

CHAPTER - VIII

**RECOMMENDED WATER HARVESTING AND
WATERSHED MANAGEMENT WORKS**

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8.0 AGRO-CLIMATIC ZONES

Based on the requirements of agricultural development, the country has been demarcated into 15 agro-climatic regions. However, for promoting rainwater harvesting with particular reference to augmenting drinking water availability in rural areas, these regions have been slightly modified and an additional region viz. "Himalayan foot hills" has been added. Broad features of these 16 regions and the recommended water harvesting measures for each region are discussed in the following paras.

8.1 HUMID NORTHWESTERN HIMALAYAS

This region comprises hilly areas of Jammu & Kashmir, Himachal Pradesh and Uttaranchal. This cold region has skeletal soils, podsollic soils, mountain meadow soils and hilly brown soils. The terrain is highly undulating with steep slopes. The soils are generally silty loam and are prone to erosion. Landslides are common in denuded hill slopes especially where there are excessive human settlements with good network of roads and hill tracks. Water harvesting measures recommended for the region are:

- (i) Roof water harvesting
- (ii) Diversion of perennial springs and streams water in storage structures
- (iii) Village ponds
- (iv) Collection from hill slopes

8.2 HIMALAYAN FOOT HILLS

The region is characterized by slope-wash material comprising loose soil deposits underlain by boulders and pebbles. These deposits generally have moderate to high percolation rates where the soil cover is thin. In topographic lows the thick soil cover provide scope for dug ponds with fairly good water retention capacity.

Often the ground water gradient is steep which is conducive to quick drainage of ground water into nearby streams. The region covers foothill areas of Jammu & Kashmir, Himachal Pradesh, Punjab and Uttaranchal in the west and parts of West Bengal, Assam and Arunachal Pradesh in the east. The recommended structures are:

- (i) Collection from hill slopes
- (ii) Village ponds
- (iii) Contour trenching

8.3 HUMID HIGH RAINFALL NORTH EASTERN ZONE

The region is characterized by complex geological formations with rocks either exposed on surface or under moderately thick soil cover. The soils are generally fragile and prone to severe erosion. The region covers large areas of Sikkim, Darjeeling hills, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Tripura, Mizoram, Assam, and Jalpaiguri and Cooch Behar districts of West Bengal. These are high rainfall areas with high surface runoff. In some areas because of adverse topography and hydrogeological conditions, ground water development is not techno-economically viable while in some others the habitations do not have convenient access to the potential ground water sources, which are usually found in topographic lows like stream beds and intermontane valleys. The recommended measures are:

- (i) Roof top harvesting
- (ii) Diversion of perennial springs and streams in storage structures (tanks)

8.4 HUMID ASSAM BENGAL PLAINS

The region covers parts of the lower Gangetic plains comprising alluvium with diverse mix of sand, silt and clay. The main topographic features of the region are the fluvial plains, and lower and upper alluvial terraces. The fluvial plains are characterized by abandoned river channels, ox-bow lakes and the land surface carved by numerous perennial and seasonal streams. Though the region receives good rainfall, there are often drought like situations due to long gaps between successive spells of rainfall especially in areas drained by small seasonal streams. The natural drainage channels and streams flowing through the alluvial terraces severely erode their banks. Because of excessive agricultural activity coupled with unscientific land management the topsoil is prone to erosion.

The ground water usually has excessive iron and mica. Excessive arsenic is found in about 1,000 habitations in West Bengal. However, ground water development in the region especially in Assam is constrained by, inter alia, lack of reliable power supply. The recommended water harvesting measures are:

- (i) Tanks
- (ii) Check dams/ Anicuts
- (iii) Gully plugging
- (iv) Contour bunding

8.5 SUB-HUMID AND HUMID SUTLEJ-GANGA ALLUVIAL ZONE

The region covers parts of Punjab, Haryana, Uttar Pradesh and Bihar and is served by middle reaches of the Sutlej basin and the lower and middle reaches of the Ganga basin. The eastern part of the region covering plains of Bihar and eastern Uttar Pradesh receives good rainfall but due to its uneven distribution in space and time, some areas face sub-humid conditions and even drought like conditions in the years of below-normal rainfall. The southern part of the Sutlej basin has sub-humid climate.

During the last 5 decades the region has seen large-scale development of ground water for irrigation. This has resulted in lowering of ground water table in many areas. The problem of

drinking water supply is, however, mainly because of non-sustainability of the water sources for various socio-economic reasons. The recommended water harvesting measures for the region are:

- (i) Ponds
- (ii) Check dams
- (iii) Gully plugging
- (iv) Contour bunding

8.6 NORTH-WESTERN SEMI-ARID AND ARID ZONE

This zone consists of western Rajasthan, which is characterized by hot sandy desert, erratic rainfall, high evaporation, absence of any perennial rivers and scanty vegetation. Because of low rainfall and high evaporation the natural ground water recharge is negligible. The ground water table in most places is at considerable depth. Potable ground water at reasonable depths is found at a few locations.

