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A Review on Augmentation to Amravati Water Supply Scheme

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ABSTRACT: Water Distribution Network is necessary infrastructure for supply of water. It connects consumers to sources of water using hydraulic components such as pipes, valves, pumps and tanks. The primary aim of water distribution network is to deliver water to meet the demands on pressure and quality. WaterGEMS is hydraulic modeling software which is used for analysis and design of water distribution network. The study presents hydraulic analysis of AUGMENTATION TO AMRAVATI WATER SUPPLY SCHEME. Google Earth used for ensuring layout of water distribution network and Satellite image of study area shown effectiveness for selection of alternate alignment of road. Steady state analysis has been carried out for calculation of hydraulic parameter such as head pressure and flow rate. The result obtained verified that the pressure at all junction and the flows with their velocities at all pipes are feasible enough to provide adequate water to the network of study area.

I. INTRODUCTION

The ancient name of Amravati is “Udumbravati”, prakrut form of this is “Umbravati” and “Amravati” is known for many centuries with this name. The mispronunciation form of this is Amravati and now the Amravati is known with the same. It is said that Amravati is named for its ancient Ambadevi temple. The ancient proof of existence of Amravati can get from stone carved inscription on the base of marble statue of God Adinath (Jain God) Rhishabhnath. This shows that, these statues were set up here in 1097. Govind Maha Prabhu visited Amravati in 13 th century, at the same time Warhad was under the rule of Deogiri’s Hindu King (Yadav). In 14th century, there was famine (drought) in Amravati & people abandoned Amravati and left for Gujrat and Malva. The local people were returned back after several years at Amravati, the result of this was scanty population. In 16 th century, Mager Aurangpura (today’s, ‘Sabanpura’) was presented for Jumma Majseed by Badashah Aurangzeb. This reveals that Muslims and Hindus lived together here.

Amravati Municipal Corporation is the local authority in the city. It is headed by a mayor who is assisted by a deputy mayor elected for tenure of three years. It was established on 15 August 1983. The area governed by the Municipal Corporation at that time was 121.65 km2 comprising the erstwhile Municipal Councils of Amravati and Badnera along with eighteen revenue villages. Now the total area of Amravati city is 270 km2 of which 181 km2 falls under municipal limits and about 89 km2 does not fall within the municipal limits. Amravati Municipal Corporation is ‘D’ class corporation and is located at Mumbai-Kolkatta national highway and Badnera is the nearest main line Railway junction

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from which a shuttle railway service is available for Amravati city terminus station which is at 340m above MSL and Bandera city stands 300.8m above MSL and is situated at about 154km from Nagpur and 673kms from Mumbai.
Amravati city is experiencing tremendous growth and most development is outside the limit of erstwhile municipal council but within the limits of Municipal Corporation limits especially along Amravati-Badnera, Amravati-Walgaon, Amravati-Nagpur Road. The villages adjoining Amravati city now merged in corporation area have also been experiencing a substantial growth. Multistoried buildings are now coming up in the outskirts of city resulting in horizontal as well as vertical expansion. The number of households is 140000 approximately out of which house service connections for drinking water are more than 94000. The percentage of area coverage is 65%. The total road length is about 2000km.

HISTORY OF AMRAVATI WATER SUPPLY SYSTEM:

In the year 1983, on 9th of August, Amravati water supply scheme was handed over to then Maharashtra Water Supply & Sanitation Board by Municipal Council, Amravati. In ancient times, Amravati city was dependent on few tube wells, some trenches in city having horizontal bores to receive water from nearby areas, open dug wells and lake - Chatri Talao. Also there were local tube wells in different areas of city which served the nearby areas. Chlorination was done using bleaching powder. Also water was supplied from nearby village Revsa which is 15km away from city. The entire network was of GI pipeline having many stand posts and few individual connections. A small treatment plant of 25MLD was built near Maltekdi in which water coming from Revsa village was treated and then supplied to city. The overall system was run on pumping having multiple pumping stations nearby tube wells, open wells, trenches and lake. Due to pumping, water supply was totally dependent on electricity. The system was like a tree root system in which different sources from multiple locations were used to serve the need of city to flourish it like a tree. Some structures viz. Benoda Trench, Chatri talao, Open wells and few tube wells are still present in deteriorated condition. But as city started developing, this supply was not enough to quench the thirst of flourishing city.

Upper Wardha Dam

PRESENT STATUS & AMRAVATI W.S.S

1. Source: Upper Wardha Dam, Morshi approximately 60 km from WTP site.
2. Intake work: Intake well in R.C.C. is located in right bank divide wall of the dam. Intake well of 3.0x 8.0m size and 1250mm dia. MS outlet pipe are embedded in the masonry portion of the dam.
3. Raw water connecting main: Raw water connecting main of 1250mm dia MS pipe is laid from outlet of dam to raw water sump of length 600m.
4. Raw water sump and pump house: Raw water sump and pump house constructed in R.C.C.
5. Raw Water Pumping Machinery: Total 5 numbers of 750BHP were installed including 2 stand by.
6. Raw water rising main: 1422mm outer dia. MS pipe around 23.00km in length laid from sump to BPT.
7. Break Pressure Tank at Ner Pinglai Gad of capacity 8 lakhs litre.
8. Raw water gravity main of 1500mm dia PSC pipe of length around 31km laid from BPT at NerPinglai Gad to WTP at Taovan, Amravati.

