Research Paper Engineering

Analysis for Different Level of Service in Rural Water Supply: A case Study of Mothala Village, Kutch District, Gujarat

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ABSTRACT

As per the norms of funding, in the rural water supply (RWS) programs of developing countries the choice of Level of Service (LOS) is incorporated at the stage of planning itself by the Consumers. However, in most of the cases the Consumers accept these programs with just the basic LOS in order to minimize their share of contribution. Hence, such schemes can effectively be termed as the scheme planned and designed with the philosophy of supply driven approach (SDA). In such situation it can be mention that the "some for all, rather than more for some" policy leads to "minimum unsatisfactory virtually free service to all". Thus planners should rather strive for basic service to all and higher LOS to those who are willing to pay for more. Cost of RWS for different LOS for Village, starting from basic service to higher service level.

Keywords : Rural water supply, Level of Service, Supply driven approach, Willing to pay

GENERAL

The importance of consumers demand for water and sanitation has been recognized for some years. It is widely accepted at every level that "The Principal lesson is that progress and continuing success depend most on responding to consumer demand."

This perspective and its implication have gained increasing attention with "supply driven approach" and "demand responsive approach". The planners and designers are used to design the rural water supply systems using supply driven principles. Standard consumption rates and minimum levels of services are incorporated in design criteria and used to design systems, which are adequate to meet social or political objectives.

PROBLEM STATEMENT

Rural Water Supply (RWS) project currently rely on Government of India & State Government, who are subsidizing the recurrent costs of supply. This subsidy burden is increasing as more infrastructural projects are implemented. There appears to be insufficient funds available for national or local government to be able to continue this role in the future.

The users are in general dissatisfied with the basic level of service which results in poor payment levels of water charges and many systems are riddled with unauthorized connections leading to the failure of RWS system well before its designed life. It is unlikely that Gram Panchayat of Village Water Supply Committee (VWSC) or Water Service Provider (WPS) have access to sufficient government subsidy to subsidies running costs in the future. Therefore it is imperative that cost recovery through user charges is improved for RWS projects to be sustainable in the future. The Government of India currently subsidize the capital cost of a 'basic level of service' i.e. a communal stand pipe supply. Many users aspire to individual connections and are not willing to pay for a supply perceived to be inferior to the yard connection and or house connections. However, the other users can not afford to pay for even this basic level of service.

The policy and practice adopted by Government of India at present is resulting in RWS projects being implemented in a supply driven approach. This is resulting in poor payment for services and consequently a shortage of recurrent income. A demand-responsive approach is needed in order to design for improved financial and service sustainability. A mixed level of service needs to be supplied to meet the varied demand of users and design should cater for projected changes in demand allowing households to upgrade their level of service. The tariffs need to be based on the actual recurrent cost supply.

STUDY AREA

Mothala Village, Abdasa Taluka, Kutch district of Gujarat State is selected for the Study. The geographic location of the area is 23° 13' north & 69° 8' east. As per District Census Hand Book-2001, the total area of village is 7231.29 hectares out of which 202.35 hectares is Irrigated Land, 2486.60 hectares is unirrigated Land & remaining area is not available for cultivation. The population as per 2011 census is 4010. There are three schools out of which two are primary school & other is secondary school. The main occupation of the villagers is agriculture. The situation of water supply in the village is poor.

DATA COLLECTION

The main source of raw water is surface water of Kankavati River. Water supply in the village is provided from one production well which is situated on the river. The length of existing rising main is 5.0 km and the drinking water is conveyed to the village through yard tap connections. The existing water supply scheme is 30 years old which is near to its end of design period. The condition of the existing distribution system is poor and in most of the area is beyond repairs.

The quality of water from the source is not good. It is informed by Gram Panchayat official and committee members that the water is too hard. People of this village get the water at the interval of 4 to 5 days often. There are only two bore wells in the village. During summer season the tube wells run for 2-4 hours hardly depending upon the rainfall. These sources are not capable of fulfilling the demand of village. The situation becomes grave after march even in the year of good rainfall.

METHODS

The methodologies use to investigate these aims are

- To compare the current supply driven approach with a demand responsive approach
- A case study applying the design principles to village for different levels of service considered in terms of water demand and capital costs of water supply scheme.

DATA REQUIREMENT
- Population.
- Details of existing water supply scheme.

SURVEY
- Existing use of water which provided through Yard Trap Connection.
- Various requirement of water in village.

POPULATION FORECASTING
The water supply project is planned to meet the present requirements as well as the requirements for a reasonable future period termed as design period. Hence it is essential to know the present population of village and also to forecast the future population.

