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A case study of Integrated Watershed Management Programme at Aapsinga Village in Maharashtra

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Abstract- *Aapsinga is a small village in Tuljapur Taluka of Osmanabad District of Maharashtra state (India). It is located at a distance of 8kms from Tuljapur & 18kms from District place Osmanabad. The average temperature ranges from 27 to 38 degree Celsius and the average rainfall of Osmanabad district including this area is about 730 mm. The hilly terrain is the main feature of this region, the entire area is covered by South east "Balaghat" ranges and large spur & valleys have pockets of high biological diversity. This area is in Marathwada region which is in draught condition for most of the years in last decade. This village is facing acute water scarcity problem every year. To overcome these problems related to water Central Government had started a programme of watershed management viz. Integrated Watershed management Programme (IWMP).This village is in the programme (IWMP-21) along with two neighboring village's viz. Katri & Kamtha as a cluster. This study is an overview of various techniques like farm ponds, check dams, vanrai bandharas, etc. which are suggested to overcome the problems related with reducing runoff amount after implementation of IWMP.*

Keywords-**Integrated Watershed Management, Farm Ponds, Runoff, Check Dam, Vanrai Bandhara etc.**

1. INTRODUCTION

A. Watershed Management

Integrated watershed management programme is the strategy adopted in the India for sustainable development of dry land areas and a recent comprehensive assessment of watershed programs in India. One of the definitions of watershed management is "the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal, and human communities within a watershed boundary. In spite of sufficient rainfall, people have to face water scarcity for their use especially supply in summers in most of the areas. This is mainly due to large runoff which is responsible for water loss as well as soil loss of the land. Watershed management involves the judicious use of natural resource with active participation of institutions, organization, peoples, in harmony with the ecosystem.

There is an increase on concern about watershed problems and interest in methods of meeting them, around the world. Concern over repeated floods, excessive siltation, accelerated erosion with loss of soil and capacities have resulted have in an interest in measures to correct these situations and prevent their occurrences. For development of agriculture and drinking water resources the basic elements required are land and water. Indian agriculture sector is lot more dependent upon the monsoon. But from last 3-4 years, due to inadequate rainfall, people are looking towards the underground water as alternative sources without regarding to its recharge resulting in deepening of ground water table 90 to 150 m below the ground surface.

Rainfall is the important source in agricultural activities. The monsoons affect most part of India, the amount of rainfall varies from heavy to scanty on different parts. There is great regional and temporal variation in the distribution of rainfall. Over 75% of the annual rainfall is received in the four rainy months - June to September.

A watershed could be described as fan shaped (near circular) or fern shaped (elongated).

B. Types of Watershed

Watershed can be classified into a number of groups depending upon the mode of classification. Such as size, drainage, shape and land use pattern. There are generally five levels of watershed based on geological area of the watershed viz.:

1. Macro Watershed (>50,000 Ha)
2. Sub-watershed (10,000 to 50,000 Ha)
3. Mili-watershed (1000 to 10,000 Ha)
4. Micro watershed (100 to 1000 Ha)
5. Mini watershed (1-100 Ha)

C. Objectives of Watershed Development

Watershed development programme in India envisages promotion of multiple objectives. They include the following:

1. To promote the economic development of the village community.
2. To encourage restoration of ecological balance in the village.
3. Special emphasis to improve the economic and social condition of the resource-poor and the disadvantaged sections of the Watershed Community such as the asset less and the women.

Along with above mentioned objectives following are the technical objectives of the programme

- To control runoff and degradation and thereby conservation of soil and water.
- To utilize the runoff water for useful purpose.
- To protect, conserve and improve the land of watershed for efficient and sustained production.
- To check soil erosion and to reduce the effect of sediment yield on the watershed.
- To moderate the floods peaks at downstream areas.
- To increase infiltration of rainwater.
- To enhance the ground water recharge.

