Watershed Development- A Case Study on Harsule Village

Akhilesh Jitendra Jagtap[1] Sanket Sunil Bhadane[2]
[1,2]MBA Student
[1,2]Department of Project and Construction Management
[1,2]MITCOM, MIT-ADT University Pune, India

Abstract— India occupies approximately 2.4per of the total geographical area of the world. Population is huge and land is scarce. thus, agricultural lands are degrading and are turning into wastelands. So, it is necessary to restore the non-forested wastelands. Wasteland development is necessary to tackle the full potential of the available land resources and prevent its further degradation. The problem of degraded land, water audits management is complex and multi-dimensional and its development aims to develop human resource in watershed development and management. In India several Ministries namely, Ministry of Agriculture, Ministry of Rural Development and Ministry of Environment and Forests have been involved in Watershed Development Programs with substantial variation in their approaches. The main objective of the Watershed development program was to improve irrigation facility, water conservation, and land use pattern which leaded to increased agricultural productivity in drought prone and desert prone areas. Poverty reduction, better livelihoods and improved bio-physical and socioeconomic environment would bring about sustainable development. The site selected for water shed development project is near Harsule Village in Sinnar taluka of Nashik District. It is 13kms from Sinnar town and 33kms from Nashik City. Its latitude is 19.822455 and longitude is 73.940904. During summer water problem arises and also the water table goes down. Some measures have been required to recharge the ground water sources by suitable techniques to overcome the water scarcity problem.

Keywords: Watershed Development

I. INTRODUCTION

Along with a speedy economic growth rate, the conflict between limited resources and sustainable development is getting fiercer leading to land degradation. To restore the productivity of the land proper management of the watersheds is necessary task. In developing countries, soil erosion and sediment related problems is a great threat for sustainable land management and water resources development. Most of such problems are results of development plans which cause conversion of forest and range lands into agricultural lands and human settlements.

In response to such threats, soil erosion control and sediment management strategies are necessary to be implemented. Soil Erosion causes economic losses, productivity decrease of topsoil and finally energy, food and water security problems. These issues, poses a threat to water-storage capacity of watersheds, water reservoirs and dams and pollute surface water. The land degradation occurs mainly due to a combination of changes in land use, intensive agricultural and intense rainstorms. Hence, proper planning and management of watersheds is necessary in order to maintain and improve resources productivity is necessary mainly achieved through promoting optimum land use in endangered areas. Rain fall on the mountains flows down in small rivulets. A bunch of rivulets, as they come down, join together to form small streams. The small streams combine to form bigger streams; and finally, the bigger streams join the rivers. The area which supplies water to stream or river also called as drainage basin or catchment area, is said as watershed of that particular stream or river. A watershed may be small, consisting of a few hectares, or huge, covering several thousands of hectares. It consists of ridge line which is the outermost line of watershed area. The valley region is the outlet area where all the water which flows from hilly areas gets collected. Drainage line is the line or streams by which water flows from ridge line to valley region. Valley region is also called outlet of watershed.

II. MATERIALS AND METHODOLOGY

A. Site selection:

Site is selected on the basis of different parameters of land such as low soil fertility, undulating topography, land degradation, soil erosion and depleted water table, no land treatment structures, downstream impacts, inappropriate agricultural practices, deforestation, high rainfall area, etc.

Site selection also depends on some social criteria such as small marginal farmers, labour availability, credit management skills, tribal status, people response/interest, presence of people institutions, state of poverty, no other source of income, presence of bonded labour, inability to meet consumption needs, etc.

The site selected for water shed development project is near Harsule Village in Sinnar taluka of Nashik District. It is 13kms from Sinnar town and 33kms from Nashik City.

B. Various area treatments of watershed are-

1) Bunding:

Bunds are small earthen barriers provided in agriculture land having slope 1-6 % to reduce the velocity or runoff flow and to avoid rill and gully formation.

2) Continuous Contour trenches (CCT)

Contour trenches are the pits dug along contour lines. It helps in water retention along slopes and also checks soil erosion.

3) Water Absorption Trench (WAT)

It is a means of managing water runoff. These trenches are dug above the farmlands in order to" capture" the water runoff before it reaches the fields. It allows the water to percolate into the ground to recharge groundwater and improve soil moisture.

4) Contour Stone Bunds (CSB)

Stone bunds are used along contour lines to slow down, filter and spread out runoff water, thus increasing infiltration and reducing soil erosion. Over time sediment, which is

captured on the higher side of the bunds, accumulates to form natural terraces.

5) Gully plug (GP)

Gully Plug is the technology for soil conservation. It prevents soil erosion during rain and flood. It is stone base construction system. It acts as a soil trap. Water is passed through it and soil is retained.

6) Loose Boulder Structure (LBS)

It is a small barrier constructed of rock, fiber rolls, gravel bags, sandbags, or reusable products, placed across a constructed swale or drainage ditch. These structures reduce the effective slope of the drainage, thereby reducing the velocity of flowing water, thus allowing sediment to settle and reduce erosion.

7) Earthen Gully Plug (EGP)

Earth plugs, which are small structures, are constructed across the gullies. Their main purpose is to hold water and let it percolate into the ground.

8) Gabion Structure

Gabion structure is constructed at the nala where other water conservation works cannot be taken. While selecting the site of Gabion structure care should be taken that due to structure soil on the bank should not be blown. This structure is preferred in the middle reaches of the watershed area.

