A Case Study on Existing Status of Water Supply in Ward No.17 of Belagavi City

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Abstract -- Belagavi district is the fourth largest district in Karnataka and is located in northern Karnataka, bordering the states of Maharashtra and Goa. Belagavi has an average rainfall of about 808 mm usually (the state average being 1035 mm) with a substantial water table. As per the 2011 Census, Belagavi City Corporation (BCC) situated in Belagavi Taluka, has a population of about six lakh. The town is situated nearly 2,500 feet (762 m) above mean sea-level. The main source of water for Belagavi is "Rakaskopa" and "Hidkal" reservoirs. The weak monsoon had lead to the deflection of water level at "Rakaskopa" and "Hidkal" reservoirs. The levels at the "Rakaskopa" across the Markandeya river, the main source of water to the city situated 18 km away was hardly one feet above the bed in April 2015. The concerned authorities are drawing 9-10 MGD of water from "Hidkal" dam across Ghataprabha River nearly 51 km from the city to suffice the drinking water needs of the residents. Out of the 58 wards from the Belagavi city the ward taken under the consideration for the case study is the ward No. 17. It consists mainly 5 percent of the Belagavi's area. It has the population of 10,176 according to the 2011 census obtained from the city Municipal Commission Belagavi. Four houses were selected from ward No. 17 and determination of discharge is carried out. Based on the frequency of supply and duration per capita supply was determined as 71.424 lpcd, which is very less considering the needs. The people are deviating to alternate source i.e. groundwater for their water needs. There are 79 open wells and 34 borewells from which an average of 1500 liters are extracted. Supply from the Municipality for the selected area is 169.5 m3 per day and Alternate sources provide an additional 726.79 m3 per day. Total quantity of water used by the people in ward No. 17 is 896.26m3 per day.

I. INTRODUCTION

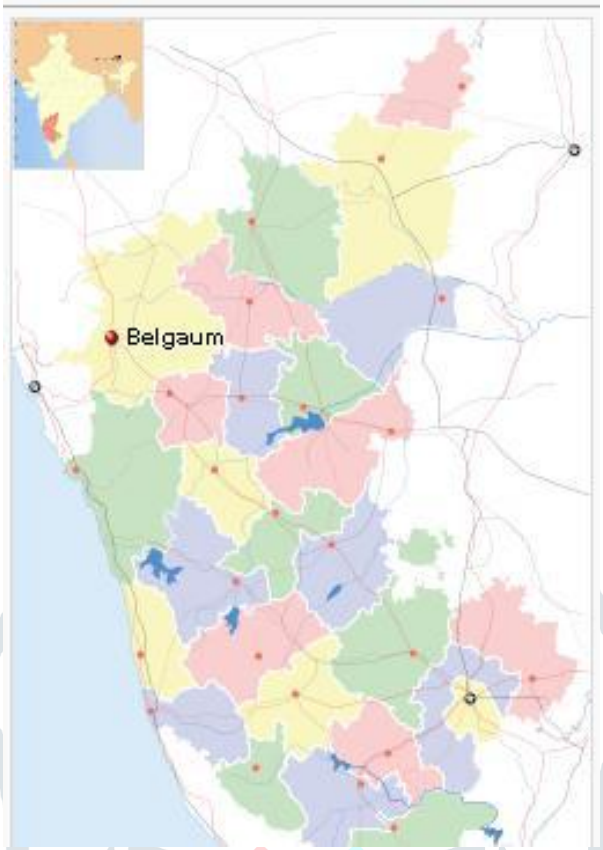
Water supply is the provision of water by the public utilities, commercial organization, community endeavors, or by individuals, usually via a system of pumps and pipes". It provides luxuries, comforts and fulfilling the basic necessity of the life. No life can exist without water. It has been estimated that 2/3rd of the human body is constituted of water further it is necessary that water required for these needs must be good and it should not contain any impurities. Depending on the economic base of the community or neighborhood concerned, the discussion may go on to consider the provision of alternative or reserve water for livestock, small-scale industry, or irrigation; however, the first priority should always be water for drinking, cooking and personal hygiene. Belagavi district is the fourth largest district in Karnataka and is located in northern Karnataka, bordering the states of Maharashtra and Goa. Belagavi has an average rainfall of about 808 mm usually (the state average being 1035 mm) with a substantial water table. As per the 2011 Census, Belagavi City Corporation (BCC) situated in Belagavi Taluka, has a population of about six lakh. The town is situated nearly 2,500 feet (762 m) above mean sea-level. Each of the 58 wards in Belagavi City Corporation has an elected councilor; together they form the City Council.