D. Study Area

For the study Aapsinga village in Tuljapur taluka Osmanabad district is selected. Here a cluster of three villages are included in the programme viz. Aapsinga, Katri, Kamtha. The cluster is given the name as IWMP-21.

2. Identification of Problems

- Average annual rainfall of Aapsinga village is 760 mm.
- Fluctuations in the rainfall is very high in year 2003 rainfall is 498mm and in year 2010 it is 972mm.
- Silting of existing water resources.
- Less Awareness of the people regarding programme.
- Excessive runoff due to Balaghat ranges.

3. Objectives of the work

a. Analysis of water resources in Aapsinga village
b. Guidelines for watershed development programme
c. To analyze the socioeconomic condition of peoples in Aapsinga.
d. Results and interpretations

4. Methodology

The methodology adopted for the present area includes following three phases

1. Literature Survey:
   In this phase, literature survey of watershed development techniques will be carried out by internet browsing & referring to various journals, Common guidelines for watershed development given by central government and government of Maharashtra, district agricultural office Osmanabad etc.
2. Socio-Economic survey:
   Water resources and requirement, by observation and discussion with local people, by personal interviews of the local people, through Social Mapping of the areas for developing the social relationship with the local people.
3. Watershed development measures:

Suggestions in the present watershed area other than IWMP-21 programme and Calculation for design and approximate cost required for watershed development measures By Survey including contour map, natural stream line map, micro watershed map, slope map, soil erosion map etc

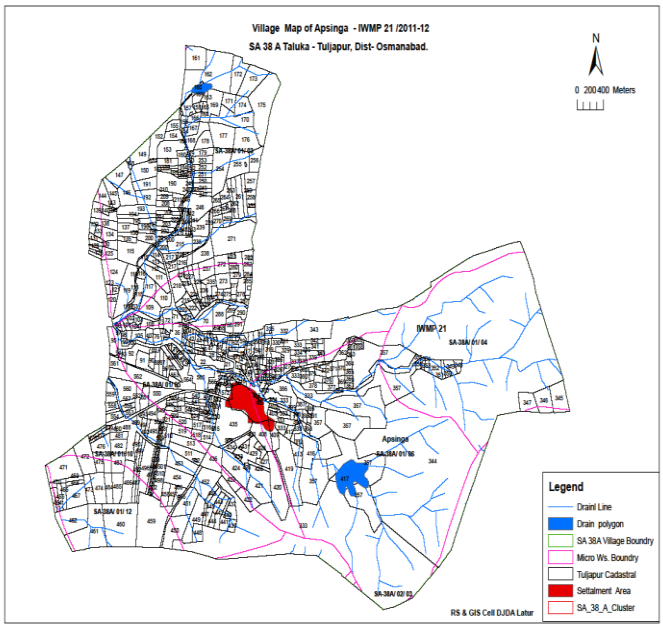
5. Details of Watershed Area

Location - Apsinga is located in N18 03.638 Latitude & E76 02.476 Longitude with an average elevation of 1862–2166 ft. from mean sea level 8 kms from the north of Tuljapur tehsil of Osmanabad district the climate of this region is cool and pleasant as compare to other region of the district. The average rainfall of the village is 760mm.It is located in the draught prone zone of Marathwada region. Population of the village is 4090 according to 2011 census of which 2250 are male and 1840 are female. Total number of households in the village is 765 of which 271 households are landless and 494 households are having land. There are total 309 BPL (Below Poverty level) households.

Sources of water- Rainfall is typically monsoonal in nature. In Aapsinga it varies from 498mm in year 2003 and in year 2010 it is 972mm. Rainfall data is very important data in planning the watershed development for study area. The surface water sources in the village are as follows: -

Table No.1 Status of Surface water

Treatment in IWMP	Unit	Qty. No	Qty. Ha	Estimated Cost in Lakh
Compartment Bunding	ha	0	1546	107.23
C.C.T.	ha	0	51	7.54
Earthen Nala Bund	No/ TCM	8	1	3.10
Cement Nala Bund	No/ TCM	6	2	6.25



Map No.1 Village Map of IWMP-21

6. Provisions in the IWMP-21 and its remedies-

Table No.2 Types of treatment in the Watershed.

