



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 7, July 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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Design and Analysis of Water Distribution Network Using WaterGEMS Software

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ABSTRACT: The basic essential amenity for a healthy living is Safe Potable Water Supply. Water is life for all living being on the earth as it is essential element required for the edibles of life. Water supply network are expensive infrastructure designed with a goal of minimizing the overall cost, while meeting the water demand needs in the sufficient quantity, quality and at satisfactory pressure. WaterGEMS involves variable decisions that are pipe diameters, reservoir elevation & its capacity with a primary variable. The result obtained is represented by using various colour coding of pipe dia., tables and graphs which helps to discover what better can be adopted. WaterGEMS also track the flow of water, pressure at each node, each pipe and height of water in tank during simulation.

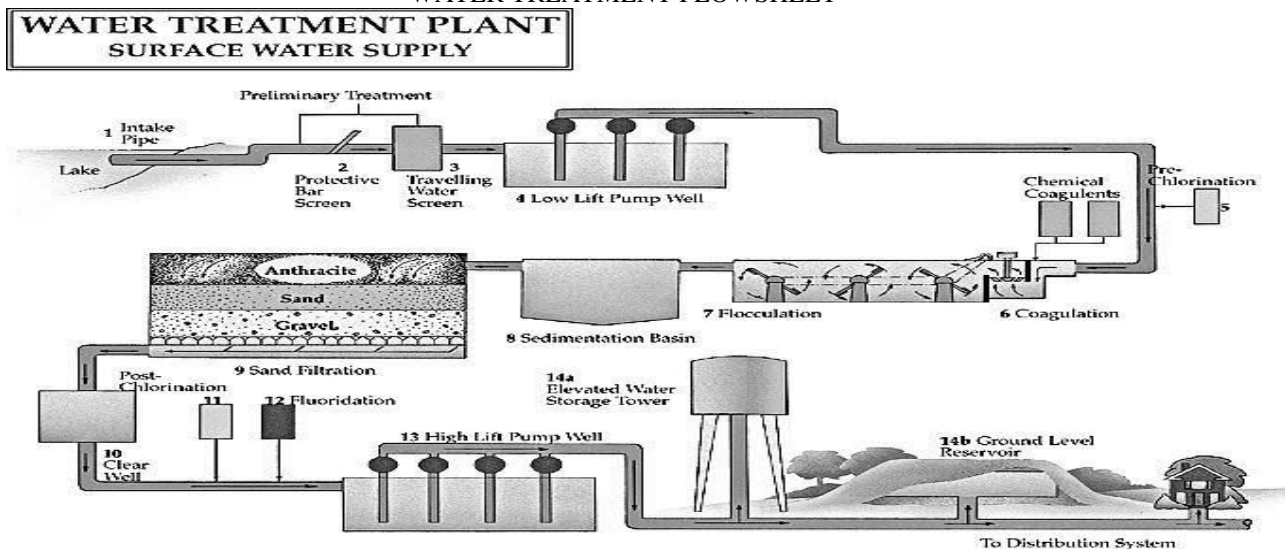
KEYWORDS: Satisfactory Pressure, Pipe diameter, Infrastructure, Reservoir.

I. INTRODUCTION

Water constitute one of the significant physical environments of man and has a straight bearing on his health, there is no gainsaying that pollution of water leads to health hazards. Water is a vital element in the living system and is an important component. Water plays a key element for the socio-economic development of a country. The urban population tends to be hundred millions by the end of century, with rise in demand on civic amenities which includes water supply for domestic purpose and non-domestic purpose. Which have to keep pace with the increasing demands of rising population. Identification of source, its conservation and optimal utilization is utmost important.

Water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end-use. Treatment for drinking water production involves the removal of contaminants from raw water to produce water that is pure enough for human consumption without any short term or long term risk of any adverse health effect. Measures taken to ensure water quality not only relate to the treatment of the water, but to its conveyance and distribution after treatment. It is therefore common practice to keep residual disinfectants in the treated water to kill bacteriological contamination during distribution.