Table 1 data profile – Belagavi city

Urban Population	610,189
City Area	94 sq.km
No. of Wards	58
No. of Properties	80,456
Length of Road	615 km

The current system of supply of water in Belagavi city is not optimum, it is mainly due to urban infrastructure issues of the city, urbanization, and population. The present storage of drinking water is due to the poor rainfall in the recent years. The main source of water for Belagavi is Rakaskopa and Hidkal reservoirs. The weak monsoon had lead to the deflection of water level at Rakaskopa and Hidkal reservoirs .The levels at the Rakaskopa across the Markandeya river, the main source of water to the city situated 18km away was hardly 1ft above the bed in April 2015. The concerned authorities are drawing 9-10 MGD of water from Hidkal dam across Ghataprabha river nearly 51 km from the city to suffice the drinking water needs of the residents.

Figure 1 Location of Belagavi in Karnataka and India



II. MATERIALS AND METHODOLOGY

Per Capita Demand

It is the annual average amount of daily water required by one person, and includes the domestic demand:

Table 2 Minimum Domestic Water Consumption (Annual Average)

Use	Consumption in liters per head per day
1. Drinking	5
2. Cooking	5
3. Bathing	55
4. Washing of clothes	20
5. Washing of utensils	10
6. Washing and cleaning of houses and utensils.	10
7. Flushing of water closets, etc	30
Total	135 l/h/d

Factors Affecting Per Capita Demand

The annual average demand for water considerably varies for different towns or cities. This figure generally ranges between 100 to 360 lpcd for Indian conditions [4].

Size of the city

The per capita demand for big cities is generally large as compared to that for smaller towns. This is because of the fact that in big cities, huge quantities of water are required for maintaining clean and healthy environments. In a big city, commercial and industrial activities are generally more, thus requiring more water. Affluent rich living in air cooled homes may also increase the water consumptions in cities.

Climatic conditions

At hotter and dry places, the consumption of water is generally more, because more of bathing, cleaning. In cold countries, more water may be consumed, because the people may keep their tap open to avoid freezing of pipes, and there may be more leakage from pipe joints, since metals contract with cold.

Types of gentry and habits of people

Rich and upper class communities generally consume more water due to their affluent living standards. Middle class communities consume average amounts, while the poor slum dwellers consume very low amounts. The amount of water consumption is thus directly dependent upon the economic status of the consumers.

Industrial and commercial activities

The pressure of industrial and commercial activities at a particular place increases the water consumption by large amounts. Many industries required huge amount of water, as pointed out earlier, the industrial water demand is having no direct connection with the population the size of the city, but more industries are generally situated in big cities, thereby increasing the per capita demand for big cities.

Quality of water supplies

If the quality and taste of the supplied water is good, it will be consumed more, because in that case, people will not use other sources such as private wells, hand pumps, etc. Similarly, certain industries such as boiler feeds, etc., which require standard quality of water will not develop their own supplies and will use public supplies, provided the supplied water is up to their required standards.

Pressure in the distribution system

If the pressure in the distribution pipes is high and sufficient to make the water reach at 3rd are even 4th storey, water consumption shall definitely be more.

This water consumption increases because of two reasons.

- People living in upper storey's will use water freely as compared to the case when water is available scarcely to them.
- The losses and wastes due to the leakage are considerably increased if this pressure is high.

Development of sewerage facilities

As pointed out earlier, the water consumption will be more, if the city is provided with 'flush system' and shall be less if the old 'conservation system' of latrines is adopted.

