SOURCE SUSTAINABILITY ACTIVITES FOR COMMUNITY WATER SUPPLY SCHEMES

Introduction

Ground water is a finite and replenishable resource. A source can be considered sustainable when it delivers designed quantity of safe water in all seasons for the designed life of the scheme. Primarily there are two aspects of the source sustainability - supply side factors and demand side factors. Supply side factors are the geological formation, aquifer parameters, rainfall quantity and intensity, topography and land use patterns. There are natural boundary limits for supply of ground water which can be modified in a limited manner. The demand side factors are primarily linked to water demand and the usage pattern. For ensuring sustainability of sources both supply and demand side issues of water source needs to be considered.

Proposals for ground water based scheme must be identified predominantly in areas demarcated by Water Security Plans as safe watersheds in which potential for ground water development is high. Nevertheless community needs to understand the factors influencing the sustainability of sources. The role of water conservation specialist (hydrogeologists) certification for the identified source about yield and quality is non-negotiable. There have been numerous examples of failure of ground water based drinking water sources. The primary reason is depletion of ground water level and it leads to chemical contamination is due to increased concentration of pollutants. In some situations there are anthropogenic interventions like untreated waste water for habitations/ panchayat and local industries etc. These issues can be mitigated by supply and demand side interventions, proper regulatory and institutional measures and most importantly through community participation. The other important factor in ensuring sustainability is to maintain balance between extraction and replenishment.

Source selection:

The geologic and hydro geologic conditions at a specific site coupled with water security plan of the GP influence the selection of an appropriate well design and drilling method based on water security plan. Prior to the start of source development activities well

inventory of the surrounding habitations and related subsurface tests are usually made to define the geology beneath the site and to assess ground-water flow paths and velocity.

Following conditions favour location of well sites. The conditions may serve as a guide in locating a drinking water source in the given area. However the site selection is always location specific and it is carried out through a technical person like Hydro geologist who assist the site selection process.

• Areas included between two streams near the confluence having soil thickness of over 0.30 meter and weathered mantle or soil cover of over 3 to 5 meters. Applicable in hard rock, sedimentary, and metamorphic areas.

• Alluvial flats close to river or streams in sedimentary and metamorphic formations.

• Depressions in land scape having 0.30 meter or more soil cover and 3 to 5 meters of weathered mantle or alluvial overburden with good catchment and runoff availability. Applicable in hard rock, sedimentary, and metamorphic areas.

• Close to the stream or river banks towards the high grounds, provided the banks are not clayey. Hard rock is not exposed. Applicable in hard rock, sedimentary, and metamorphic areas.

• Zone of luxuriant vegetation with leafy and healthy plants.

• Old course of stream and river channels/buried channels; these are represented by presence of sand and gravels.

- In side loop of streams and river meanderings represented by sand and gravels.
- Damp and moist areas with overburden of at least 3 to 5 meters. Applicable in sedimentary, and metamorphic areas.
- Local alluvial depressions with good catchment or natural recharge conditions.
- Highly fractured and jointed rocks with good recharge and catchments. In hard rock areas open wells in horizontal jointing and bore wells in vertical jointing have good success ratio.
- Upstream of a natural dyke running across a stream. Applicable in hard rock areas and sedimentary as well.
- Flood plains, alluvial fans, deep transported sediments by rivers in sedimentary areas.

- Field observations indicate that fault zones commonly have a permeability structure suggesting they can act as carrier or barrier systems in which along-fault and fault line flow is encouraged and across-fault flow is impeded.

Bore well or Tube well and dug well (abstraction points) site selection is a domain specific skilled job. A systematic survey needs to be carried out for site selection. Hydrogeologists invariably collect field data of 4 to 5 abstraction points already existing in the surrounding. The observed abstraction points may then be posted on top sheet with exact location. The estimated mean sea level at the location of this abstraction point can be assessed from the available data. In the same fashion the bottom (depth) of the abstraction point can also be assessed. The difference of the elevation between the top and the bottom and by appraising the groundwater truth collected during the survey, probable depth of the new source can be estimated along with yield, probable water struck zone, casing requirement etc. In addition to it, a pumping/ aquifer test of the surrounding well also guide good measure of water availability in the area before taking the bore well drilling.

Water budgeting:

Before going for the source siting, the first work that has to be carried out is water budgeting. That is to assess the daily requirement of the community for different seasons. Here it has to be kept in mind that summer attracts maximum demand due to seasonal requirement, social and cultural needs like marriages and other functions and festival. Many places have a challenge of floating population like busy public transport places, bus stand, railway stations, social and cultural pilgrimage and fairs etc. Water budgeting includes, total rainfall, water infiltration rates, water availability demand. The difference between water availability and demand gives you the availability of water, whether it is surplus or in deficit. In the specific context under Jaljeevan mission we are looking at drinking water budget in the following format. Demand, supply and deficit to be mentioned in LPCD.

