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A CASE STUDY OF WATERSHED MANAGEMENT OF A NAIKBOMWADI VILLAGE

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Abstract - *Percentage of earth covered by water is 71 percentage but water scarcity is main problem in front of the whole world. Watershed management plays important role in reducing soil erosion and water conservation. Naikbombwadi is a village located at distance 14 kms from Phaltan tashil city of state of maharasthtra . it lise between latitude17.93519& longitude 74.55579 This village suffering from water scarcity. In Maharashtra there are many villages to the government is supplying water by tanker naikbomb wadi village is one of the.*

Key Words: G.I.S., Q-G.I.S, Watershed, Water Scarcity, Water Conservation

1. INTRODUCTION

Water is a prime natural resource for human beings and hence a precious national asset. The easy and cheaply available groundwater is the most important resource for domestic, industrial and agricultural uses etc. However, rapid growth of population, vagaries of rainfall, expansion of irrigation, increased industrialization etc. have resulted into enhanced demand for groundwater in various countries. parts of the As a result, the groundwater prospecting, exploration and management have become a big task in India in general, and certain drought prone areas in particular. Hence, in the current scenario, it has become crucial not only to find out groundwater potential zones, but also to monitor and conserve this important natural resource.

For development of agriculture and drinking water resource the basic elements required are land and water. Because of tremendous rise in population, urbanization, industrialization and agriculture area, resulting in steep incline water demand line. Indian agriculture sector is lot more depend upon the monsoon. But last 3-4 years due to inadequate rainfall, people are looking towards the underground water as alternative source without regarding to its recharge resulting in deepening of ground water table near about 100m below the ground surface.

2.0 METHODOLOGY

2.1 Methods used for achieve objective

For achieving first objective we conduct general and social economic survey by preparing questionnaires and fill up this form of that village people.

To carried out visit to the Naikbomwadi village and collection of data from tehsil office and Grampanchayat.

By carrying out Quantum GIS we get contour map and stream line map of whole area. With the help of this we get possible outlet and their location.

By using G.P.S. survey plot the location after meet outlet points.

To study the ground water level fluctuation of the study area, water levels in different wells located in the study area have been observed for different period for these 11 wells have been selected.

These pre and post monsoon water levels are plotted and are compared with the overall fluctuation of average rainfall. By suggesting appropriate structure in study area

2.2 Measurement of ground water fluctuation

- To study the ground water level fluctuation of the study area, water levels in different wells located in the study area have been observed for different period for these 11 wells have been selected.
- These pre and post monsoon water levels are plotted and are compared with the overall fluctuation of average rainfall

2.3 Following steps were followed for implementing techniques

- Selection of site for implementing watershed techniques.
- Collection of data of site condition and surrounding area.
- To manage and utilize run-off water for useful purpose, the suitable structures on water outlet points were suggested.

3.0 AREA SELECTED FOR STUDY:

Study area lies in Phaltan tehsil, in the Indian State of Maharashtra. It is located at 14 km. away from Phaltan tehsil city. It lies between North latitude 17056'5" and East longitude 740 32’33", covering an area of 825.93 hector. The average rainfall ranging is 337mm.