System of supply

The water may be supplied either continuously for all the 24hrs of the day, or may be supplied only for peak periods during the morning and evening. At many places, the intermittent supplies may not give much saving over the continuous supplies, because of following reasons.

- In intermittent supply system, water is generally stored by consumers in tanks, drums, utensils, etc. for non supply periods. This water is thrown away by them even if unutilized as soon as the fresh supplied is restored.
- People have a general tendency to keep the taps open during non supply hours, so that they may come to know of it as soon as the supplies restored.

Cost of water

If the water rates are high, lesser quantity may be consumed by the people. This may not lead to large savings as the affluent and rich people are little affected by such policies.

Policy of metering and method of charging

Water tax is generally charged in two different ways

- On the basis of meter reading (meters fitted at the head of the individual house connections and recording the volume of water consumed.)
- On the basis of certain fixed monthly flat rate.

Modern Methods of Water Supply

There are mainly 2 types

- Branched configuration
- Looped (grid) configuration

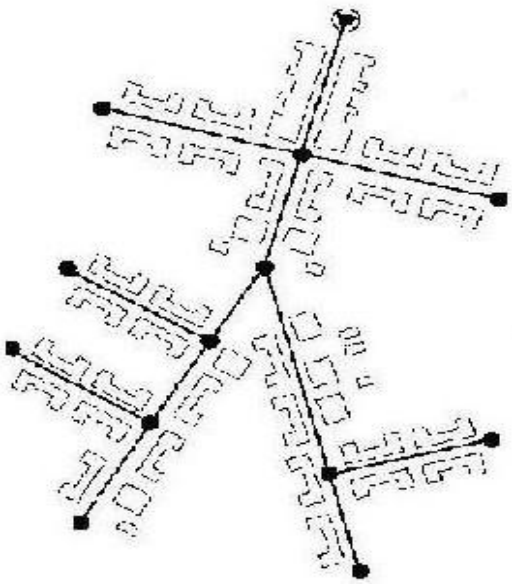
Branched Network

Branched networks are predominantly used for small-capacity community supplies delivering the water mostly through public standpipes and having few house connections, if any. Although adequate, having in mind simplicity and acceptable investment costs, branched networks have some disadvantages

- Low reliability, which affects all users located downstream of any breakdown in the system.
- Danger of contamination caused by the possibility that a large part of network will be without water during irregular situations.
- Accumulation of sediments, due to stagnation of the water at the system ends ("dead" ends) occasionally resulting in taste and odour problems.
- Fluctuating water demand producing rather large pressure variations.

Branched systems are easy to design. The direction of the water flow and the flow rates can readily be determined for all pipes. This is different in looped distribution networks, where consumers can be supplied from more than one direction. Looped networks greatly improve the hydraulics of the distribution system. This is of major importance in the event that one of the mains is out of operation for cleaning or repair [4].

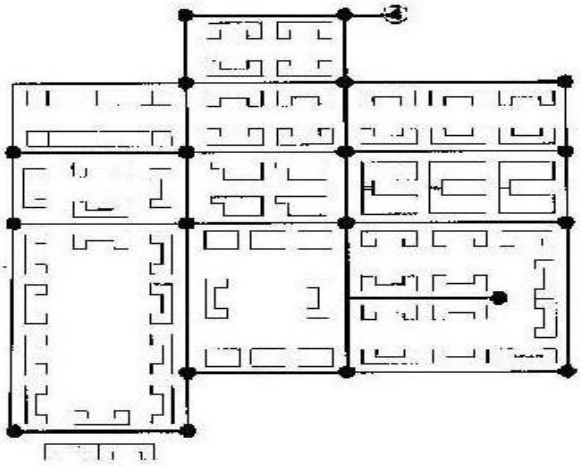
Figure 2 Branched Networks



Looped Network

A looped network usually has a skeleton of secondary mains that can also be in a form of branch, one loop ('ring'), or a number of loops. From there, the water is conveyed towards the distribution pipes and further to the consumers. The secondary mains are connected to one or more loops or rings. The network in large (urban) distribution systems will be much more complex; essentially a combination of loops and branches with lots of interconnected pipes that requires many valves and special parts. To save on equipment costs, over-crossing pipes that are not interconnected may be used but at the cost of reduced reliability[4].