WATER TREATMENT FLOWSHEET



II. LITERATURE REVIEW

STUDY AND DESIGN OF 24/7 WATER SUPPLY DISTRIBUTION SYSTEM BY WATERGEMS (2018)

The study of Sujal Nirmal Abhiyaan project for up gradation of water systems of small & medium towns under which government insisted various urban local bodies in the state. The water supply scheme was developed for 30 years. The current supply was intermittent mode and can be converted to 24*7 by operating valve.

MEHTA, YADAV, PRAJAPATI AND WAIKHOM 2017 (CASE STUDY SURAT)

Study of Punagamarea in Surat city interms of pressure. WATERGEMSV8i software an analyses the pressure at each node, track the flow of water in each pipe and height of the water in each tank during simulation. Paper contains scarcity problems, leakages and its causes with its impact. Result obtained was compared with actual field data, pressures at all junctions at all pipes are feasible enough to provide adequate water to the network of the study area. Flow and velocity have been computed using WATERGEMSV8i and by following the methodology, it was 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 as per the consumer needs.

Minakshi M. Yengale, (2012)

The objective of study was to minimize the time required for analysis & to make the tedious work to easier by using computer technique. And also the best option in order to optimize the cost of the network. The software program for discharge analysis & cost analysis for network Karanja village is made by using VB language. Water industry due to its unique nature faces many problems. The supply of water from the limited water resources in order to fulfil the ever increasing demand of water. In order to make infrastructure improvement, a water supply system has to handle a large amount of diverse information on continuing basis. The necessary information includes the data about pipelines, valves, pressure, ESR's, Pumps.

Verma Manisha (2009)

The author has observed that the provision of safe drinking water is considered today as a fundamental to governance; to promote good health and welfare of the people. To ensure that different aspect of rural drinking water supply is adequately taken care of the funds budgeted for rural drinking water supply under the centrally sponsored scheme. ARWSP (Accelerated Rural Water Supply Program) bifurcated in different components. In this study it is also given some strategy to improve safe drinking water in rural areas.

Pushpangadan K. (2001)

This presentation provides capacity utilization in rural schemes as an explanation for the wide variation in the coverage of drinking water supply existing between the estimates of norm-based consumption and actual consumption. It also develops an engineering methodology for the calculation of actual water supplied from the pumping hours using a stratified random sample of 199 rural schemes in Kerala. The paper effectively proves that the capacity utilization is only 49.5% in Kerala.

III. METHODOLOGY

Preliminary survey and working designs:

It is carried out from head works to water treatment plant (WTP) and to other required destinations which includes taking levels cross sections at nodal and salient points. Then Procurement of Land is to be carried out with Population forecasting using various methods according to growth pattern of villages.

By knowing the demand of ultimate stage we have designed Hydraulic models. Hydraulic design of Gravity main & distribution network is carried out by using Bentley's WaterGEMS software. We prefer Water GEMS software as it holds several advantages over the other hydraulic modeling software (LOOP, EPANET etc.). The prominent features of Water GEMS software include EPS (Extended Period Simulation), Optimization of Pipe Network, Terrain extraction



for levels, Nodal demand estimation as per land use, Scenario Management, Cost & Energy estimation for the system, Criticality analysis for isolation segments, Visualization of model results as far as design is concerned. For the hydraulic design of distribution system, various factors influence the design such as residual pressure, velocity, water demand and supply. Our aim of construction activity of the entire project is vague to be terminated around 12 months.

PROCCUREMENT OF LAND:-

For various components of project land acquisition is required such as Intake well, water treatment Plant, RCC MBR, RCC OHT's.

POPULATION FORECAST: -

Population is forecasted for the design period by using various methods based on the growth pattern of villages.

Sr no.	Mathematicalmodels
1	Arithmeticalincreasemethod
2	Geometricalincreasemethod
3	Incrementalincreasemethod
4	Line-fitGraphicalmethod
	a.ExponentialTrendcurve
	b.LinerTrendcurve
5	Decadalgrowthmethod

The design population is calculated with due regard to all the factors prevailing the further growth & development of project area in the urbanization, educational, social & administrative spheres. Special factor which are caused by sudden emigration or influx of population is also foreseen to the extent of possible

Design Flow: -

The design flow is based on the water required in ultimate year 2043 and would include domestic and non-domestic use in residential, commercial and institutional areas and non- domestic use in industrial areas and infiltration.