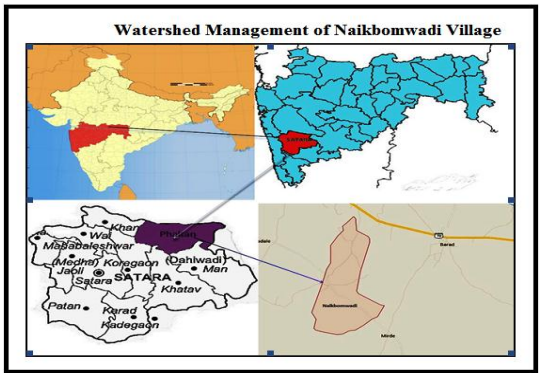


Fig-1 : Location Map of Study Area

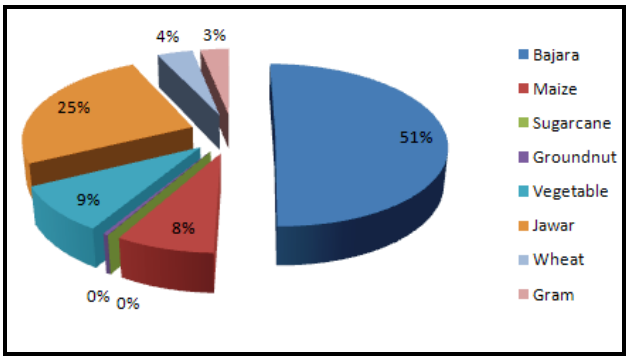


Fig2: Crop Pattern of Study Area

4.0 Land use pattern in study are

Table1:- Land use pattern

Sr. No.	Land use pattern	Area (hector)
1	Total area	825.93
2	Area under agriculture	590.67
3	Nonagricultural area	19.89
	a) Industrial purpose	11.45
	b) Residential area	8.44
4	Irrigated area	335
5	Non irrigated area	255.67
6	Area under lake	6.47
7	Road area	17.30
8	Govt. acquired area	0.15
9	Forest area	Nil

Crop ranking and crop pattern of study area 2016-17Ranking of the crop is the real picture of the study area. The Ranking of the crop show the tendency of farmer or cultivator weather the farmer is traditional or market oriented.in this method that crops occupy the highest percentage of the total cultivated area, is chosen as first rank crop.

Table 2: Crop Pattern of Study Area

Sr. No.	Location	Crop	Area for Crop Sown	Area available for Sown
1	Naikbomwadi	Bajara	128.00	590.67
		Maize	20.00	
		Groundnut	1.00	
		Vegetable	23	
		Jawar	64.00	
		Wheat	10.00	
		Gram	8.00	

5.0 Problems arriving in study area

- After having a meeting with Sarpanch, Grampanchayat, Naikbomwadi, We have come to know the people from the Naikbomwadi were facing water shortage problems throughout the year, especially in summer season
- Even though the soil condition was good due to water shortage people cultivated only one season crop during the rainy season. On the hill top due to rain erosion of the soil is taking place is too high thus reducing the soil cover on the hill surface. Few problems which are understand by us while making meetings and discussion with the people of study area are listed below.
- The lack water availability has also resulted in low agriculture production.
- Supply of water through tankers becomes essential.
- Low income level with low living standard.
- High percentage of barren, cultivable waste land.
- The average rainfall is very less and also having high fluctuation i.e. average annual rainfall of 450mm.
- Silting of existing water harvesting structures like percolation tank and Nala bunds etc.

6.0 RESULTS AND CALCULATIONS

6.1 Socio – economic and ecological survey questionnaires for Naikbomwadi village.

1) Name of Village –Naikbomwadi village.
2) Name of Family Head –
3) No. of People In Household

	Below 18 years	18-60 years	Above 60 years
Age	**70**	**205**	**75**
Sex	M-70, F-65	M-205, F-213	M-75, F-62
Literacy	**91%**	**81%**	**71%**

4) Source of Livelihood

Private jobs	Labour	Labour outside village
15	71	2

5) Family Income –Below 1 Lakh-105, Above 1 Lakh-07

6) Available Job in Village –Nil

7) Own Agricultural Land–590.67 Hector.

8) Bio-Gas/Solar Plant– Nil

9) Own House

Slab	Manglore tile	Shed	Huts	Flat Roof Soil
07	70	10	25	Nil

10) Source of domestic and agricultural water

Well	Bore Well	Stream
178	27	Nil

11) What are your main source of income?

Agriculture	Own Business	Other
Yes	Yes	No

12) What types of crops?

Kharif	Rabbi	Perennial
Bajara, Gram, Pomegranate	Jawar, Wheat	No

13) Method of irrigation for applying water to crops

Furrow Irrigation	Basin Irrigation	Sprinkler Irrigation	Drip Irrigation
Yes	No	No	Yes