III. DATA COLLECTION AND ANALYSIS

A. Water Audit:

It is a general survey of the available water in the village. As Harsule is a remote, drought prone village in the rain shadow region of Maharashtra, it was a picture of despair, depleted of natural resources necessary for rural livelihood. Even sometimes drinking water was not assured for the villagers and they have to cover the miles for bringing the water. Agriculture process was badly affected due to the scarcity of water and todays scenario is not different. They have to call the water tankers for fulfilling their needs of water. Due to this the wastage of money and material occurs. Many of the people in the village have left their cultivable land because of scarcity of water. So, the following survey was done and information about the availability of water is collected on the basis of their daily use, requirement for agriculture and requirement of the animals and other purpose. Following data is collected from the village by using the source of Grampanchayat.

Sr. No	Population classification		Workers in village	Members involved
1	Total Population	782	Farmers	638
2	Male	408	Farm Labours	256
3	Female	374	Labour	28
4	No. of Families	152	Businessmen	25
5	Scheduled Caste	24	Trader	5
6	Schedule Tribe	165	Skilled labour	150
7	Sex ratio	917	Milk Business	103
8	Children	104	Other than agriculture	200

Table 1: Demographic details

Sr.No	Type of Animals	Number of Animals
1	Hybrid Cows	50
2	Hybrid Ox	20
3	Cows	50
4	Buffalo	15
5	Goat	50

Table 2: Animals used for agriculture and other purpose:

Sr.No	Classification of Area	Area(ha)
1	Village Area	970.14
2	Area in Forest	0.40
3	Irrigated Area	50 per
4	Non-Irrigated Area	50 per
5	Cultivable Area	30 per
6	Actual cultivable Area	937.18
7	Fertile Land	52.54
8	Irrigated Area	322.10
9	Per Capita Land	0.37
10	Area for each Family (avg.)	1

Table 3: Geographic information

Sr No	Present land use	Area(ha)
1	Total area	970.14
2	Cultivable Area	291.04
3	Wheat	485.07
4	Soybean	679.1
5	Groundnuts	9.7
6	Vegetables	9.7

Table 4: Present Land Use

Sr. No.	Crops	Need of Water (mm)	Area (ha)	Total water required (m3)
1	Wheat	500	485.07	2425.35
2	Soybean	550	679.1	3735.05
3	Groundnut	600	9.7	58.200
4	Vegetables	300	9.7	29.100
Total Water required				6247.7

Table 5: Water required for different crops

Sr. No.	Types of Animals	Water required (lit/day)	Water required (lit/yr.) (m3)	No of Animals	Total Required Water (m3)
1	Human	135	49.27	782	38533.05
2	Big Animals	3-30 Gallon	27.594	135	3725.19
3	Small Animals	0.5-4 Gallon	4.41	50	207
Yearly Requirement of Water					42465.24

Table 6: Need of Water for Animals

Therefore, Total requirement of water is: (Water for Living Animals + Water for Crops)

= 42465.24 + 6247.7

= 48712.94 m3

Extra water requirement in this village is:

Therefore, extra volume of water is to be retained is:

= 48712.94 48605.784

= 107.156 m3

B. General Survey

Soil depth is founded on the basis of depth ranges. Erosion type in percentage is founded on the basis of exposed rock.

As the rock is exposed up to 1/4 to 3/4 top soil lost; rill erosion. Slope of land is calculated by using RLs at different points. The slope of land is 17.22%. It is calculated by dividing the vertical reading of staff by horizontal distance between instrument and staff. It is required for area treatment process and design of various structures. Average rainfall is calculated by using yearly rainfall data.

C. Land Capability Classification

The basic principle of soil and water conservation is to use the land according to its capability and treat the land according to its need. Land capability classification knowledge is a prerequisite and important for planning, implementation and execution of soil and water conservation program. It is a systematic arrangement of different kind of land according to those properties that determine the ability of the land to reproduce on a virtually permanent basis. By taking preliminary tests on soil at site we classify the soil in different texture classes.

D. Possible Treatments

According to the general survey of land and land capability classification, the possible suitable treatments which can be provided are- Seed Sowing, Farm Bunds, Pit excavation Small Earthen Plugs, Continuous contour trenches (CCT), Horticulture and Argo-forestation. From these we have designed CCT, as the water can be retained only in CCT.

E. Design of CCT

Based on the rainfall data, site and soil condition, slope of land. We have calculated the length and number of CCT's to be provided by using method used by watershed organization trust, Ahmednagar, India. The calculated dimensions are-Proposed area treatment: Plantation/Pit excavation/CCT Horizontal interval between two CCT (m): 11.09m.
No. of lines of CCT: 3. Total length of CCT: 8246.53 m.
Cross Section of CCT (sq. m): 0.54 (0.6x0.9)
Cross Section of Pit: 1m x1m.

F. Water Management

Among all the proposed area treatments, water can be retained only in Continuous Contour Trenches, water collection pits and farm bunds. So, following volume is retained in these structures.

Water collected in CCT subtracting all losses is calculated as 160.38 m^3.
Water collected in pits is 4 m^3.

Therefore, the total water retained is 164.38 m^3.

IV. Result and Discussion

1) From water audit we gain the information that total available water for the villagers for their need is 48605.785 m3.
2) Water requirement for the village is 48712.94 m3.
3) Villagers need extra water of 107.156 m3 for fulfilling the general needs of them.
4) Area treatments founded are-
   - Seed Sowing
   - Farm Bunds
   - Pit excavation
   - Small Earthen Plugs
   - CCT
   - Horticulture and Agro-forestation
5) Total water retained by providing the area treatments is 164.38 m^3.
6) Through watershed development 57.224 m3 net extra water is made available.

V. Conclusion

For Harsule village water required is 107.156 m of extra water excluding their daily availability of water.
By providing various structures (area treatments) we are retaining 57.224 m^3 of water.

By making this much volume of water available for the villagers we can turn their focus especially on farming.
By this we can improve the workability of land present in the village by increasing the ground water level.

Acknowledgement

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