There are various population forecasting methods, out of which the following three methods are commonly adopted in practice which are listed below.

1. Arithmetical Increase Method
In this method it is assumed that population increases at the constant rate. This constant rate is taken as the average increase in population per decade during a number of past successive decades. The future population "Pn" after "n" decades from the year corresponding to latest known population "Po" is given by the expression

$$Pn = Po + n \times c$$

Where, "c" is the average increase in population per decade.

2. Geometrical Increase Method
In this method it is assumed that the percentage increase in population per decade remains constant for each future decade. The value of this constant percentage increase in population per decade may be determined from the known populations of number of past successive decades. The forecasted population "Pn" after "n" decades from the year corresponding to the latest know population "Po" is given by expression

Pn = Po (1 + r) n
Where "r" is the average increase in population per decade. The "r" can be calculated by any one of the methods mentioned below.

If r1, r2, r3, ... rt are the increase in population for each of the past "t" successive decades, then the value of "r" is taken as

r = (r1, r2, r3, ... rt) / t .....Arithmetical Average Method

r = (r1, r2, r3, ... rt)1/t ....Geometrical Average Method

3. Incremental Increase Method
In this method the population of each successive future decade is first worked out by the arithmetical increase method and to these values the average incremental increase per decade is added once for the first future decade, twice the second future decade & thrice for the third future decade and so on.

$$Pn = Po + n \times c + [\{n \times (n+1)\}/2] \times i$$

Where – "c" is the average increase in population per decade & "i" is the average incremental increase per decade.

Water Demand in different Level of Service: Scenario 1 to 5

Table 1: "Levels of Services"

Scenario	Description
1	Basic LOS – All SP Connections
2	Mixed LOS – 25% SP & 75% YT Connections
3	Mixed LOS – 50% SP & 50% YT Connections
4	Mixed LOS – 25% SP & 75% YT Connections
5	Higher LOS – All YT Connections

DESIGN FOR COMPONENT OF WATER SUPPLY SCHEME FOR DIFFERENT SCENARIO
The gross water demand obtain from different scenario, design will be formulate for,

- Intake channel & Jack well
- Rising Main
- Pumping Machinery
- Water Treatment Plant
- Gravity Main
- Elevated Service Reservoir
- Distribution System

ANNUAL COST OF WATER SUPPLY SCHEME
The annual capital cost is calculated by using the following equation Annual Capital Cost = Capital Cost / $[(1+f)/ (i-f)] \times [1 – \{(1+f)/(1+i)\}n]$

Where;
i = Rate of Interest in Percentage
f = Inflation Rate in Percentage
n = Useful Life in Years

RESULTS & DISCUSSION
The following results may be drawn from the study.

(i) The capital cost of the scheme increases with the increase in level of service. It is Rs. 1,05,43,350.00 for basic LOS to Rs. 1,55,91,150.00 for highest LOS (thus increase in capital cost by 47.87%)
(ii) The daily demand of water including demand for floating population, institutional demand and UFW for basic LOS is 3,31,695 Liters in 2042 and for highest LOS is 6,26,535 Liters which is 88.88 % more than demand for basic LOS.
(iii) The average per capita daily demands for all five scenarios are 61,74, 88,101 and 115 Liters.
(iv) The annual capital cost of the WSS per KL of water decreases with increase in average per capita daily demand. It is Rs.6.14, 5.78, 5.25, 5.09 and 4.68 per KL for scenario 1 to 5.

CONCLUSION
- The 90% cost of rural WSS for basic LOS is granted by Government of India and Government of Gujarat and accordingly the WSS are executed as per existing norms. However, many of the consumers are not satisfied with basic LOS.
- The dissatisfaction of consumers results in poor cost recover and at the same time results in increase in illegal connections, which leads to inequitable distribution of water in the village and further deterioration of socio-economic condition of water supply authority in the village.
- Actually, in every village, there is need of mixed LOS, because basic LOS as well the highest LOS does not meet the requirement of all consumers. Many of them cannot afford higher LOS due to their financial constraints however some of them are reluctant to go for basic LOS due to their social status, although they are ready to pay for their higher demand. The progressive deterioration of socio economic condition of village water supply authority leads in reduction in useful life of village WSS due to the malfunctioning and overstressing of system.
- The reduction in useful life of the WSS may be termed as financial loss. Hence, if the WSS is planned and executed for mixed LOS, instead of basic LOS, the system will be certainly more effective as far as its utility and cost is concern.

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