Sr.No	Type of Structure	Total Nos.
1.	Village tank	00
2.	Percolation tank	04
3.	Cement Nala bandhara	00
4.	Channel	06
5.	Lake	00
	Total	10

Provision of treatment in the village watershed as per the IWMP-21 is as follows:

As we see the above table we can say that there is no provision of the treatments like vanrai bandharas, check dams, farm ponds etc in the watershed.

These are very important structures in utilizing rainwater for recharging groundwater. They are also useful for soil conservation. Rainfall in watershed is not sufficient but runoff goes waste due to insufficient no. of rainwater harvesting structures.

Aapsinga village is facing problems related to water even after implementation of the IWMP-21 because after implementing such programmes there are some of the lacunas such as listed below.

1) The shortage water availability in the region especially in the post monsoon has resulted in the scarcity of water in Aapsinga.

2) The lack of water availability has also resulted in low agriculture production due to unavailability of water for irrigation purposes.

3) Water scarcity over a long period has led to an increase in migration of people to the urban areas for the employment purpose.

4) Due to shortage of drinking water in summer season, supply of water through tankers becomes essential.

This village is situated in "Balaghat" ranges and large spur & valleys have pockets of high biological diversity their fore there is a lot of runoff is taken place as the nature of ground is sloping following table no 3 will show the runoff in the village area according to slope of the land. Out of total 2636.35TCM runoff 670TCM runoff will be stored due to existing structures like Earthen nala bandh, cement nala bandh, percolation tank and nearly 970TCM runoff will be stored due to proposed structures in the programme like cement bandhara(CB), Contineous Contour Trenches(CCT) and farm pond. The remaing balance runoff 995TCM can be stored by techniques like vanrai bandhars, check dams, farm ponds to some extent.

Slope of land	Runoff (T.C.M./ha)	Geographical Area (ha)	Total runoff (T.C.M.)
less than 5 to 20 %	1.2797	820.50	1049.99
less than 5 %	0.8538	1857.99	1586.35
Total	**2.1335**	**2678.49**	**2636.35**

Table No.3 Runoff Calculations

Following table will show the present scenario of the watershed work and also it is showing the total runoff which is stored by the existing structures and runoff to be stored by the structures after implementation of IWMP programme. Still there is 995.21 TMC runoff is in balance stage. To store some part of the runoff from balance following remedies are suggested which will store some part of balance runoff.

Sr. No.	Name of treatment or structure	Per unit Qty. of runoff stored (TCM/unit)	Runoff stored by existing treatment		Runoff to be stored by proposed treatment	
			Qty (No/ha)	Amt. of Runoff stored	Qty (No/ha)	Amt. of runoff stored
1	2	3	4	5 (3x4)	6	7 (3x6)
1	C.B.	0.60		0	1546	927.60
2	CCT	0.27		0	51	13.77
3	LBS	0.18		0	0	0.00
4	Farm Pond	2.11		0	7	14.77
5	ENB	5.00	8	40	1	5.00
6	CNB	5.00	6	30	2	10.00
7	P.T.	100	6	600		0.00
TOTAL		**113.16**	**20.00**	**670.00**	**1607.00**	**971.14**

Table No.4 Runoff Calculations before and after implememtation of IWMP.

