



Design of Water Supply Network in Gift City

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ABSTRACT

The primary focus of this paper is to mitigate the issues of water supply network in GIFT city. The city spans over an area of 4 sqm which is further planned to be extended. The development of the city is being carried out in phased manner and is envisaged to finish in next 7 to 10 years. Being developed as a model smart city, water supply in the city is also developed as per the requirement from the developer to curb the wastage of water and keeping the sustainability of the city into vision. This has resulted into unplanned extension of water network to feed the temporary construction into the city. This paper focuses on the design of water supply network in GIFT with a view to provide water at all developments and it will be developers' onus to use water. Software used to design water supply network is Bentley WaterGEMS. Scheduling of the project is done in Primavera.

Keywords: GIFT City, Water Supply Network, Sustainability, WaterGems, Primavera

1. Introduction

Water forms important physical environment of humankind and has a direct bearing on the health. As per CPHEEO manual WHO refers to "Control of Water Supplies to ensure that they are pure and wholesome as one of the primary objectives of environment sanitation." [1] With proper planning of the water supply project, quality and quantity of the water supply can be well planned and maintained. Proper designing of the water supply network is necessary to optimize the cost involved in the construction of the project.

The basis of this study is optimizing the time, cost and resources required for designing of the water supply network with an aim to optimize the capital and operational cost of the project while following the required standards.

Planning of the project will be carried out in Primavera or MS Project and the design will be carried out in Bentley WaterGems software.

1.1 About GIFT City^[2]

GIFT City is an emerging global financial and IT services hub, a first of its kind in India, designed to be at or above par with globally benchmarked business districts. It is supported by state-of-the-art infrastructure encompassing all basic urban infrastructure elements along with an excellent external connectivity. Companies from Financial Services, Technology and all other services sector is being targeted as potential occupants within the city. Few of them have already started operations from GIFT City.

1.2 Geographical Conditions: -

GIFT development area lying on the west bank of the river Sabarmati is a part of the North Gujarat Alluvial Plains. So, the slope of water runoff is from East to West towards river. The flow in river is from North to South. The climate of the area is semi-arid and is characterized by a hot summer and general dryness except during the south-west monsoon between the months June and September. The cold season starts from December and lasts till February; the temperature increases from March with May being the hottest month while January the coldest. The average Rainfall in the region is about 635 to 762 mm

1.3 Water Management Study: -

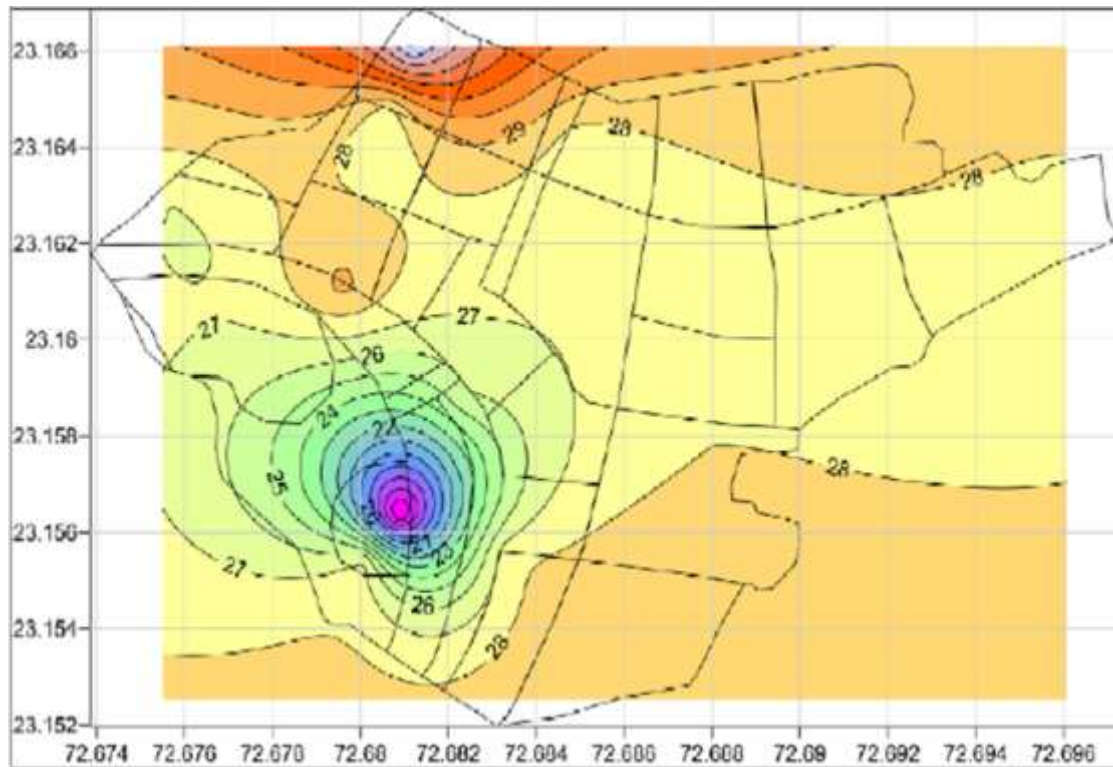
The development of the scale of GIFT will have a substantial water requirement. GIFT area falls under dry weather condition where semi-arid climate predominates. Conventional water supply source of river and lake are not available for the GIFT City area. The rainwater runoff from upstream is collected in the Sabarmati River basin area by small hydro-dams. The groundwater aquifers are unsaturated as they are overlain and underlain by weathered rock with high transmissivity. The density of the tube well also contributes to the over exploitation of groundwater resources by virtue of which the groundwater level has acquired a declining trend.

