SUSTAINABLE WATERSHED MANAGEMENT FOR GHATANGRI VILLAGE

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ABSTRACT

Ghatangri village is located in Osmanabad Tehsil of Osmanabad district in Maharashtra, India. It is 13km away from the city Osmanabad. As per 2009 stats, Ghatangri is the gram panchayat of Ghatangri village. The total geographical area of the village is 1989.56 hectares. Osmanabad is the nearest town to Ghantagri which is nearly 13km away. The climate of the village is characterized by a hot summer and general dryness throughout the year except during the southwest monsoon season, i.e., June to September. The mean minimum temperature is 8.5°C and the mean maximum temperature is 42°C. the area under study is in the Marathawada region (Maharashtra) which is in drought condition for most of the year in the last decade. This village is tackling an intense water shortage issue each year. The rainfall pattern in this region is unbalanced, due to the Deccan trap basalt water does not percolate into the groundwater table due to uneven rainfall it is not satisfactory to meet out the demand of domestic, agriculture demand. The total area of agricultural 1257.5ha but nowadays it is irrigating about 450ha. To conquer these issues identified with such water shortage executing the watershed structure like farm pond, storage tank, community well, percolation tank & check dam to store the maximum amount of water to meet out the demand of domestic & agricultural. by implementing such a structure area of agricultural land will irrigated about 960ha.

Keywords: Water conservation; water Shortage, Watershed structure.

I.   INTRODUCTION

A Watershed is a hydrogeological area from which rainwater drains through a solitary outlet. Ghatangri district deals with the issue of water dry season. The total population of Ghatangri is 3200 and about 1257.5ha of agricultural land. The average annual rainfall of the Ghatangri region is 714mm. It is not possible to achieve the demand of domestic and agriculture. It required near about 45675 m3 water. Average annual rainfall which can't fulfill our different needs. It required storing a maximum amount of surface as well as subsurface water. 90% of the Geographical area of Ghatangri village is made of Deccan trap basalt. it is quite a chance to percolate the water into the ground. Different types of watershed structures have to implement in the Ghatangri region where rock features are Deccan trap basalt, constructing a Storage tank, farm pond, community well, and where chances of percolation more constructing the percolation tank, check dam. The above-proposed watershed structure at Ghatangri village will be useful to tackle the issue of different interest consistently.

II.   LITERATURE SURVEY

Wani et al (2001) – study in Kothapally in Andhra Pradesh is one of 6 such studies that highlight the effective community participation in watershed management. Their study has developed the model for efficient involvement in watershed management.

Deshpande and Reddy (1991), Shah (2001), Joshi (2004) have studied different elements of watershed management. These studies while addressing several issues have also focused on the positive impact of watershed management on cropping, agricultural productivity, employment generation, and increase in income amongst others.

Kerretal (2002) – noticed that many studies have revealed that watershed management involvements were successful in controlling soil erosion, runoff reduction, etc Author concluded that the successful watersheds have reduced runoff water and recharged ground and surface water aquifers, improved drinking water supply, increased agricultural strengthening and crop.

Mahdi Zarghami (15 March 2011) – Efficient watershed management Case study of Uremia Lake, Iran who states that Limited water resources with uneven distribution and growing demands are the main challenges of water management in Iran. This paper concludes watershed techniques system provides key monitoring,

decision support, and feedback component that will form the exceptional watershed structure for even distribution of water throughout the year.

John Kerr (2002)-Watershed projects play a progressively important role in managing soil and water resources throughout the world. Research is needed to ensure that new projects draw upon lessons from their predecessors' skills. However, the technical and social complexities of watershed projects make evaluation difficult. This paper presents mixed-method approaches for evaluating watershed projects. According to the above, literature to adopting watershed management following key is to consider that means many watershed management techniques around the world have worked poorly because they failed to take into account the needs, constraints, and practices of local people. Participatory watershed management in which users help to define problems, set right of way, select technologies and policies, and monitor and evaluate impacts is expected to improve performance.

Deshpande & Narayanamoorthy (1999), Kshirsagar, K.G., M.P. Madhusoodhanan, S. Chavan, and R. Rathod (2003) - have recognized that watershed development programmers are potential to augment income and reduce poverty among the watershed communities. These studies have focused that there is a positive change in crop yielding and productivity, cropping intensity and optimum use of farm executes despite some odds.

III.   OBJECTIVE

1.   To design watershed structures like a storage tank, barrages, percolation tank, earthen bunds, concrete Nala Bandara, etc.
2.   To collect the rainwater (surface runoff) in the storage basin.
3.   To collect the information about the topography of the proposed watershed site for constructing watershed structures.
4.   Distinguishing proof of appropriate locales technical guidance for the construction of suitable sites for Earthen bunds, small barrage, widening of nalas, Agricultural pond, etc.
5.   To examination the sustainable approach for drought village by providing effective rainwater management.