15) What type and no. of animal

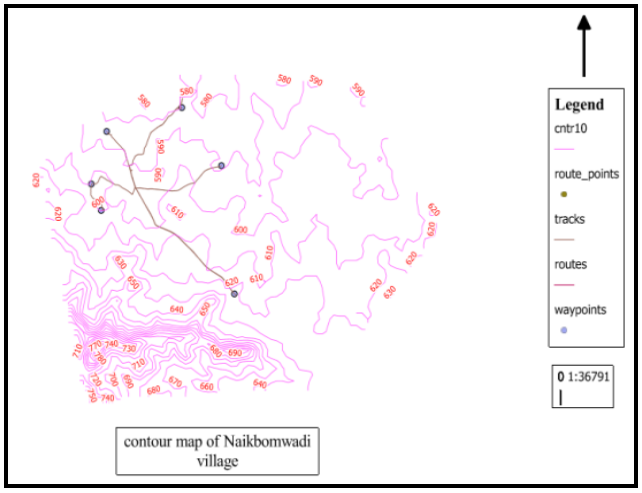
Cow	Buffalo	Goat	Sheep
382	93	230	956

16) Migration of Members in Family

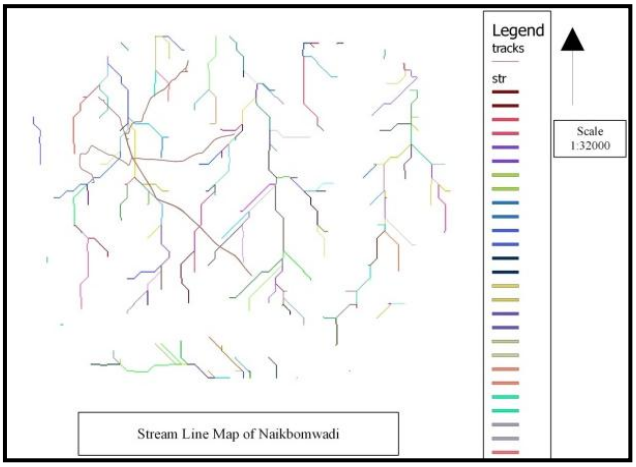
1) If Yes (How) – 32 2) Reason of Migration – for the purpose job in govt. as well as in private job.

6.2 Various Maps of Naikbomwadi Village by Using Q-G.I.S.

Contour map



Stream line map



6.3 Demand and Supply Analysis

Total population= 722

Standard demand=135lit/day

For drought area water requirement per capita =70lit/day

=70×722 =50540 lit/day

Annual water required for domestic = 50540×365 = 18447.1 cu.m

Total numbers of Ships & Goats =1166

Water requirement per Ships & Goats =10 lit/day

Total water requirement for animals =1166×10 =11660 lit/day =11.66 cu.m/day =11660×365=4255.9 cu.m

Cows below 1 Year

Standard demand =9 lit/day

Demand= No. of Cows Calves × Standard Rate

=154×25 =3850 lit/day = 3850×365 = 1405.250 cu.m

Milky cows standard demand =115 lit/day

Dry Cows = 41 lit/day

Demand =115×228 = 26250 lit/day = 26250×365 = 9570300 lit/day = 9570.3cu.m

Buffalo = 93

Demand = 115 lit/day = 93×115 = 10695 lit/day = 10695×365

= 3903675 lit/year = 3903.68 cu.m

Hens = 676

Standard demand = 676/1000×105=70.98 lit/day =70.98×36 =25907.7 lit/year

= 25.9077 cu.m

Total water demand for animal =1405.25+9570.3+3903.675+25.11+11.66

= 14916.80 cu.m

Water requirement for different crops

Area under agriculture = 590.67 hect.

Crop taking in this area Jawar , Bajara, Pomegranate

Kharif: Bajara , Pomegranate

Rabi: Jawar , wheat, Vegetables

Demand for Kharif season

Average delta in mm

Jawar = 300 mm Bajara = 300 mm Gram= 300 mm

Demand for Kharif crop = Delta × Area

=0.3×5900670 = 1772010 cu.m

Demand for Rabi

Wheat= 375mm , Gram=300mm

=0.375×59067000 = 2215012.5 cu.m

Total demand = Domestic requirement +Animal requirement + Agri.requirement

=18447.1+14916.86+2215012.5 = 2248376.4 cu.m

Total demand = Domestic requirement + Annual requirement + Agri.requirement

= 18447.1+14916.80+22015012.5

= 2248376.4 cu.m

Runoff & water requirements of study area [Inglis formula=For cal. yield based on studies carried out for catchments in western Ghat & Plains of Maharashtra C.G. Inglis gave the following relation for non-ghat (Hilly) area with Rainfall P less than 200 cm.

