BOARD *for* COMMUNITY DEVELOPMENT *through* EDUCATION

GOVERNMENT OF ANDHRA PRADESH

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VILLAGE WATER BUDGET - WORKSHEET

(Compiled by B.Lakshmikantham, Dy.Conservator of Forests (Rtd) Ph.9704203396)

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OBJECTIVES:

To understand the importance of water as a natural resource

To identify sources and availability of water in a village

To estimate the need of the water in a village

To calculate amount of surplus of deficit of water

To prepare action plan for conservation of water

INTRODUCTION:

Life exists on the earth because of availability of natural resources, viz., Soil, Water, and Vegetation more importantly the water. In order that living beings sustain their life, water is most essential resource. Water availability is the quantity of water that can be used for human purposes without significant harm to ecosystems or other users. Consideration is given to demands from human and ecosystem needs, equitable apportionment of water among uses, and indicators of stress to the water resource.

About 71 percent of the Earth's surface is water-covered, and the oceans hold about 96.5 percent of all Earth's water. Water also exists in the air as water vapor, in rivers and lakes, in icecaps and glaciers, in the ground as soil moisture and in aquifers. 97% of water on earth is found in oceans. 3 % of earth's water is fresh water. 2.5% is locked up in polar ice caps, Glaciers, atmosphere, and soil. Only 0.5% is available fresh water.

Most of the water in an area is obtained from monsoon rains. If this rain water is harvested, conserved and judiciously utilised, there will not be any scarcity of water in an area. Quantity of annual rainfall varies from place to place. It also depends on physiographical features of an area.

Hence it is essential to assess the availability of water in an area, in particular in a habitation or village, to utilise water according to availability. Normally, the water is essential to grow crops, daily human usage, industries, animals, etc.,

Procedure:

Every village has various land uses, like Agriculture lands, Pasture lands, forests, habitation area comprising houses, school, hospital, and other infrastructures. Entire village is bounded by a village boundary. If we observe a Cadastral map or a revenue village map we can observe the area of the village, various land use patterns, within village. Also annual rainfall quantity is available in Milli meters per annum. Total amount of rain water can be computed if we know the area of the village and the quantity of rainfall in a year. Normally the village lands are undulating. Because of undulations and slope of the land the rain water flows from higher point to lowest point and cross the boundary of the village. The rain water that flows on the surface of the ground after the upper layers of soil are saturated , is called 'Run-off ' water. This run off water fills the tanks, ponds etc., existing in the village.

One mm of rainfall in an area of 1 sq.mt is equal to one litre of water.

If one metre height of water is standing in one Hectare of area, then the quantity of water is called one Hectare meter (Ha.M). One Ha.M water is equal to 10,000 Cu.M. It is assumed after various observations that, 10% of the total rain water converts into ground water. 40% goes as run off,

Now let us see one example of a village to calculate the quantity of water, utilisation, surplus or deficit. This is also called Water Budgetting.

1. Area of the village = 2836 Ha.
2. Average annual rainfall = 700n mm
3. Total rain water obtained = 1985 HA.m.
4. Ground water(10%) = 198.5 Ha.m
5. Runoff (40%) = 794 Ha m
6. Evapotranspiration evaporation = 794 Ha.m
7. Soil moisture (10%) = 198.5 Ha.m

Now, we have to calculate the water holding capacities of all water harvesting structures like Check Dams, percolation tanks, Big tanks, ponds, etc., existing in the village. These structure hold the run off water and allow the rest to flow out of village boundary. This surplus or extra run off can be harvested or impounded by taking up new structures.

Suppose the total Water that can be stored in the existing structures = 70.0 Ha.m

Net Run off = 794 – 70 = 724 Ha.m

Available water = 70+198.5 + 198.5= 467 Ha.m

The following table gives the water requirement per annum for various components.

S.No	**Particulars**	**Quantity**	**Unit (Ha.M)**	**Required water (Ha.M)**
1.	Human beings	3381	3.0/1000	10.14
2	Live stock	2081	3.2/1000	6.65

3	Goats and sheep	10889	0.7/1000	7.6
4	Poultry	1717	0.1/1000	0.18
5	Paddy (Ha)	129.14	12/10	154.97
6	Sugarcane(Ha)	0	8/10	0
7	Dry crops(Ha)	1521	1.7/10	258.57
8	Horticulture (Ha)	186.23	2.8/10	52.14
9	Vegetables	85.02	2.4/10	20.4
	Total			510.65

Soil moisture is mostly utilised by rain fed and horticultural crops.

Surplus / Deficit water = Available water – Required water

= 467- 510.65 = - 43.65 Ha.m

Hence there is a deficit of 43.65 Ha.m which can be trapped from run off water by constructing Tanks, check dams, Farm ponds etc.,

Advantages of Water budget:

1). Water budget gives information about the total quantity of water and utilisation within the village

2).The farmers will get information about the water availability, which can be used to assess the crops to be sown.

