RAIN WATER HARVESTING AND AUGMENTATION OF WATER RESOURCES FOR SUSTAINABLE LAND AND ECOSYSTEM MANAGEMENT

A SLEM BEST PRACTICE

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Indian Council of Forestry Research and Education has documented Rain Water Harvesting and Augmentation of Water Resources for Sustainable Land and Ecosystem Management as one of the best practices for sustainable land and ecosystem management (SLEM) under the World Bank funded SLEM Project.

In rainfed areas, agriculture depends substantially on ground water and hence various water conservation and storage practices have been employed traditionally. Locally constructed reservoirs/ farm ponds/ village ponds known as talab, pokhar, johad, dhabri etc. have played an important part in conserving ground water for replenishing soil moisture and sub-surface water. These practices have played an indispensable role in exploiting rain water to fulfil water requirements for the crops in the arid season, thereby increasing the productivity. This assumes more importance in the states of Chhattisgarh and Madhya Pradesh, where agriculture is mainly rainfed.

The major benefits of rainwater harvesting structures are:

- To provide lifesaving/supplemental irrigation to crops and plantation
- To improve moisture status of the soil profile and augment groundwater recharge
- To reduce soil erosion and help in peak flood retardation
- To meet water demand for domestic, animal and other uses

Selection of site for construction of farm ponds

The selection of a site in a participatory mode depends on availability of suitable site for pond location and farmers' willingness to part with a portion of the land for pond construction and to share harvested water with neighbours.

Criteria for the location of pond

The pond should be located in the area with well-protected (treated) catchment for arresting rapid siltation. The command area near the pond should be free of salinity/alkalinity and the site should require little or no land shaping around the pond. For drinking water, it should be near to village. For supplemental irrigation, the pond should be located on a site such that it benefits maximum number of farmers. Pond should be located on one side of the watercourse to avoid rapid siltation.

Types of Farm Pond

As per the method of construction and their suitability to different topographic conditions, there are three types of farm ponds:

1. Excavated farm ponds for flat topography;
2. Excavated cum-embankment ponds in mild sloping topography; and
3. Embankment farm ponds for hilly and rugged terrain.

In the regions with flat to mild sloping topography, generally excavated type ponds are more suitable.

Design Criteria of Farm Pond

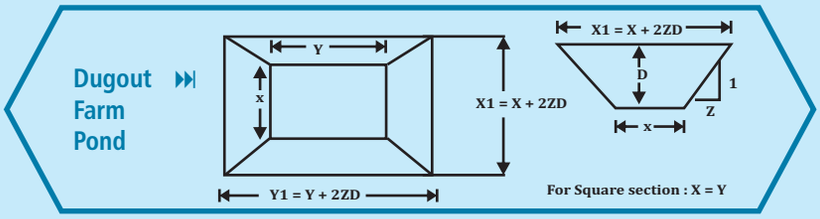
The design of the pond depends upon (i) Storage Capacity, (ii) Shape, (iii) Dimensions, (iv) Inlet and (v) Outlet

(i) The storage capacity of the pond is governed by the purpose for which the pond is created. The pond capacity would depend on the size of the catchment, rainfall and various other factors like soil, topography, adjoining land use etc.

(ii) Shape of the farm ponds are of two types viz. square and rectangular. However, the square pond is most commonly adopted having less evaporation and seepage area compared to a rectangular pond and it is easy to construct.

(iii) Dimensions (depth, top and bottom widths, side slopes)

Side slopes: The side slopes are decided by the angle repose for the sub-soil. Where the soils are very deep (more than 90 cm), the angle of repose for soils may also have to be considered. The constant action of standing water may require relatively flatter side slopes to avoid slippage due to saturation. Generally, the side slopes of 1.5:1 is considered best.



For example, for a pond of capacity of 500 cubic meter and 2.0 m depth, the bottom side of each section (X) is of 12.5 m and the top side of square section (X1) would be 18.5 m.

(iv) **Inlet:** The inlet is designed as a chute spillway for diverting the runoff into the pond in a controlled manner. The entry section can be designed as a rectangular broad crested weir.

(v) **Outlet:** The outlet is constructed as a rectangular or square channel and position of outlet should be a little lower than the elevation of the inlet to avoid backwater effect. The discharge capacity of the outlet can be assumed to be half that of the inlet capacity at peak rate of runoff.