Agriculture in the area, except the command of the Indira Gandhi Nahar Pariyojna (IGNP) is rainfed. There is extensive ground water exploitation for drinking water supply in rural areas. The rainwater harvesting measures recommended for this zone are:

- (i) Nadi/ Talab
- (ii) Tanka
- (iii) Khadin
- (iv) Percolation tanks
- (v) Anicuts
- (vi) Gully plugging
- (vii) Contour bunding

8.7 CENTRAL SEMI-ARID VINDHYAN ZONE

This zone comprises southeastern districts of Rajasthan, southern districts of Uttar Pradesh and central parts of Madhya Pradesh. The area has diverse topography with ravines in some parts of Narmada Valley and hills in others. Nearly one third of the land is not suitable for cultivation. Irrigation and cropping intensities are low. While the rainfall in areas lying in Madhya Pradesh is fairly good being of the order of 900 mm, it is as low as 350 mm in the areas falling in Rajasthan and Uttar Pradesh. Because of the predominantly hilly terrain the monsoon runoff is high which causes extensive soil loss from hill slopes and erosion of riverbanks. Ground water movement from higher levels to lower levels is significant which is evident from the depletion of water levels in wells and hand pumps especially those along stream banks. The water harvesting and watershed development measures recommended are:

- (i) Ponds
- (ii) Check dams
- (iii) Contour bunding
- (iv) Gully plugging
- (v) Sub-surface dykes

8.8 HIGH RAINFALL HIGH RUNOFF CHHOTANAGPUR PLATEAU

This area is characterized by soils of medium to shallow depths and undulating topography. Because of steep slopes, high rainfall intensities and long rainy spells the surface runoff is high which causes extensive soil loss due to rill and gully formations and stream bank erosion. The problem is further compounded by unscientific agricultural practices. The region covers the entire Jharkhand state and adjoining hilly areas of Bihar, West Bengal and Orissa. Because of adverse topography and pattern of human settlements in the hilly terrain potential ground water sources are not within convenient reach of all the rural population. Improvement of watersheds and local rainwater collection and storage are considered necessary to improve water availability. The recommended water harvesting practices, therefore, are:

- (i) Tanks/ Ponds
- (ii) Check dams/ Anicuts
- (iii) Gully plugging
- (iv) Contour bunding

8.9 MALWA PLATEAU & NARMADA BASIN

The region forms a major part of peninsular India with an annual rainfall of about 900 mm. The predominant soil type is deep black soil. Because of low permeability of soil natural ground water recharge is mainly through fissures and joints in exposed rocky strata and through streambeds. The water harvesting methods recommended for the region are:

- (i) Ponds
- (ii) Check dams
- (iii) Sub-surface dams

8.10 SOUTH-CENTRAL DECCAN PLATEAU ZONE

The region covering parts of Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra is typically semi-arid. The region is characterized by highly diverse geological setting with predominance of hard basaltic rocks and variable rainfall. Ground water occurs under varying conditions in shallow and deep aquifers. Surface strata and soil types are by and large conducive to natural ground water recharge. The recommended water harvesting structures are:

- (i) Ponds
- (ii) Check dams
- (iii) Percolation tanks
- (iv) Bandhara
- (v) Gully plugging
- (vi) Sub-surface dams
- (vii) Contour bunding

8.11 CHHATTISGARH PLATEAU ZONE

The region comprises Chhattisgarh state and southwestern Orissa hills. The geological and geomorphological characteristics of the region are more or less similar to those in South-Central Deccan Plateau Zone. Even though rainfall in the region is relatively higher, the recommended structures are the same as those for the South-Central Deccan Plateau Zone.

8.12 SOUTH-EASTERN BROWN/ RED SOIL ZONE

The region covers Pachamalai and Kadavur hills and pediplain areas of Tamil Nadu and Veligond hills and part of the plains (excluding the 4-5 km wide coastal belt) of Andhra Pradesh. The rainfall in the region varies from about 818 mm in Perambalur district of Tamil Nadu to 1,148 mm in Nellore district of Andhra Pradesh. Runoff coefficient varies from 6.64 to 10.67 percent in plains and from 20 to 45 percent in plateau and foothill areas.

The recommended water harvesting structures for the region are the traditional ponds/ tanks. Besides percolation tanks and sub-surface dams are suggested in the vicinity of drinking water sources like dug wells, hand pumps and tube wells.

8.13 SOUTHERN VARIABLE RAINFALL, MIXED SOIL ZONE

The region covers southern parts of Maharashtra and west-central parts of Tamil Nadu. It has a highly undulating and dissected landform with an elaborate natural drainage system. Distribution of rainfall is highly uneven. The land surface is diverse in composition, the main features being sandy or younger alluvial plains and rocky gravel pediments. The soils are friable and prone to erosion, which results in excessive gully formation. The recommend water harvesting and watershed development measures are:

- (i) Ponds/ Tanks/ Kunta
- (ii) Nadi
- (iii) Check dams
- (iv) Percolation tanks
- (v) Sub-surface dams
- (vi) Gully plugging

8.14 SOUTHERN BI-MODAL RAINFALL ZONE

The region covers the southern most parts of Kerela, Karnataka and Tamil Nadu. The prominent physiographic features are the southern plateau and hills, east coast plains and hills and west coast plains and hills. The recommended water harvesting and watershed development measures are:

- (i) Ponds/ Tanks
- (ii) Percolation tanks
- (iii) Check dams
- (iv) Gully plugging
- (v) Contour bunding

8.15 EASTERN COROMANDAL

The region covers the entire coastal belt of Orissa, Andhra Pradesh and West Bengal. The recommended measures for water harvesting, ground water recharge and watershed development are:

- (i) Ponds/ Tanks/ Kunta
- (ii) Nadi
- (iii) Check dams
- (iv) Percolation tanks
- (v) Sub-surface dams
- (vi) Gully plugging

8.16 WESTERN MALABAR

The region covers the western Malabar area of Kerela and coastal areas of southern Karnataka. The recommended measures for water harvesting, ground water recharge and watershed development are:

- (i) Ponds/ Tanks/ Kunta
- (ii) Check dams
- (iii) K.T. Weirs
- (iv) Bandhara
- (v) Percolation tanks
- (vi) Sub-surface dams
- (vii) Contour bunding