USE OF WATER BANKING CONCEPT IN AND AS WATER CONSERVATION

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Abstract— We called WATER as 'LIFE'. No one can live without water. As everyone knows the recent condition of whole world, 'WATER SCARCITY' not only in Maharashtra, not only in India but throughout the world. How to conserve water for recent and future use? There are many ways to conserve the water. This study deals with concept of BANKING of water from the deposing money in bank i.e. banking concept of money. As today we save money in bank for future use or future problem. Similarly, water can also be stored and saved for future draught problem if it occurs, we should be prepared for this condition. The goal of water banking, in general, is to efficiently allocate all available water to achieve an economic growth while achieving an environmental sustainability. In the study implementing this 'WATER BANKING' concept to solve the water scarcity problem in Manmad. Water should be store in ample quantity, so it can be used for this year and remaining can be used for next year also. To implement water banking concept, it is neccessory to increase storage capacity of a already constructed dam(Rialway Dam) by removing its silt i.e. 'DESILTATION OF DAM' in Manma city. It leads to increase in storage capacity of dam and ground water level etc. Thus, there is a need to explore a new management design approach.

Index Terms— Banking, Silt, Desiltation, Water Conservation, Railway Dam, Water Banking.

I. INTRODUCTION

The entire history of mankind could be written in terms of our need for water. From the very beginning, man realized that water is essential for survival.
"Water is a key resource to sustain human life". Therefore, sustaining growth in the human population requires even more water to be available. A reduction in water availability, conflicting water uses and other water-related environmental problems are rapidly increasing in many parts of the world.
The rainfall distribution in India varies over time to time as well as place to place. For any region of country 70% of annual rainfall is received during the monsoon month, June to September and for the rest of period there may be slight rain. In addition to the uneven distribution of rainfall in a year, the rainfall may show the considerable variation from year to year. With such uneven distribution of rainfall, it would be necessary to construct the reservoirs for storing and conserving water during excess rainfall period.
'WATER BANKING' concept can be define as, water can be save, store for future use, draught problem if it occurs. As it is necessary to save the money in bank, and as we use money which we have already saved in bank when we had more than enough. Similarly water should also be saved or stored in bank of reservoir for its future use. For this water should be carefully use to keep it for future use also.

II. STUDY AREA

1. MANMAD

Manmad is in district Nasik and taluka Nandgaon in Maharashtra having area 28.70sq.km. Manmad is a junction place of central railway. The India's 3rd Gurudwara is in Manmad. Along with this, Asia's largest grain godwon i.e. F.C.I. (Food Corporation Of India) which store and supplies grain to the country. It has the IOC (Indian Oil Corporation) plant to which oil is supplied directly from Mumbai by pipeline. Topographically Manmad is surrounded by Mountains and having longitude 20º14'38" N and latitude 74º25'34" E. From these mountains, rivers like Satvai, Ramgulna and Panzan arises which flows from south to north. In Manmad there are two small scale dam named as Waghdardi dam and RAILWAY DAM. In drought seasons, Waghdardi dam, Railway dam are getting water from Palkhed dam(36km) and Patoda dam(22km).
Manmad having approximate 80,000 population according to Census 2011 with 14,433 families. It is provided by 7MLD water by Manmad municipality and central railway.

A. History of Manmad:-

From past 45-50 years, from our grand to grandparents, people didn't get enough water ever. It's not been in listening that people are satisfied with the basic need of living i.e. WATER.

B. Recent Condition of Manmad:-

This is the most toughest and hardest TIME for Manmadkar up till now.No one has seen ever the drought condition like this. Rainfall of this year was just 392mm. All rivers and dams are in dry condition. Water supply is once in 50-55days. People are not even getting enough water for drinking and cooking purpose. It's being difficult to live in such condition. People are migrating from Manmad to another place. All bore wells are dried now. Water tankers of capacity 3200-3500 litres are being purchased for

Rs.700-750 /- by the people. The rotation from outsider dam like Patoda and Palkhed are pending.

C. Dangerous Future of Manmad:-

The unhealthy climate, crimes, migration will go on increasing if such condition is continued for future also. It will be so difficult to handle the people, insufficient water, climate, crime etc all at once. And one day, such condition will occur that MANMAD WILL BE TOTALLY DISTROYED.