IV.   SCOPE OF WORK

1.   Demand for water for Agricultural and Domestic needs is required every year in the Ghatangali region to check if it should satisfy demand obtained from proposed watershed management.
2.   All the calculations regarding the demand, design of the structure, and Estimate required to be study
3.   Required native land for implement the proposed watershed structure need to be analyzed
4.   Study of cost and capacity of the proposed watershed structure
5.   study of the payback period of the structure is to be researched.
6.   Determination of storage capacity of the watershed structures.

V.   MATERIAL AND METHODOLOGY

A) AREA UNDERTAKEN FOR STUDY

Fig-1-Location Map of Study Area

Fig-2-Location of Study Area Ghatangri Tehsil-Osmanabad

Fig-3-Gat no. map of Study Area

B) GROUNDWATER TABLE OF STUDY AREA-GHATANGRI

Table 1. 5 Years data of Groundwater table (area-Ghatangri Village)

Sr no	Village	Watershed no.	Depth of well	Last 5 years					Average 2015-2016	GWL May 2020	Difference
				2015	2016	2017	2018	2019			
1	Ghatangri	SA-37A	13.50m	9.40 m	11.80 m	7.50 m	7.40 m	15.00 m	10.22m	12.90 m	-2.68m

C) STUDY AREA DETAILS

Table 2. The area under Ghatangri Village

Sr.no.	Name Of Village	Total geographical area	The area is not available for cultivation and forest area.	Net shown area	Total Net Shown Area
1	Ghatangri	1956 H	279.33 H	1676.67 H	1676.67 H

D) LAND USE PATTERN -(Ghatangri)

Table 3. Land Usage pattern of Ghatangri Village

Sr.no	Land Use Pattern	Area(hector)
1	Total Area	1676.67 H
2	Area under agriculture	1257.5 H
3	Nonagricultural area	120 H
	a) Residential area	12.20 H
4	Irrigated area	567 H
5	Non irrigated area	21.4 H
6	Area under lake	14.45 H
7	Road area	15.30 H
8	Govt. acquired area	0.2 H
9	Forest area	21.08 H

E) CROP PATTERN OF STUDY AREA

Crop ranking and crop pattern of study area 2019-20 Ranking of the crop is the real picture of the study area. The Ranking of the crop shows the tendency of the farmer or cultivator whether the farmer is traditional or market-oriented. In this method that crops occupy the highest percentage of the total cultivated area, are chosen as a first-rank crop.

Table 4. Crop pattern of Ghatangri Village

Sr.no	Location	Crop	Area of crop shown	Area under agriculture
1	Ghatangri	Sunflower	40 H	1257.5 H
		Sorghum	170 H	
		Gram	166.9 H	
		Safflower	58 H	
		Soya-bean	487.78 H	

Wheat	102 H
Vegetables	43 H
Sugarcane	29 H
Groundnut	69 H

VI. PROBLEMS FACING IN STUDY AREA

1. Low-income levels hence minimal living standards.
2. Very low irrigation.
3. Agricultural production in only one season.
4. Poverty.
5. The average rainfall is less.
6. Lack of water supplies in the summer season.
7. Farmers adopting traditional methods of irrigation.
8. Migration of laborers.

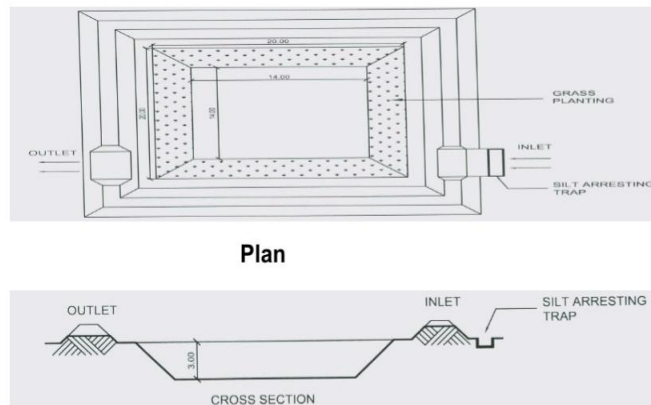## VII. STRUCTURE UNDER PROPOSED WATERSHED MANAGEMENT

A. FARM POND

Fig-4-Farm pond of Ghatangri watershed (30m × 25m × 8m)

B. STORAGE TANK

Photo-1-proposed site for storage tank [30m x 12m x 6m]

C.   PERCOLATION TANK

Photo-2-Progress of work on Site for-Percolation tank

D.   CHECK DAM

Photo-3-Under repairing of check dam situated on nala of Ghatangri watershed

VIII.   DESIGN CALCULATIONS OF PROPOSED WATERSHED STRUCTURES

Table 5. Dimension of Watershed Structure and Calculations

Sr.no	Name of Structure	No.	Size of structures			Seepage Rate mm/day	Free Board (m)
			L	B	H		
1	Farm Pond	2	30 m	25 m	8 m	9.24	0.5