Sr.No	Runoff stored by	Total runoff (T.C.M.)
1.	Existing structures	670.00
2.	Proposed structures in IWMP	971.14
	Total	1641.14
	Total Balance Runoff (2636.35-1641.14)	**995.21**

Table No.5 Balance Runoff

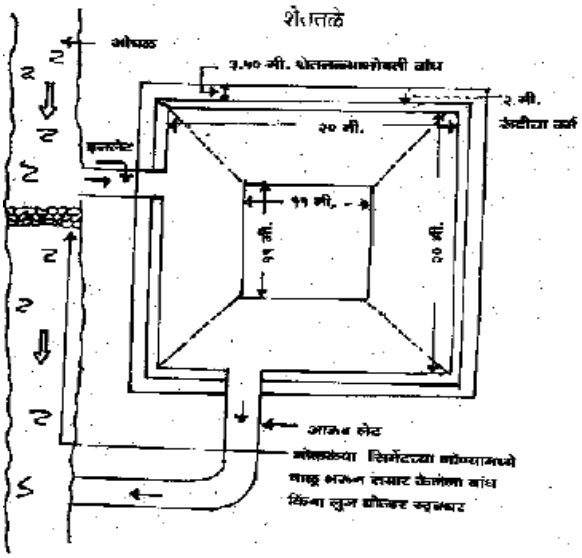
Remedies to overcome balance Runoff-

1. Vanrai bandhara

Design Details

a) Available land slope = 5-10 (%)
b) Height of vanrai bandhara = 0.8-1.2 m
c) Length of the bandhara = 6 m up to 25 m.
d) Breadth of the bandhara = 2 m to 2.5 m.

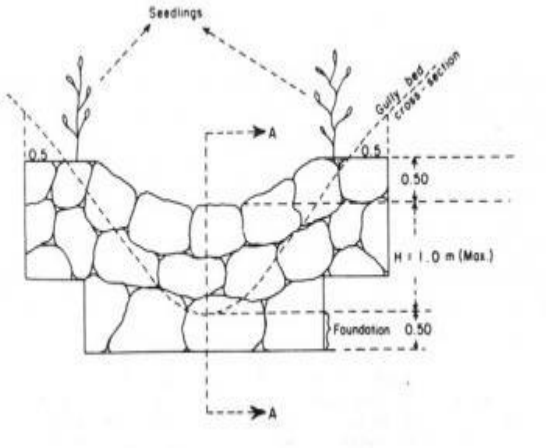
2. Farm Pond Design Details.



1) Excavation details
a) Top dimensions of pond = 20m x 20m
b) Bottom dimensions of pond = 12m x 12m
c) Depth of pond = 3m
d) Side slope to excavation = 1:1

2) Side earthen bund details
a) Top width = 0.9m
b) Height = 1.0m
c) Side slope = 2:1

3. Check dams Design details.



a) Available land slope = 0-20(%)
b) Horizontal interval (Spacing between two bunds)
= depends on site conditions
c) Dimensions of the Check dams
a) Top Width = 1.0 m
b) Base width = 2.0m
c) Height =3.0m above ground
d) Depth of foundation = 1.0m
e) Length of check dam = depends on site Conditions
f) Freeboard = 0.50m

If these mentioned structures were constructed runoff will be stored in following way

A) There would have water recharge by farm pond
= [(20x20) + (12x12)]/2x 3 = 816Cu.m.
(Assuming it is recharged 4 times)
=4 x 816Cu.m. =3264Cu.m./farm pond

B) There would have water recharge by Vanrai bandhara, Check dams as,
=125196.5x10%
=12519.65Cu.m./bandhara/Check Dam

Sr. No	Type of structure	No of structure	Water to be recharged m^3
1	Check Dams	2	25039.3
2	Vanrai bandhara	6	75117.9
3	Farm pond	5	16320
		Total	116477.2
Total Runoff Stored			**116.477 TCM**

Table No.6 Remedies outcome for balance runoff.

Sr. No.	Type of structure	No. of structures	Cost of structure	Total cost
1	Check Dam	2 Nos.	107500	215000
2	Vanrai Bandhara	6 Nos.	15420	92520
3	Farm Pond	5 Nos.	94000	470000
			Total cost in Rs.	777520

Table No.7 Cost of watershed techniques for proposed watershed

7. Recommendations

1. Check dam

The check dams or in-stream storage structures with or without gated arrangements are to be capable of safely releasing the anticipated design flood without affecting the safety of the structures with minimum afflux in the upstream. Water can be stored in such a pond / reservoir towards the end of monsoon. Check dams, upto a height of 3.0 mt. can be constructed across small tributaries / nallah / drainage channel within the banks and streams in middle and higher reaches .They require regular maintenance.