Yield= {P[P-17.78]}/254

Where P is precipitation expressed in cm.

Runoff calculation Avg. yearly rainfall in Phaltan

=287.75+246.75+490.88+332.55+326.44/5

P= 33.69 cm

A] Runoff by using basic formula formula

= [P(P-17.78)]/254

= [33.69[33.69-17.78]]/254

= 2.11 cm

B] Total available water = Area of watershed [sq.m]×Rainfall

= 82593000×0.3369 = 2782558.17 cu.m

Ground water recharge = Area of watershed [sq.m] × avg.fluctution × Specific yield

= 82593000×1.5×0.15 = 1858342.5 cu.m

Formula runoff = Precipitation-ground water recharge = 2782558.17-1858342.5

= 9,24,215.67 cu.m.

Evaporation

Pan evaporation rate = CP×Pan evaporation

In this region use Class A land Pan

Therefore CP = 0.6

= 0.6×pan evaporation

Take avg. value of Pan Evaporation 2014, 2015, 2016

Pan evaporation= 4.81+4.89+4.98/3

= 4.893mm/day

= 0.4893cm/day

=0.004893×365×64700×0.6

= 69330 cu.m.

Water available for artificial recharge for watershed development= Runoff – Evaporation

=924215.67-69330= 854885.67 cu.m.

6.4 Measures to be taken for improvement of water table surface as well as subsurface and reduce soil conservation

- Contour trenching and tree plantation: It is proposed to excavate trenches along the contours and planting the trees on their downstream sides.
- Bore Well Recharging: The area has two bore wells which would dry in summer seasons. Hence it is proposed to recharge them by diverting the water from contour ditches nearby them.
- Construction of continuous contour trenches on upstream side of the hill.
- Plantation of 'Madras Anjan' grass on hilly slope, 'Stylo' grass on downstream of continuous contour trenches and 'Khus' grass on bund constructed on pond.

6.5 Vanarai 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.

Vanarai Bandharas constructed at location-

Table No. 3: Location of Vanrai Bandhara

Sr. No.	Latitude	Longitude
1	17.93519	74.55579

6.6 Check dam

Sr. No.	Latitude	Longitude
1	17.93036	74.53954
2	17.93151	74.54355

6.7 Design details of check dam

Check dams are proposed across bigger in areas having gentler slopes. Layout and construction of permanent check dams to ensure proper storage and adequate outflow of surplus water to avoid scours on the downstream side for long stability of the dam. The site selected for check dam have sufficient thickness of permeable soils or weathered material to facilitate recharge of stored water within a short span of time.

6.8 Design details

Available land slope = 0-15(%),

Horizontal interval (Spacing between two bunds) =depends on site conditions

Dimensions of the Check dam:

Top Width = 1.0 m

Base width = 2.0m

Height =3.0m above ground

Depth of foundation = 1.0m

Length of check dam = depends on site conditions

Free board = 0.50m

Design details of percolation bund:

6.9 Percolation bund

Sr. No.	Latitude	Longitude
1	17.93695	74.54270

Side earthen bund details: Top width = 0.9 m, Height = 1.0m, Side slope = 2:1

7.0 CONCLUSIONS

After the rainy season around month of February upto month may of each year the water scarcity starts in the study area and water demand increases. As large amount of ground water is drawn out from under ground, reduction of ground water table which in turn reduces water level in wells.

To cater this problem of water storage in study area, the technique of watershed management is best suited. By implementing this method the ground water table is

increased thus providing sufficient water to the farmers during drought season and reducing the call of tankers on which crores of rupees were spent by the government. This method is cheap and also provides employment to villagers.

In this village there are great losses due to evaporation upto 69330 cu.m. So take remedial measures to avoid these losses. By reducing these losses we get extra supply of water for watershed management. Total demand of water in that village including man, animal and crop requirement is 2248376 cu.m. and supply is 89448 cu.m. This supply is calculated by considering evapotranspiration losses and avoiding evaporation losses.

7.1 Future Scope

1. From this we had concluded that the evaporation losses are major concern. To prevent evaporation losses further study can be carried out.

2. In this project work we did not done work on estimation and design of structure. It will be more rational to know how much finance need for construction of structures.

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