Figure 3 Looped Networks

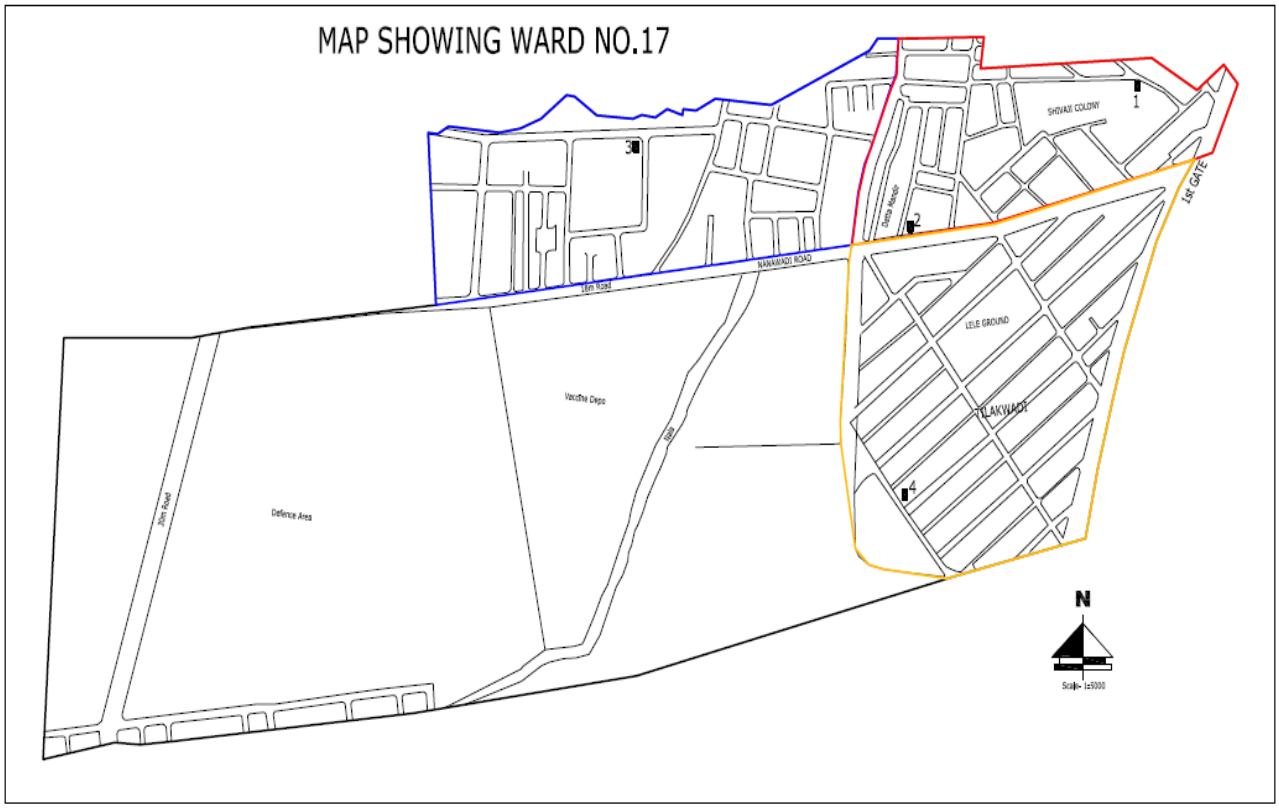


III. RESULTS AND DISCUSSION

Belagavi city has 58 wards throughout and ward No. 17 is considered for the present study. It consists five percent of the Belagavi's area and has a population of 10,176 according to the 2011 census obtained from the city Municipal Commission Belagavi. The number of houses in the selected ward is 1650.The people leaving in this area are middle class people and also includes defense land. The present study is conducted to visualize the deficiency of water supply in ward No. 17 due to severe summer season. The study was conducted over a period of 6 weeks from 15/03/2016 to 08/05/2016. During the study period frequency of water supply is 5 days and for a duration of 2 hours.

