SOURCE PROTECTION FOR COST EFFECTIVE AND SUSTAINABLE RURAL WATER SUPPLY

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1.0 Introduction

Sustainability of water supplies of adequate quality to satisfy basic human needs towards social and economic development has consistently been recognised over the past two decades as a major concern. This concern has been increasingly expressed at various forums. In June, 1997 general assembly of United Nations noted that water would become a major limiting factor in Socio-economic development in view of the growing demand, unless early action was taken. It called for highest priority to be given to the serious fresh water problems facing many countries.

In number of countries, the improvements in some aspects of fresh water development, protection and management have been achieved since the adoption of Agenda 21 principles in 1992. However, the overall progress in the implementation of objectives of Agenda 21 with regard to the application of integrated approaches to the development, management and use of water resources has not been adequate to reverse the trend of increasing shortages and deteriorating water quality.

Degradation of capacity, deterioration of water quality etc. of sources of rural water supply schemes are observed as obstacles for smooth functioning of such water schemes. Various recommendations are suggested so far by the experts to overcome this situation. These are mostly found as technically bias costly measures, such as rehabilitation of the whole scheme, replacing of mechanical components such as pumps and motors or even the augmentation of the schemes. Eventhough, they are important suggestions, implementing such proposals are found to be difficult due to lack of funds and suitable skills. Therefore, alternative appropriate and cost effective measures have to be identified with regard to depletion of the recommended yields of rural water sources irrespective of the type of source.

2.0 Rural Water Sources

Any type of water source can be utilised as a rural water resource. A rural water supply scheme is generally designed to cover a population of 500 – 6000 inhabitants. This covers the villages and the rural centres or small towns as well within an administrative area of a Pradeshiya Sabha as per the newly drafted rural water supply policy. Under village schemes, most of sources are found to be the traditionally used streams, medium scale rivers, springs and protected dug wells. In the dry zone the hand pump tube wells also contribute to this situation. These sources are often easy to manage and the reliability of supply is high and can be categorised as environment friendly.

However, the condition of water sources of small towns is not that fascinating. Small towns are defined in the draft rural water policy as rapidly growing rural centres where pipe borne water is a condition for it's economic development. Selecting a water source for a Small Town Water Supply Scheme is an important activity in which attention has to be focused to number of important factors. Population growth rate of rural centre is much greater and is also subjected to gradual development. It has a more exposure to increasing commercial and domestic mobility hence the demand for drinking water and the improvement of level of service are essential requirements of that society. Therefore, selecting a suitable water source for a Small Town has a severe bearing on such implications and it should also be accountable to the increasing demand in the future.

The tropical climate of Sri Lanka does not allow constant saturation conditions in water availability. Prolong hot weather periods dry off most of surface water sources and reduced the ground water table. Heavy rain increases the flood situations and erodes the earth surface, increasing soil erosion and reducing fertility. Therefore, careful consideration should be given when selecting rural water sources irrespective of the type of the source. Further, demand of the users, required water quality and quantity and uncertain environmental conditions should be given much thought when selecting the source.

2.1 Surface Water Sources

Adequate flow measurements to be done if a surface water source is to be selected as a source for a rural water supply scheme. Flow measurements have to be carried out during the dry period for sufficient duration to ensure the quantity of water that can be abstracted from the source. Obtaining a sufficient quantity of water, continuously with an acceptable quality would be the first step towards the sustainability of scheme. Selecting a suitable point of abstraction may have a bearing on cost of transmission and type of structures to be built to receive the water. Designer should be mindful on the budgetary limitations for

the scheme when selecting the point of abstraction as it could influence the cost effectiveness as well.