This demands a comprehensive study and planning approach if the city must grow and prosper. It has been observed historically that cities which has grown and prosper as dynamic towns were on the banks of river or has planned well for their future water demand.

1.4 Ground Water Table Analysis:

The ground water table is a little deeper in the GIFT City area, ranging around 25 – 30 m or even more. Water table depth is deeper in the northern part, while little shallower towards the riverbanks. The water table depth contour map (See Fig 1) is prepared based on the water table depths.

introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 9.5 pt. Here follows further instructions for authors.



1.5 Design Basis

The water supply network is developed considering the topographical survey details and Master plan layout. Piping network details are developed according to the general practice adopted with a view to provide individual connection for water supply to each plot.

Potable water reaches from Nabhoi reservoir to the WTP plant located in the GIFT City via rising main. Water is being treated there and is supplied to the city using conduits laid in the utility tunnels.

This project we are designing the distribution network only. Water is being supplied using the VFD pumps, as the outcome of this project we will be supplying the potable water network design and the head required at the supply point. This data will be used to construct a network of water supply around the city.

1.5.1 Population Data:

Zone-wise population data as received from the GIFT City Planning department is mentioned below:

Land USE	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5
Residential	18,800	30,300	0	68800	0
Utility	2150	500	5225	1910	1600
Commercial	87,700	86,300	34800	17600	105700
Total	1,08,650	1,17,100	40,025	88,310	1,07,300

1.5.2 Water Demand

The potable water quantity is based on total occupancy within the proposed development. Water demand and the area for GIFT City is considered as per the details provided in CPHEEO Manual.

Water demand is calculated based on manual on lpcd basis, which is shown in following table for different sectors,

Particulars	Value	Unit
Residents	150	lpcd
Commercial	45	lpcd
Other	200	Liters per Day
Hospitals	450	Liters / bed / day
Hotels	135	Liters / bed / day

1.5.3 Hydraulic Design on Distribution Network

Total Length of potable water supply distribution network for all zones is 16.3 km considering plot level roads. For design purpose, on account of fittings, minor losses that will occur into the distribution network, 10% of additional length is considered. While the status of existing network is not analyzed – it was assumed with due deliberation with GIFT CL authority that there will be reinstating of the existing network also. But if there are minor changes in the pipe diameter at the existing location then existing pipes to be designed as per new only. There will be no change in the design parameters for the existing and proposed network.

It was also finalized that if the head required at the supply point is more than 30m it would be advisable to have and ESR instead of using VFD pumps. So, the aim of this design is to keep the required head at the supply point below 30 m.

Hydraulic design of Potable water supply network is carried out using Bentley WaterGEMS V8i software. Software methodology is explained below:

Water demand at each node of distribution network will be calculated by using land-use area method. In this method the demand to each node will be allocated based upon the area and density of land-use type polygon. Details of the same are placed in Table 2 and Annexure XX. The table depicts the BUA allotted (and proposed allotment) to each plot and also estimated usage based on NBC Guidelines. These guidelines are used to deduce the number of persons using/occupying the development in the plot. Further as per the land-use pattern the water demand is calculated.

Step-1: for given plot, number of persons occupying the development parcel is attained. Property connections are placed at each plot.

Step-2: Property connections are named as per the plot area. Details of Property Connection are in Section 5.6.4 of the same chapter

Step-3: By using load builder function of WaterGEMS software, Demand is assigned to each property connection to match Table 2

Step-4: based on these nodes wise demand a network will be designed by keeping in view the criteria set forth in manual and as shown in below table,

1.6 Conclusion

Water constitutes an integral part of any city's infrastructure and is considered as one the basic needs. GIFT city being the model smart city and the first operational smart city in India the state of water supply network can be streamlined from the present state. The present situation of the network is an outcome if the city administration's commitment to provide services to the developers in the city. There is a need of change in the administration approval of the connections also. To improve and optimize the water network in the city, a fully functional water supply network must be laid in the utility space available for tunnel. This can later be shifted into tunnel upon construction of tunnel.

Further ahead for the expansion of the city there should be enough provision of the water supply utility corridor in the master plan itself. The master plan itself should be developed keeping in mind the phased development of the city and the commitment to the developers.

References

- [1] IIT KGP, Manual on Water Supply and Treatment By Central Public Health Works and Environmental Engineering Department, Volume 1, pp 57-79 <http://cphceo.gov.in/cms/manual-on-water-supply-and-treatment.php>
- [2] <https://www.giftgujarat.in/>