3). Rainfall is not normal in every year. The rainfall is erratic and uneven. In that case if during drought year farmers raise water intensive crops like sugarcane and paddy, there is possibility of failure of crops, due to drought. Hence during deficit rainfall years, farmers can opt for less water consuming crops.

4). While preparing water budget, farmers can be involved.

5). Water budget helps in planning the number of water harvesting structures, to be taken up in the village, and reduce the run off. These structure help in recharge of ground water.

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GROUND WATER RECHARGE METHODS

(Source: www.geographynotes.com)

This article throws light upon the top nine methods of groundwater recharge. The methods are: 1. Spreading Basins 2. Recharge Pits and Shafts 3. Ditches 4. Recharge Wells 5. Harvesting in Cistern from Hill Sides 6. Subsurface Dams 7. Farm Ponds 8. Historical Large Well across Streamlet 9. Check Dams.

Method # 1. Spreading Basins:

This method involves surface flooding of water in basins that are excavated in the existing terrain. For effective recharge highly permeable soils are suitable and maintenance of a layer of water over the highly permeable soil is necessary. When direct discharge is practised the amount of water entering the aquifer depends on three factors—the infiltration rate, the percolation rate, and the capacity for horizontal water movement.

At the surface of aquifer, however, clogging occurs by deposition of particles carried by water in suspension or in solution, by algae growth, colloidal swelling and soil dispersion, microbial activity, etc. Recharge by spreading basins is most effective where there are layer below the land surface and the aquifer and where clear water is available for recharge.

Method # 2. Recharge Pits and Shafts:

Conditions that permit surface flooding methods for artificial recharge are relatively rare. Often lenses of low permeability lie between the land surface and water table. In such situation artificial recharge systems such as pits and shafts could be effective in order to access the dewatered aquifer. The rate of recharge has been being found to increase as the side slope of the pits increased.

Unfiltered runoff water leaves a thin film of sediments on the sides and bottom of the pits, which require maintenance in order to sustain the high recharge rates. Shafts may be circular, rectangular or square cross-section and may be back filled by porous materials.

Excavation may be terminating above the water table. Recharge rates in both shafts and pits may decrease with time due to accumulation of fine-grained materials and the plugging effect brought by microbial activity.

Method # 3. Ditches:

A ditch is described as a long narrow trench, with its bottom width less than its depth. A ditch system is designed to suit topographic and geological condition that exists at the given site. A layout for a ditch and flooding recharge project could include a series of trenches running down the topographic slope.

The ditches could terminate in a collection ditch designed to carry away the water that does not infiltrate in order to avoid ponding and to reduce the accumulation of fine materials.

Method # 4. Recharge Wells:

Recharge or injection wells are used to directly recharge the deep-water bearing strata. Recharge wells could be dug through the material overlaying the aquifer and if the earth materials are unconsolidated, a screen can be placed in the well in zone of injection.

Recharge wells are suitable only in areas where thick impervious layer exists between the surface of the soil and the aquifer to be replenished. They are also advantageous in areas where land is scarce. A relatively high rate of recharge can be attained by this method. Clogging of the well screen or aquifer may lead to excessive build up of water level in the recharge well.

Method # 5. Harvesting in Cistern from Hill Sides:

In this method construction of small drains along contours of hilly area are done so that the runoff in these drains are collected in a cistern, which is located at the bottom of a hill or a mountain. This water is used for irrigation or for drinking purpose and the water is of good quality.

Method # 6. Subsurface Dams:

Ground water moves from higher-pressure head to lower one. This will help in semi-arid zone regions especially in upper reaches where the ground water velocity is high. By exploiting more ground water in upper reaches more surface water can be utilized indirectly, thereby reducing inflow into lower reaches of supply. Ground water is stored either in natural aquifer materials in sub-surface dams or in artificial sand storage dam.

Method # 7. Farm Ponds:

These are traditional structures in rain water harvesting. Farm ponds are small storage structures collecting and storing runoff waste for drinking as well as irrigation purposes. As per the method of construction and their suitability for different topographic conditions farm ponds are classified into three categories such as excavated farm ponds suited for flat topography, embankment ponds suited for hilly and ragged terrains and excavated cum embankment type ponds.

Selection of location of farm ponds depend on several factors such as rainfall, land topography, soil type, texture, permeability, water holding capacity, land-use pattern, etc.

Method # 8. Historical Large Well across Streamlet:

If any historical wells are located near the streamlet, then allow the water into the well from streamlet by connecting drains. In this case the historical wells act as a recharge well so that ground water can be improved.

Method # 9. Check Dams:

Check dams are small barriers built across the direction of water flow on shallow river and streams for the purpose of rain water harvesting. The small dams retain excess water flow during monsoon rains in a small catchment area behind the structure.

Pressures created in the catchments area send the impounded water into the ground. The major environmental benefit is the replenishment of nearby ground water reserves and wells. The most common case of check dams is to decrease the slope and velocity of a stream to control erosion.