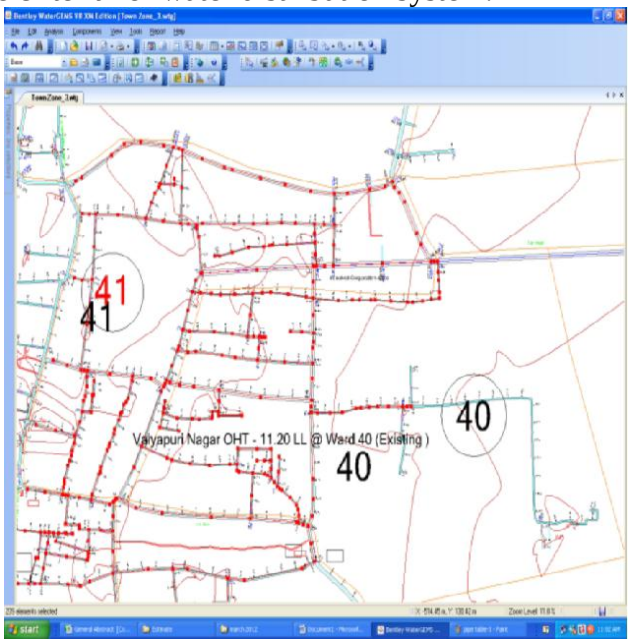

Fig 3: Zoning of Distribution System

2. Primarily reservoir is a focal point from where the pipes and nodes will be drawn through water gems software. Elevation and flow direction were automatically taken from the input parameters by the software. While digitizing the pipe line and the nodes care are taken elevation was considered from the previous level.
3. After finalizing, all the pipes and the nodes, input such as demand and pipe material will be provided to the software. Software takes into consideration of the elevation, contour, demand,

pipe material and other parameters. A simulation is carried out by the software are it decides the diameter of the pipe and flow direction and flow quantity along with the drawing profile.

III. Conclusion

The main focused of the research is to analyze the water distribution network and identify deficiencies (if any) in it. At the end of the analysis it would found that the resulting pressures at all the junctions and the flows with their velocities at all pipes are adequate enough to provide water to the study area. In addition, the following situation is observed in the distribution pipe line network which in future can cause inadequate supply of water to the area is:

1. It is observed that the pipes connected to the tanks as distribution pipes to the other pipes have smaller diameters.
2. It is observed that the network on the topographical map does not have a wider coverage of water distribution to some parts of the area; this as well, can cause water crisis as a result of rapid expansion of the area in future [2].

The residual pressure at all nodes is found to be greater than 7.00 m. By using tools like EPANET, the analysis can be done with in a period of time even for complex type of networks [1].

The software's has graphical interface, user friendly and modifications and further modification is easy. Therefore the system with WATER GEMS and EPANET software's is more convenient and consumes lesser time computation. Treated water conveyed through a piped network is exposed to numerous surfaces. It is important that no materials placed in contact with the drinking water in the network promote microbial growth or leach any contaminants into the water that can support microbial growth [3].

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