2.2 Ground Water Sources

If a ground water source is selected as a water source, different type of measures have to be undertaken to guarantee the reliability. Addition to the quality measurements taken through the sample bottles or containers, adequate measurements of pumping test data to be collected to estimate the quantity that can be extracted. Possible environmental impacts have to be studied before recommending the suitable yield. When ground water is the available option as a source, it would be either shallow or deep water depending on the requirement and the existing conditions. Whatever the type of ground water extraction method used, how the mobility of water to the source from soil strata, availability of different type of soil strata, how saturated they are, how reliable the supply etc. have to studied in detail before finalising a well or another suitable method as the point source for a scheme. Fracture patterns of rock and dynamics of ground water hydrogeology and rock dipping behaviour also to be studied in detail with regard to deep tube wells.

3.0 Source Protection

The objective of the source protection is to implement measures to assure priority usage of water resources to drinking water and to protect quality and sustainability of ground water resources.

Following activities have been identified to achieve the above objective.

- Define appropriate remedial measures to address water quality problems.
- Design a strategy for developing water supply schemes in areas with water quality problems to meet safe drinking water requirement and acceptability (preference) of users.
- Develop technology and other innovative options for solving water quality problems (Fluoride, iron and arsenic) both at village and household land as well as for piped schemes.
- Develop ground water legislation and regulations and develop regulators' capabilities to mange and protect ground water resources.

- Develop institutional capabilities for multi-sectoral water allocation, Planning and Management, including water pricing mechanism and features to prioritise allocation for drinking water and protection/mitigation against pollution.

Drinking water for rural households is facing increasing competition. Most of rural populations of Sri Lanka rely on shallow or deep ground water aquifers for drinking water. The recent expansion and development of industry and agricultural sectors have swelled the demand for ground water based industry and irrigation. The rapid development of industry and irrigation is depleting ground water resources, resulting in dried up sources of drinking water. This clearly has serious social, financial and institutional implications for the rural drinking water supply, especially where alternative suppliers require more complex and expensive technology.

With regard to the rural water supply schemes, source protection would achieve very favourable results. It may drastically reduce the cost of treatment and improve the quality of water which intern guarantee the improved health conditions of the end users and increase their efficiency and productivity. Unlike in major schemes, in rural sub sector, it is very convenient to carryout source protection programmes, as the capacity and cost are very low. Once the source is adequately protected, maintenance of the other components of a water treatment plant also can be reduced. Therefore, it is understood that source protection is an unavoidable component in the rural water supply sub sector if cost effective and sustainable rural water supply schemes are to be developed.

3.1 Management of the Source and Policy Development

The overall economic achievements of recent decades, together with the rapid growth in population, have put increasing pressure on limited fresh water supplies and increased the complexity of development and management of fresh water resources in the region. Moreover, several countries are already facing a water crisis, with serious seasonal water shortages and heavily contaminated and depleted surface water and ground water resources. There is therefore an obvious and urgent need for more efficient management of water resources to avert problems caused by diminishing water availability and the increasing scarcity and growing depletion of water resources.

In many parts of the world, misuse of water resources and poor water resource management practices have already resulted in the depletion of aquifers, falling water tables, shrinking inland lakes and stream flows diminished to ecologically unsafe levels.

Therefore, it is imperative to focus the attention to keep a provision for source protection of rural water supply schemes in the policy development processes.

In the draft National Rural Water Supply Policy this issue is addressed with an outstanding importance and responsibility under the main philosophies governing the Policy. The policy spells out that "RWSS systems should be in harmony with environment without causing negative effects on water resources, over abstraction of water etc." It also quotes the important statements issued under "Agenda 21" as goal of the government of Sri Lanka in the area of water and sanitation as noted below;

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.

- Water has an economic value in its entire competing users and should be recognised as an economic good.

Recent developments related to the water sector of Sri Lanka emerged the development of several policies such as ground water policy, water resources management policy, policy on water rights etc. It is fascinating to notice that all the said policies address the source protection measures with a greater emphasis.