Peak Factor:-

The peak factors considered for design is 3 as per the recommendations of CPHEEO manual based on contributory population. The peak factors are applied to the projected population for the design year considering an average per capita water flow required based on allocation.

As pipes deteriorate with age, a roughness coefficient is assumed for the design period assuming fair condition. The roughness coefficient 'n' is assumed to be the same for all diameters and is taken 140 as per CPHEEO Manual.

OVERVIEW OF THE WATERGEMS V8i:-

The software has had a great evolution especially in features such as interoperability, ease of use, productivity tools, connection to external data; consultation processes multi-criteria, operations of spatial analysis, graphics capabilities, integration with Systems Geographic information (GIS), etc.Using Genetic Algorithms for automated processes hydraulic calibration, optimal design and energy optimization, Analytical Leakage Detection, Vulnerability Plans to Pollution Events, Systems integration with SCADA, Multi-parameter Quality Analysis, Network Renewal Planning, Integration with Analysis of Hydraulic Transients and Waterfall.

WATERGEMS V8i isa hydraulic modeling application for water distribution systems with advanced interoperability,

geospatial model building, optimization, and asset management tools. From fire flow and constituent concentration analyses, to energy consumption and capital cost management, WATERGEMS V8i provides an easy-to-use environment for engineers to analyze, design, and optimize water distribution systems.

Results:

Water distribution Networks are meant to supply water to each and every individual in the required quantity and of required quality. Providing safe, potable and adequate quantity of water for the villages in rural and urban communities is the most important task of a Government authority, upon which the health and well-being of the people depends. Water provided should meet minimum water quality standard and be readily and conveniently accessible at all times, and in all situation to rural people.

IV. CONCLUSION

The scheme so formulated provides following benefits to the habitants of the project area, in a manner that the water supply will be made available to the users at their door step, and they will have easy access to the service.

The scheme will cover total population in the area. At present a large population is deprived of the availability of potable water through tap connections.

The economical weaker sections of society will benefit in terms of employment which will be generated by the implementation of the project, since the service will be a continuous service in term of annual operation and maintenance even after completion of the project.

The designed network is a well suitable network for collection of data generated. It is easy to prepare a proper water distribution network by software and also modified representation of the layout can be done in it.

REFERENCES

- [1] Manual for preparation of Detailed Project Report for Rural Piped Water Supply Schemes issued by Govt. of India Ministry of Drinking Water & Sanitation issued date 20th February 2013.
- [2] Guidelines given in the National Urban Drinking Water Programm (NUDWP).
- [3] Guidelines and circulars issued by the MPHEd.
- [4] SOR's of M.P.PHEd and other relevant SORs.
- [5] Census Data Of GOI.
- [6] Optimal Design of Water Distribution Network by P. R. Bhave.
- [7] Dr. P.R. Bhave and S.D. Shangarpwar from IWWA march 2001 "computer aided analysis and design of water distribution network"
- [8] Dr. P.R.Bhave and Dr. R.Gupta "Analysis of Water Distribution Network"
- [9] The World Bank (1993): the Demand for Water in Rural Areas: Determinants and Policy Implications, the World Bank Research Observer, Vol. 8, Washington D.C.
- [10] Supply Augmentation and Pricing Hyderabad City, InDia.', World Bank Technical Paper, Number 395, The World Bank, Washington DC.
- [11] Santhakumar, V. (1998) 'Inefficiency and Institutional Issues in the Provision of Merit Goods- A Case Study of Public Water Supply in Rural Kerala, Working Paper , No. 285, CDS, Thiruvananthapuram. Evaluation study on Rajiv Gandhi National Drinking Water Mission, Government of India. (2010).



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.423



ISSN INTERNATIONAL
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