2. Farm Pond

Farm ponds are small tanks or reservoirs constructed for the purpose of storing water essentially from surface runoff. Farm ponds are useful for irrigation, water supply for the cattle, fish production etc. The design and construction of farm ponds require a thorough knowledge of the site conditions and requirements. Some sites are ideally suited for locating the ponds and advantage of natural conditions should always be taken.

3. Vanrai bandhara

Vanarai bandhara or Bunds are constructed across a stream or small river using gunny bags refilled with locally available soil or sand. These bags are sealed properly and are arranged in the form of a wall barrier. This is a temporary structure built across water course to collect the water as well as to reduce the velocity of stream so that infiltration rate of water increases. It helps in replenishing the aquifer below the river bed resulting in increase in ground water level in the surrounding area. Normally Vanarai Bandhara is constructed at the end of monsoon period and it lasts till the onset of the next monsoon.

Along with above mention remedies some common but effective remedies are as below-

1. Social Aspects

Concentration should be given on The Awareness regarding usage of available water. The government rule for maximum depth of bore well is 200 feet and it should follow then ground water level is maintained. In Aapsing For the kharif season crop is Onion, Tour pulses, Maize and rabbi season crop is jawar. These crops are not cash crops. If the cash fruits like Pomegranate, Grapes, etc. are cultivated, then economic condition of farmer is increased. It can be achieved by selecting the crops/fruits which require minimum water. If drip irrigation and mulching film are used for crops/fruits then 50% of water is saved. In watershed area different water conservation structures are suggested taking into consideration average annual rainfall.

2. Silt removal from lakes and wells

In the given watershed there are 4nos of percolation tanks in these tanks Due to excessive silting water storage capacity has depleted. There is 6 to 8 feet silt deposited. Removal of silt at proper interval is necessary to increase water storage capacity of lakes, wells and reservoirs. It also increases ground water level considerably.

3. Forestation

It is the most important factor to be considered because as we know “Precaution is better than cure” Forestation will increase rainfall, increases soil conservation so it must be adopted effectively.

8. Conclusion

In Aapsinga village efforts are made to increase recharging of water by various water and soil conservation structures. The village is taken under various government schemes like IWMP-21 for fulfilling the water demand for irrigation and domestic purpose. Rainwater is naturally and freely available source and which is properly utilized by means of water harvesting and recharging techniques.

1) Village is totally depending upon rainfall for water as there is no Perennial source of water. If watershed development techniques are implemented, it will result in increase in the irrigation potential which ultimately increases the crop production which will increase living standard and economic condition of people of Aapsinga.

2) In the considered area the total runoff of the average annual rainfall of 760mm is 2636.35TCM runoff 670TCM runoff will be stored due to existing structures like Earthen nala bandh, cement nala bandh, percolation tank and nearly 970TCM runoff will be stored due to proposed structures in the programme like cement bandhara(CB), Contineous Contour Trenches(CCT) and farm pond. Out of the remaining balance runoff of 995TCM nearly 117TCM runoff can be stored by techniques like vanrai bandhars, check dams, farm ponds.

3) For constructing suggested structures in the watershed total of Rs. 7, 77,520.00 are required as fund.

4) For watershed development project runoff is very important factor. It is easy to make rise in water table, due to check to the flow of water or runoff. Runoff occur in nallas/streams.

5) These types of the watershed management programme can effectively solve problem of irrigation and drinking water problems.

6) Due to various watershed measures like farm pond, check dam, vanrai bandhara they should be implemented to cope up with the drought conditions.

7) After implementation of such programmes also the Maintenance of these structures should be done regularly e.g. silt removal from the lake, wells and check dam it will result in increased water storage capacity of above structures and increase ground water table.

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