Ground Water Recharge (GWR) for source sustainability and for establishing a successful Water Supply Scheme for the Beneficiary:

GWR intervention methods are useful and appropriate for Source Strengthening. Ground water is a finite resource. Groundwater regime of any area, region, state, or a country depends upon its physiography, hydrology and hydrogeology and varying rainfall patterns.

There are competing demands for ground water. The major demand for ground water comes from irrigation. (*In many states the major portion of irrigation water demand is catered by ground water. It is almost more than 80% of the total ground water demand. There are demands from increasing population and also industries. These demands have led to unscrupulous extraction of ground water disregarding the sustainability. It has hampered natural ground water recharge and withdrawal balance.)* In this context sizable efforts are required to strengthen and protect community/ BG drinking water sources. Various conventional and unconventional methods are implemented to protect drinking water sources. Rainwater harvesting techniques are also implemented through various initiatives. Some of the source strengthening measures are given below.

Conventional methods : Lose boulder structures (LBS)/Gully plug Gabion structures Earthen Nala bund Underground bund, Sub surface barrier/dyke , RCC check dam, Bore well recharging, Vented gross bars, Contour bunds/terraces, roof water well recharging, pond desilting for source protection

Unconventional **methods**: Rooftop rainwater harvesting

Source strengthening:

The selection and implementation of these methods is defined by local hydrogeology, topography and rainfall. Combination with inputs from hydro-geologist and community ensure appropriateness of these structures.

Quantity of water available

Maximum/ desired quantity of water available

Quality of water

The water should be potable best being free of any contamination as per GoI and state government standards.

Distance of source from the habitation

Any community will prefer source at the closest distance from the habitation. Sometimes technically feasible source may be located at a distance. Hence community are educated/ informed to take a right decision.

Geographical location of source and habitation

Geographical location of source and habitation is very much important particularly in tribal areas where habitation is located on higher elevation and the source is located in a valley or lower elevation.

Economic viability

The source sustainability is also linked to economic viability. It includes cost of the source and the whole system of transportation (WSS) storage and distribution of water. If this cost factor is not acceptable to the community it can create difference of opinion among the stake holders which is objectively addressed.

Land use

Land use pattern is also very much important. Sometimes best source site may be located in a reserved forest or private land and it becomes very difficult to acquire land the execution of the Water Supply Scheme may delay or have to be cancelled. Hence during the course of the finalising the source, land issues will have to be considered.

Activities undertaken for project implementation

- Survey of existing sources in each Grama Panchayath
- Preparation of Grama Panchayath map in GIS (Water Security Plan)
- Topographical survey
- Survey for surface water source sustainability
- Geo-physical survey for ground water sustainability
- Socio-economic survey of each Grama Panchayath
- Conducting gram Sabha in each Grama Panchayath
- Preparation of detailed estimates

GWR proposals to be implemented in the GP for source sustainability

Many of the streams draining through the panchayat are catering only to the water requirements of the inhabitants during monsoon season as they are practically dry throughout the summer months. A large area of the Panchayat along the upper reaches is water scarce after the withdrawal of monsoons. There are many other regions also in the Panchayat where water scarcity is acute. The Water Security prospect map (*prepared by*

integrating various geological, geomorphological, geohydrological , hydrochemical, socio-economic parameters etc using GIS technology so as to include ample scope for further updating and expansion of use in future spatial planning of the Panchayat .) form the basic guideline for locating well sites and recharge structures.

Check dam interventions appropriate to the topography and lithology ensure source sustainability. Moreover it will help in increasing the water table of wells in the vicinity of individual ownership/ houses. The retention capacity within the watersheds gets improved with these interventions, thus scarcity problem is likely to be perennially solved.

Conclusion and recommendations

The Ground Water Recharge initiatives in the GP for WSS will help in source sustainability. The Panchayat will have sufficient water resources to ensure water availability throughout the year.

As demand for water increases, water managers and planners (SLEC) need to look widely for ways to improve water management and augment water supplies. Artificial recharge is one option in an integrated strategy to optimize total water resource management.

It is recommended for the future managers of the water sources in the GP that the recovered water must be monitored carefully to provide assurance that pathogenic microorganisms and toxic chemicals do not occur at concentrations that might exceed drinking water standards or other water quality parameters established specifically for reclaimed water which consider the nature of source water. The protection of both human health and environment are goals in any recharge system, and both require careful attention to system management and monitoring. The use of recharge technologies may have impacts on the environment, and presence of these impacts as well as their magnitude will vary from situation to situation.

Further it is suggested for the future that the best structure to improve the groundwater retention is a subsurface dyke at the emerging point of the micro watershed. Since the valley section of the GP holds only limited overburden material of 4 – 6 m the terrain is suitable for construction of subsurface dykes.

CHECK DAM AT FULL RESERVOIR LEVEL-(IN SUMMER SEASON)