4.0 Community Participation in Rural Water Source Protection

From a national perspective, community participation in public RWSS services has been negligible until recently. The totally government provided water supply scheme systems have created a culture of dependence in which the water supply system is not mainly perceived as common property. The Jathika Sarvodaya Movement, Estate Sector institutions and the World Bank Assisted "Community Water Supply & Sanitation Project (CWSSP)" have offered programmes on water supply with the active community participation since 1980. Community participation has been more successful when it occurs throughout the project cycle and it is noticed that participation is not effective when agencies retain control over the details of implementation or when issues concerning physical infrastructure and technology are addressed more effectively than issues of social organisation necessary for managing the project works. The forms of user participation vary substantially, ranging from representational committees of users to committees dominated by the rural elite and from direct involvement in construction to supervision of contract.

Under the CWSSP, several Small Town Water Supply Schemes emphasis on source protection with a special consideration due to the nature of the source as well as emphasising more on cost effectiveness and sustainability of scheme. Three Catchment Preservation Programme are being carried out by user communities so far in the districts of Matara, Badulla and Ratnapura as source protection measures.

Eventhough, Catchment Preservation of rural water sources seems very straight forward method leading to source protection of rural water source, there are other activities also which could be adopted as water source protection measures depending on the state of the source. In Koslanda Small Town Water Supply Scheme, the catchment leading to the water source is very well maintained but various human activities carried out within the catchment area add polluting elements to the source. User communities identified the prevention of pollutants from reaching the water source should be the appropriate source protection measure other than the extensive catchment preservation programme.

User involvement in source protection activities elaborated very significant results. Some of them are identified as follows.

The Government is still not in a position to implement any source protection programmes alone. Eventhough existing environmental law has provision to prevent occurrence of such polluting activities, there is no suitable observer to watch such incidences. In response, more appropriate observing agents would be those who use the water from such sources for their consumption.

On the other hand, the extent or the capacity of the source also have an important role to play. In major water supply schemes chatchments are spread covering a larger extent. Organising preservation activities in such a large extent is an impossible task with community participation. However, in rural water supply schemes, it seems very feasible and easy to implement. Difficulties or obstacles which can be surfaced during the implementation process under centrally managed system also could be overcome by undergoing community participation for source protection or through the bottom up approach.

5.0 A Case Study

Extensive catchment preservation programme leading to water source protection was carried out in the community managed rural water supply scheme, Kirinda/Puhulwella. Quality improvement in fresh water, reducing the quality fluctuations and reliability of supply are the achievements in Kirinda/Puhulwella RWSS implemented through the active user involvement. Reducing the treatment cost could be reflected in the tariff once house connections are given though the scheme, illustrating the valuable achievement in-terms of cost effectiveness.

5.1 Details of the Kirinda/Puhulwella Source Protection Programme

Location - Kirinda/Puhulwella is a Small town situated in Matara District in Southern Province of Sri Lanka. It is located about 15 km from Matara on Matara – Hakmana Main Road. The town area falls within the administrative division of Kamburupitiya Pradeshiya Sabha and Kamuburupitiya Divisional Secretary Area.

Background - People of Kirinda/Puhulwella are adversely suffered due to lack of water for a long time. Most of the dug wells within and around the vicinity turn dry during the dry period. Sharing of water available in wells by groups of families could be frequently seen in Kirinda/Puhulwella during dry periods.

This situation gives rise to;

- Uncertainty on the reliability of well water
- Water Quality Fluctuations
- Insufficient Quantity of Well Water

With the inception of small town water supply programme under CWSSP, the main beneficiary request was to guarantee the reliability of source, provide continuous supply and improve the quality of water at a reduced cost as the income levels of the recipients are not adequate to bear high tariffs.

Influence of the NGO (Partner Organisations)

- Community mobilisation for Kirinda/Puhulwella was done by an Environmentally based NGO called "Youth Greenlogists". In addition it was responsible to create an environment to develop a Community Based Organisation with in the community.

- As a NGO, their main concern was on environmental protection in addition to water supply.

- In the Community mobilisation activities, "Youth Greenlogists" always paid more attention on protection of water resources, as it was the problem of the area with regard to drinking water. Beneficiaries were inspired by their approach and rallied around the protection of Kirinda/Puhulwella water source.