2. RAILWAY DAM (MAHADEV NALA)

Railway dam, also called as Mahadev Nala is constructed by British govt and is completed in 1943 as shown in fig. It is constructed across Ramgulna river rising from the Ramtekadi Mountain. This dam is of earthen type, but concreting is done on the surface during the repairs and maintenance. On upstream side there are three more small Nallah bunding made up of stone, steel and concrete, which are constructed to reduced water pressure and to avoid direct load on main dam. Thus it helps to prevent failure of dam.The silent feature of dam are as follows:

Length - 210m, Height - 9m (original), - 4.4m (after siltation) (Top width at gate- 3.8m), (Width of roadway- 1.4m),(Bottom width- 4.7m), (Free bord- 1.0m), (Catchment Area- 22 Acre)

Fig.1

It is having original storage capacity of 36cr.ltr. The silt which is carried out with the Ramgulna River is deposited in its reservoir. Before 35 years ago, in 1978, the desiltation of dam was taken place. But the recent storage capacity of the reservoir is only 9cr.ltr. i.e. near about 75% siltation is occurred at the rate of 7714.28 m3/year. Water of this dam is supplied to: 1. Railway Station (junction),2. Train Watering, 3. Central Railway Workshop (Manmad),4. Railway Colony (1250 Railway Quarters). Before supplying to these places, water is treated in filter house having 3 plants which works at rate of 4000gal/hr. Railway also has separately preserved water storage in Patoda.

III. LITRETURE REVIEW

Brief review of literature relevant to the study is presented below.

A. Australians Water Conservation Behaviors and Attitudes.

Sara Dolnicar, University of Wollongong, studied and researched the Australian water crisis addressed in many ways: ranging from increasing water conservation behaviours to minimize demand, through to producing water through large scale water augmentation projects.

Due to the extended drought experienced in many locations across Australia in recent years, there has been a recent focus on developing wastewater recycling and seawater desalination plants. While this is an important measure for emergency water supply, water conservation should still play a major role in reducing demand for water. The aim of this study is to provide much-needed empirical data about Australian attitudes towards water conservation, and their water conservation behaviours. This market insight provides a knowledge basis for the development of public policy measures and social marketing campaigns aimed at increasing water conservation among Australian residents. Results from a survey study of 1495 people indicates that Australians generally have very positive attitudes towards water conservation and water saving appliances, however these positive attitudes are not consistently translated into actual behaviour. The main barriers to adoption of water conservation behaviours identified in the study are: the perception of inconvenience and impracticality, as well as costs associated with purchasing water saving appliances. These findings highlight the fact that there is still substantial potential to be harvested in Australia though water conservation measures. Opportunities for public policy makers to stimulate this process are identified.Future demand management should target those who are high water users.

B. Equity In Watershed Development.A Case Study In Western Maharashtra

Priya Sangameswaran studied the village of Hivre Bazar in Western Maharashtra is now well known in NGO and governmental circles for its social and economic changes following watershed development. She discussed in her paper, the extent to which these changes have been equitable, with a particular focus on equity across different land holding category. The equity outcome in Hivre Bazar is better than in many other watershed programmes, mainly due to the use of watershed-plus and other attenuating measures. As such, it is a good example of how certain kinds of equity concern scan be taken up an implemented with local initiative. However, there are also limitations in the equity outcome, which raise important questions for future water interventions.

In Hivre Bazar, the equity impact is more positive than that of most watershed projects, impart due to the use of watershed plus measures and in part due to specific measures taken to attenuate the negative impact of particular aspects of the project.The

discussion in this paper used a combination of primary and secondary data. Primary data was collected in Hivre Bazar village during a 3 month stay in the village – from Nov 2001 – Jan 2002 – an occasional short visits before and after this period. A combination of semi structure interviews, participation in some village-level activities, open ended discussion and direct observations were used. Secondary data about the village were collected from official, the village-level organisation involve in the implementation of watershed development programme, govt. Publications and reports in local press.The principle watershed works constructed include continuous contour trenching and tree plantation (on forest, private and panchayat land), contour bunding, nala bunding, 2 percolation tanks and five storage bundharas.

IV. METHODOLOGY

1. SURVEY

1.1. Reconnaissance Survey

The reconnaissance survey is done of near about 19 km around the Manmad city for site seeing and surrounding condition to choose the exact location which is feasible to conserve the water.

First of all we started our survey from the Ankai Tankai. The Satvai River rises from Ankai mountain which fully flows during rainy seasons. Visual inspection of this river is done along its length from Ankai to Nagapur (4km).