2	Storage Tank	5	30 m	12 m	6 m	5.47	0.5
3	Percolation Tank	2	30 m	30 m	6 m	10	1
4	Check Dam	1	56 m	25 m	10 m	1	1
5	Community well	1	7.5 m	7.5 m	15 m	1	1

IX.   COST AND CAPACITY

A.   COST OF WATERSHED TECHNIQUES FOR PROPOSED WATERSHED

Table 6. Cost Details of Watershed Structure

Sr.no.	Type of structures	No.	Cost of structures in Rupees	Total cost
1	Farm Pond	2	Rs.160000	Rs.480000
2	Storage Tank	5	Rs. 132445	Rs.662225
3	Percolation Tank	2	Rs. 395599	Rs.791198
4	Check Dam	1	Rs. 769000	Rs.769000
5	Community well	1	Rs. 300000	Rs. 300000

Total cost of watershed techniques

 = 480000 + 662225 + 791198 + 769000 + 300000

 = Rs. 30,02,423

B.   CAPACITY OF WATERSHED STRUCTURE

Table 7. The capacity of Watershed Structures

Sr.no.	Type of structures	No.	Capacity (Liters)	Total Capacity =no of quantity X Capacity
1	Farm Pond	2	6000000	= 2 x 6000000 = 12000000
2	Storage Tank	5	2160000	= 5 x 2160000 = 10800000
3	Percolation Tank	2	5400000	= 2 x 5400000 = 10800000
4	Check Dam	1	14000000	= 1 x 14000000 = 14000000
5	Community well	1	100000	= 1 x 100000 = 100000

Total Capacity of Proposed Watershed structures

= 47700000 Liters

=47700m3

C. ANNUAL WATER REQUIREMENT FOR DEMAND OF DOMESTIC AND AGRICULTURE

Domestic requirement = 8409m3 = 840600 Liters

Agriculture requirement = 37240m3 = 37240000 Liters

Total Requirement = 45649.6m3 / year

 =45649600 Liters

D. COST OF WATER PER LITERS

Total Capacity of Proposed watershed structures

= 47700m3 (47700000 Liters)

The total cost of watershed techniques = Rs 3002423

Cost of water per liters = 3002423 / 47600000

Cost of water per liters = Rs. 0.63 / liters

Payback Period = (water demand required / Annual Inflow)

= 45649600 / 47700000

= 0.959 say 1

= 1

E. GROUNDWATER LEVEL IN UNCONFINED AND SEMI-CONFINED AQUIFERS AND SEASONAL WATER LEVEL VARIATION FOR THE SPECIFIED PERIOD OF ALL GROUNDWATER OBSERVING WELLS OF STUDY AREA

Table 8. Unconfined Water Level for past 5 Years

Aquifer Type	Water Level			
	May 2015	Aug 2015	Nov 2015	Jan 2016
	(mbgl)	(mbgl)	(mbgl)	(mbgl)
Unconfined	13.96	9.40	8.00	15.30

F. EMPLOYMENT GENERATION UNDER THE GOVERNMENT SCHEME LIKE MGNERGA, DAILY AVERAGE WAGES HAVE BEEN REVISED TO ₹205 - ₹238 IN MAHARASHTRA 2020 -21.

• Total cost of watershed techniques =30,02,423

• Cost of Unskilled labors = 60% of total cost =1801453

• Wage rate for Unskilled labor work = 205 – 238 = 220 (average wage)

• Total number of man-days = 1801453 ÷ 220 = 8189.

X.   CONCLUSIONS

1. After the rainy season around February up to May of each year, the water scarcity starts in the Ghatangri village and water demand raises

2. Now a day's area under agriculture is about 1257.5ha but due to water scarcity and uneven rainfall this region was not irrigated this area, only 450ha area is irrigated.

3. By implementing a watershed structure, near about 960ha area of agricultural land will come under irrigation of Ghatangri watershed.

4. The need for domestic and agricultural is about 45649.6m3 / yearly and by proposing watershed techniques in future plenty of water will available throughout the year. Quantity of water will available near about 47700m3 / year

5. For constructing the proposed watershed structures in the Ghatangri region, a total of Rs 3002423 are required as a fund.

6. For watershed management projects runoff is a very important factor. It is easy to make a rise in the water table

7. Check the flow of water or runoff. Runoff occurs in nallas.

8. Employment generation under MGNERGA with daily average wages of Rs. 220 generates 8189 man-days, which helps to reduce the migration of Ghatangri villagers.

9. These types of watershed management systems can effectively solve the problem of agriculture and Domestic water demand.

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