Catchment Preservation

- Kirinda/Puhulwella small town has to be provided with water by two deep boreholes.
- Preservation of the catchment leading to the Kirinda/Puhulwella borehole sources were identified as the most possible and applicable source protection technique.
- First step towards the source protection is recommending a suitable yield to be abstracted, from the boreholes without adverse effects to the environmental conditions.
- It is clearly indicated that severe environmental and social impacts could be generated if the extraction from bore holes are not done carefully. Therefore, controlling of water abstraction should be done scientifically as well as by implementing adequate catchment preservation methods leading to the improvement of bore hole water.
- Secondly, demarcating the boundary of the catchment which could lead to nourishment of the borehole recharge capacity.

Demarcation of Boundaries - Boundaries of the catchments leading to the BHs have been identified using the possible fracture patterns of the rock.

Activities proposed by the beneficiary community for preserving this catchment is indicted below.

- Controlling the soil erosion in the slopy areas by planting appropriate trees which encourage the rain water seepage in to the ground.
- Controlling the surface runoff by constructing barriers in the hilly areas.
- Educating the people not to uproot or cut down the trees meaninglessly within the vicinity.
- Find the water hating trees growing in the area and replacing with water loving trees.

Participatory Activities - Under the catchment preservation, following activities were identified to carryout;

- Educate the people in the area
  Display the name boards (Awareness), in order to indicate the catchment area.

- Controlling soil erosion in sloppy areas
  By constructing barriers
  By digging trenches to control and to carry the run off
  Improve percolation
  Prevention of massive excavation of earth

- Planting the appropriate trees in a scientific manner

Advantages of Participatory Process Practised at Kirinda/Puhulwella

- User communities and local NGO's have easy access to the individuals. Therefore, land problems could be settled very easily.

At Kirinda/Puhulwella, even though a borehole is situated in a private land, community was able to receive it for the project free of charge. To compensate it, a free house connection is to be provided to the owner of the land. It can also be considered as his contribution towards the project. Under centrally managed system, this could be very time consuming, painstaking and a tedious effort.

- Construction of masonry barriers across the slopes and digging trenches also to be carried out in private properties. Consent of landowners are obtained due to participatory approach to execute preservation activities in the respective properties.

- Dealing with Forest Department directly by the affected community avoids lot of correspondences and meaningless delays. In Kirinda/Puhulwella, CBO/NGO directly channel the Matara District Forest Department and incorporate some of catchment preservation activities in to the Community Forestry programme of Forest Department.

- Maintaining and control the depletion of ground water tables.

- Avoid artificial recharge for acquifers.

5.2 Catchment Preservation Under Centrally Managed Systems

- Under the centrally managed systems, it is very difficult or impossible to carryout preservation activities, as procedures are tedious and complex as well as the extents of catchments are so large or undefined.

- In centrally managed provider systems, catchment preservation could not be a priority as it mostly controlled by demand and supply.

6.0 Conclusion

Experience obtained in the source protection exercise so far elaborate to emerge more meaning-full strategies with regard to cost effectiveness and sustainability of rural water supply schemes. Kirinda/Puhulwella example only provides one model which illustrate how catchment preservation is adopted with beneficiary participation as an effective source protection measure. There can be various other scenarios that can be developed leading to this objectives such as adopting waste water disposal measures in micro catchments, prevention of flowing human excreta leachate in to water bodies etc. It is very clear that community awareness and participation has a vital importance to carryout such activities.

On the other hand, it is also important to build up policy framework keeping the provision for water source protection as an essential phenomenon with regard to cost effectiveness and sustainability of rural water supply schemes. Participatory approach in planning and implementing the source protection activities also need to be addressed.

It is indeed essential to carryout research studies to develop various models on source protection. It is noticed that the model developed to Kirinda/Puhulwella rural scheme could not be effectively implement in Kaltota, Koslanda or Haliela rural water schemes due to prevailing constraints in location, extent of catchment and type of source etc. of those schemes. Therefore, more research to be done in this area to develop effective models on source protection, leading to the sustainable and cost effective rural water supply schemes.

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