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9. Water treatment plant: 95 MLD old treatment plant and work of 61 MLD plant is ongoing under Amrut Abhiyan.
10. Transmission Mains: Transmission mains are laid from MBR at Tapovan WTP to 24 ESR/GSR ranging from 1600mm dia to 600 mm dia. DI/PSC pipeline approximate length 19.33km and are working flawlessly.
11. Distribution system: Distribution system includes various types of pipe viz. CI/DI/PVC/AC/HDPE material and of diameters ranging from 400mm to 80mm approximate length 350 km.

Necessity of Scheme under Amrut Abhiyan:
Meanwhile from year 1994 Amravati city undergone huge development majorly horizontal development. Due to vast development, due to increasing population and in new areas it became important to augment the scheme for future requirement. The scheme was proposed with base year 2018 and intermediate year 2033 and Ultimate year 2048 with 135 lpcd. It was noticed from Population forecast for the year 2033 and 2048 that the Ultimate year demand for the year 2016 calculated for old scheme (1994) which was 156 MLD was redundant because forecasted population for the year 2016 (as per old scheme was not achieved). Thus the new scheme under Amrut was proposed. Only with 156 MLD capacity for intermediate stage year 2033

As existing WTP capacity is 95 MLD, it was proposed to be augmented to 156MLD from 95MLD and new conventional WTP of capacity 61 MLD was proposed. In this scheme additional Capacity ESRs were proposed to cater the demand of intermediate year 2033 which will be 156 MLD and additional leading mains and distribution system was designed for ultimate year 2048 as per the records available. The following works were included in Amrut Abhiyan so that people in new locality will get benefit of water supply scheme.

1. Replacing, damaged existing Air valve Isolating 200 mm dia sluice valve by C.I. PN 1.6 rating Glandless new sluice valve on 1422 mm dia M.S. rising main from H/W Simbhora to BPT @ Nerpinglai, 1500 mm dia PSC G/M from Nerpingali to WTP Tapovan:- In this work 112 Air valves and sluice valves are to be replaced with tamperproof Air valves to avoid leakages and NRW.

2. Designing Providing & constructing & Commissioning conventional Water Treatment Plant of Cap. 61 Mld at Tapovan:- In this work 61MLD capacity WTP is proposed to achieve 156MLD capacity for which the Headworks is designed.

3. Lowering, Laying and Jointing Transmission Main for Connecting New proposed ESR:- In this work nearly 16km DI pipeline of various diameter to serve the newly built ESR is included.

4. Designing and constructing RCC Ground service reservoirs of various capacity & RCC Elevated service reservoir of various capacity & staging heights in Amrvati city: In this work 9 ESR and 2 GSR of capacity 1 to 2 ML design and construction work is proposed.

5. Providing, Lowering, Laying and Jointing D.I/ H.D.P.E. Pipes 90 mm dia to 400 mm dia. for replaces pipe line in Distribution System IN ALL ZONES: In this work, nearly 260km old existing pipeline of PVC/AC/GI pipeline replacement work is proposed. The pipelines are replaced with HDPE pipes and the service connections of existing consumers are also shifted to new pipeline.

6. Providing, Lowering, Laying and Jointing D.I/ H.D.P.E. Pipes 90 mm dia to 400 mm dia. for proposed & extended area in Distribution System IN ALL ZONES: In this work, nearly 251km pipeline of HDPE material is proposed for new areas.

7. Repairs to old existing RCC ESR at various places in Amravati city: In this work repairs to existing RCC ESR are proposed such as Chain link fencing, coloring, water level indicator, lightening arrester etc. are proposed.

8. Raw Water Pumping Machinery: In this work, old existing 750HP pumps at Simbhora Pumping Station were replaced by new 900HP pumps 5 Nos to enhance the pumping capacity to 156MLD.

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II. LITERATURE REVIEW

Dr. G. Venkata Ramana, Designed the water distribution network with using EPANET software. To design the network is „chowduru of proddaturu Mandal in YSR Kadapa district of AP in INDIA. Finally, he got the data is 53 pipes of same materials,49 junctions,1 tank and 1 source reservoir from which water is pumped to the elevated service reservoir. He estimates 2031 population and designed.

Bhavana K. Ajudiya, Designed the water distribution system for rural areas with using LOOP software. This paper is helpful to water supply engineers are facing the problems of designing new distribution network in developed rural areas. To design network in "sokada" village in Gujarat state.