Construction of Farm Pond

Construction of an Excavated Farm Pond involves the following works

(i) Site clearing: The area, where the pond is to be finally dug should be cleared to an extent of about 20 m from all sides after demarcation. All bushes, shrubs, stumps, thorns and other unwanted materials like roots etc. should be removed.

(ii) Levelling: As there will be depressions and undulation, it may be necessary to plough the area and harrow it to get a more or less even topography. This will facilitate easy calculation of earthwork quantities.

(iii) Demarcating pond area: The farm pond site is demarcated by driving pegs to indicate the four corners and if necessary the sides can be extended beyond the actual site of the pond.

(iv) Establishing reference level: Spot level at the corners and at the midpoint is taken with reference to a nearby temporary benchmark. The average of these levels is transferred on to a permanent/semi-permanent object at an approximate distance of about 15-20 m from the pond site.

(v) Stepping method of constructions: Since it will not be possible to have the cutting exactly to the trapezoidal shape, a segment wise construction known as stepping method is adopted during the time of actual excavation. These steps like formation can be subsequently cased out to get the required shape and designed side slopes.

(vi) Formation of Spoil Bank: Since considerable quantity of spoil would be obtained from such dug out ponds, its disposal should be done properly. The existing bunds and internal farm roads can be strengthened using the excavated soil. The excess soil can be placed on the field after making a bund around the pond.

Maintenance of Farm Ponds

- Periodic de-silting to restore the original storage capacity is required. The extent and periodicity of de-silting would depend on the volume of silt accumulation and decrease in the storage capacity
- Due care should be taken to maintain the inlet and outlet
- Breaches and rill formations in the spoil bank should be attended to and plugged promptly
- Barbed wire fencing may be provided around the pond to prevent human beings and animals from slipping or falling into the pond. Bio-fencing with local materials is another alternative
- Depth gauges are installed to know the depth of water and the volume of water stored in the pond. Repainting and rewriting the scales should be done periodically to maintain them
- Periodic efforts should be undertaken to clear the aquatic weeds
- The areas around the farm pond could also be developed for growing horticultural and vegetable crops, which would further make the system more viable. Thus, water harvesting and runoff recycling helps to stabilize and support a large proportion of agriculture in the semi-arid tropics. It further brings awareness in the farmers on the benefit of conserving the twin natural resources i.e. soil and rainwater

Indian Council of Forestry Research and Education (ICFRE), Dehradun as Ecosystem Services Improvement Project Implementing Unit (ESIP-PIU) is building the capacity of the local communities of ESIP project areas of Chhattisgarh and Madhya Pradesh for upscaling of Rain Water Harvesting and Augmentation of Water Resources for Sustainable Land and Ecosystem Management: A SLEM Best Practice.

Brief About ESIP

The World Bank funded Ecosystem Services Improvement Project (ESIP) supports the goals of the Green India Mission by demonstrating models for adaptation-based mitigation through sustainable land and ecosystem management and livelihood benefits. ESIP will introduce new tools and technologies for better management of natural resources, including biodiversity and carbon stocks. Main components of the project are: strengthening capacity of government institutions in forestry and land management programs, improving forest quality, and scaling up of sustainable land and ecosystem management (SLEM) best practices. ESIP is being implemented in the states of Madhya Pradesh and Chhattisgarh by Indian Council of Forestry Research and Education, Chhattisgarh State Forest Department and Madhya Pradesh State Forest Department under the overall direction of Ministry of Environment, Forest and Climate Change, Government of India.

Brief About ICFRE

Indian Council of Forestry Research and Education (ICFRE) is an autonomous body of the Ministry of Environment, Forest and Climate Change, Government of India. It is an apex body in the national forestry research system that promotes and undertakes need based research, education and extension in the forestry sector. It has a pan India presence with its 9 research institutes (Arid Forest Research Institute, Jodhpur; Forest Research Institute, Dehradun; Himalayan Forest Research Institute, Shimla; Institute of Forest Biodiversity, Hyderabad; Institute of Forest Productivity, Ranchi; Institute of Forest Genetics and Tree Breeding, Coimbatore; Institute of Wood Science and Technology, Bengaluru; Rain Forest Research Institute, Jorhat and Tropical Forest Research Institute, Jabalpur) and 5 centers located at Agartala, Aizawl, Prayagraj, Chhindwara and Visakhapatnam. Each institute are directs and manages research, extension and education in forestry sector in the states under their jurisdiction.

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