The map shows the detailed plan for the selected area for study. Four houses were selected for the determination of discharge from selected area. The positions of the houses are selected in such a way that, it gives a representative values for the entire area. The selected houses are represented as House No.1: S.P. Hosmani, House No.2: M.K. Patil, House No.3: A.S. Taware and House No.4: S. K. Desai.

Figure 4 Map showing ward No. 17



For the determination of discharge a 15 ltr capacity container is used and discharge is determined at every 30mins interval. The average value of the discharge collected is considered as average discharge for the selected house. The details of the discharge determined are as follows:

Table-3-Details of the Discharge on 25/3/16

Date: 25/3/16			**Day: Friday**		
	Trail 1 9:15 am (L/Sec)	Trail 2 9:45am (L/Sec)	Trail 3 10:15am (L/Sec)	Trail 4 10:45am (L/Sec)	Average (L/Sec)
House 1	0.30	0.34	0.37	0.28	0.322
House 2	0.27	0.29	0.30	0.26	0.280
House 3	0.25	0.27	0.27	0.17	0.235
House 4	0.16	0.17	0.18	0.14	0.163
			Total Average		**0.252**

Table-4-Details of the Discharge on 30/3/16

Date: 30/3/16			**Day: Wednesday**		
	Trail 1 9:15 am (L/Sec)	Trail 2 9:45 am (L/Sec)	Trail 3 10:15 am (L/Sec)	Trail 4 10:45 am (L/Sec)	Average (L/Sec)
House 1	0.30	0.34	0.37	0.28	0.323
House 2	0.28	0.30	0.31	0.27	0.289
House 3	0.25	0.25	0.26	0.16	0.165
House 4	0.16	0.17	0.19	0.13	0.165
			Total Average		**0.252**

Table-5-Details of the Discharge on 05/4/16

Date:5/4/16			**Day :Tuesday**		
	Trail 1 9:15 am (L/Sec)	Trail 2 9:45 am (L/Sec)	Trail 3 10:15 am (L/Sec)	Trail 4 10:45 am (L/Sec)	Average (L/Sec)
House 1	0.30	0.31	0.30	0.25	0.293
House 2	0.27	0.28	0.28	0.26	0.274
House 3	0.24	0.26	0.28	0.17	0.241
House 4	0.17	0.17	0.16	0.13	0.159
			Total Average		**0.241**

From the above table :

Total Average = (0.252+0.252+0.241) / 3
= 0.248 l/sec

To Determine the Existing Water Supply (lpcd)
=0.248*60*60*2
=1785.6 liters per 2 hr and Frequency of water is 5 days ,

Hence, Total water supplied per day
=1785.6/5
=357.12 liters per day

Average population in house is 5 (As per survey conducted),

Per Capita Supply of water for ward No. 17:
=357.12/5
=71.424 lpcd

IV. CONCLUSION

Total population of ward No. 17 is 10176 and it is a area comprising of Residential area and defense land. The water supply in the ward No. 17 is 71.424 lpcd, which is far less than the demand. Hence, Open wells and Bore wells acts as a secondary source, which supplement the water demand. Supply from the Municipality for the selected area is 169.5 m^3 per day. House No. 1 has an average discharge of 0.312 l/sec, House No. 2 has an average discharge of 0.281 l/sec, House No. 3 has an average discharge of 0.236 l/sec and House No. 4 has an average discharge of 0.162 l/sec. During the study period of 15/03/2016 to 08/05/2016 it is observed that municipality supply is very less and people in the area are suffering from scarcity of water. Supply from the Municipality for the selected area is 169.5 m^3 per day and Alternate sources provide an additional 726.79 m^3 per day. Total quantity of water used by the people in ward No. 17 is 896.26m^3 per day. During the study period of 15'th March to 08' May it is observed that municipality supply is very less and due to the alternative sources people are managing the water crises. If the alternative sources would have not been there, then the water crises for the area would have been more severe.

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