Andrea Bolognesi, proposes a new modal named genetic heritage evolution" by stochastic transmission GHEST, a multi population evolutionary strategy like algorithm applied to the design of water distribution network.

A.T. Adeniran and M.A. Oyelowo, Designs the W.D.N with using "EPANET" software. In this paper to design the area is the university of located in the mainland of the city of Lagos in the south western Nigeria. He analyses the area and estimate the population of future. In this paper to includes the hardy cross method. He done the design with the computer-based software of EPANET. He collected data about area. Area like population data, water supply records, general layout map of the university.

He designed the pipes for water supply he design the W.D.N with based upon the population demand, fire demand, minor losses and uncounted for water, finally he designed the water distribution network.

Design of Continuous Water Supply System by using Watergems, Dhumal, et. al., (2018) has studied continuous water distribution network i.e. 24 x7 water supply to every consumer throughout the year using with Watergems software. Now a days, the concept of continues water supply has generated significant interest in India due to its advantages over intermittent system of water supply. Author suggested that Watergems is very effectively design tool for design a continuous water supply system than the manual process and it required minimum time and gives accurate results within short period. Also it optimizes the distribution network on the basis of performance and cost.

Analyzing the existing water distribution system of Surat using Bentleys Watergems: Dilip Babubhai Paneria et al (2017), In this study, the existing water distribution system is simulated through construct of a model using Bentley Water GEMS. It helped in analyzing the entire network system, visualized the effects of constituent components and parameters as well as the pressure at end node is detected low, that shows the consumer near the reservoir having more advantages of water than the one that resides away from the reservoir.

A Model for transforming an intermittent into a 24x7 water supply system: Dr. Sanjay and V. Dahasahasra (2015), In this case-study, the author presents the award winning project undertaken in Maharashtra's Badlapur city for supplying pure drinking water round the clock. It is unique not only because it is the first such attempt in India but also because of the methods adopted. Water is indispensable for life but is finite and therefore precious. Serving pure and potable water to the dense populations in developing countries, especially in India, is a daunting task. According to the World Water Development Report, 1.1 billion people worldwide do not have access to safe drinking water. This figure is expected to touch 2 billion by 2050. 1.6 million die every year due to diseases related to poor sanitation and polluted water supply and 160 million are infected with Schistosomiasis while 133 million suffer from high intensity intestinal helminthes infections.

Design of Optimal Water Supply Network and Its Water Quality Analysis by using WaterGEMS Sajedkhan S. Pathan and Dr. U. J. Kahalekar (2013), In this paper design of water supply network duly considering optimization in addition to the cost minimization, minimum head requirement and minimum chlorine requirement is presented. A design is obtained duly considering minimum and maximum head and velocity criteria in order to determine the actual supply form each node to all consumers. In this paper a part of Aurangabad city is designed and its water quality analysis is done by WATERGEMS software. In this paper WATERGEMS software is used for obtaining optimal design of water supply network of a part of Aurangabad city. With the help of WATERGEMS software design of optimal water supply network and its water quality analysis is done with achieving objective of minimizing the overall cost while meeting the water demand requirements at sufficient pressures for specified maximum discharge over a long period of

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time. The software is also used for solving problems in existing network and also in expansion of existing water supply network

Arjun Kumar, Studies about design the WDNS with fulfill the water demand of the continuously growing population .it is essential to provide the sufficient and uniform quantity of water through the designed network of pipes. The author designed the WDNS in kathgarh in Himachal Pradesh. According to that state the water consumption individual person is 70l/p. the author estimated the population in future years with using of arithmetic, geometric and incremental increased methods. The EPANET is used to estimate the rods, evaluation, and number of pipes and demand of the area. He estimates the peak hour for water supply which is designed both gravity and pumping system.

Basupi and Zoran Kapelan, Deals with importance of flexible WDS design under uncertain future water demand. And to design the WDS was met the adequate pressure. Long term planning WDS requires strategic cost effective and sustainable design intervention investment across the entire planning horizon that is uncertain in nature. In this paper they describe about WDS flexible which is met the all demands. To design the WDS is New York and also to estimate the cost for the design. Methodologies that can identify design interventions that are adoptable to future climate.

OBJECTIVES OF STUDY

1. To forecast the Population of Amravati city for the year 2055 with different method and population for projected area consider with respect to previous data and as per declared by the Maharashtra Jeevan Pradhikarn Amravati.
2. To calculate the demand of water requirement for all City area as per standards.
3. To collect the data of detailed survey (i.e., contour survey for Amravati city area, treatment plant, overhead tanks , city map and city distribution system etc.) from MJP Department Amravati
4. To design of Hydraulic model of water distribution network with appurtenances for Amravati city area.
5. To develop detailed computerized drawings of water distribution network for Amravati city with using of following software i.e ArchGis, Autocad and Watergems etc.
6. Preparation of detailed report of Transmission Main & Distribution network.

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