We had thought to conserver this river water by constructing a small dam, to store its water on U/S side. The advantage of constructing a new dam across this river is: 1.It is nearest to Manmad. 2.It is at high level from Manmad, so water can be carry by gravitational force itself without any pumping.3.It is economical. After that I went to the already constructed earthen dam i.e. Waghdardi Dam (3km). We gone through the visual inspection and enquired to the nearest people about it which stores rain water and water getting from Palkhed Dam by rotation.

Then, I came to the RAILWAY DAM (MAHADEV NALA), which is in Manmad itself. After total observation of this dam, it was 75% filled by silt which is carried with Ramgulna river and deposited in the reservoir of dam.

1.2. Citizen's Survey

From Citizens survey it is seen that people are managing, surviving and living in just 35lit/ capita/day in this drought condition. So, in other seasons when water will be available to the people after implementation of this project, people can also live better life with 90lit/ capita /day. This is very important for the people to know and accept this situation. People should have learn to minimize the wastage of water by avoiding unnecessary things such as vehicle washing, shower bath, garden sprinkling, leakage plumbing etc.We have also surveyed to the common people of Manmad to know their experience and share recent water scarcity problem with them.

1.3. Selection of Site.

After the survey and detail study of these locations, I decided to select the project site of railway dam. Because it is already constructed by the British engineers, so the cost of construction of new dam is reduced. It is belongs to the Central Railway.

From the study, it would be more convenient for the implementation of this project over there. But it's difficult to the permission from the DRM, central govt.

2. DATA COLLECTION

2.1. Population Data of Manmad-is collected

2.2. Rainfall Data

Rainfall in Manmad is not constant but is varying in each year. But it is observed from having consistent rainfall. The average rainfall of Manmad is 646.40mm. If this rain water had been conserved and stored in the past, we would not have to face the scarcity problem now. In this year's rainy season, if there is moderate or heavy rainfall, then this water should be preserved and stored for this year as well as for future. The survey is carried out for the recent ground profile of that area by Height Of Instrument (HI) method with the help of instruments.

3. Testinfg on Silted soil

3.1. Standard Proctor Test

Observation Table 1:-

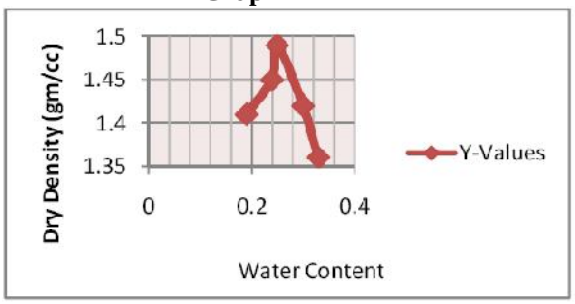
Sr. No.	1	2	3	4	5
Mass Of Empty container (M1)	13.5	13.0	13.5	13.6	13.1
(M1)+wt. Of wet soil=(M2)	39.2	44.5	35.7	44.7	54.5
(M1) +wt. Of dry soil=(M3)	35.1	38.5	31.2	37.5	44.2
W % =(M2-M3)/(M3-M1)	19	24	25	30	33

Observation Table 2:-

SR. NO.	WT. OF MOULD + WT. OF SOIL (gm)	WT. OF SOIL (M)gm	BULK DENSITY (M/V) (gm/cc)	WATER CONTENT %	DRY DENSITY (gm/cc)
1	6226	1679	1.679	19	1.41
2	6344	1797	1.797	24	1.45
3	6423	1876	1.876	25	1.49
4	6408	1861	1.861	30	1.42
5	6368	1821	1.821	33	1.36

From above table gragh is plotted as follows where water content is on x-axis and dry density is on y-axis.

Graph



Results from graph,
OMC = w = 25%
MDD = 1.49 gm/cc

b. California Bearing Ratio:-
Observation Table:-

SR. N.O	PENETRATION (mm)	LOAD (kg)	SR. NO.	PENETRATION (mm)	LOAD (kg)
1	0	0	14	6.5	61.9
2	0.5	11.2	15	7	63.3
3	1	19.2	16	7.5	64.6
4	1.5	26.1	17	8	65.6
5	2	32.7	18	8.5	66.7
6	2.5	38.7	19	9	67.5
7	3	42.7	20	9.5	68
8	3.5	46.6	21	10	68.3
9	4	49.9	22	10.5	68.7
10	4.5	52.9	23	11	69.1
11	5	55.7	24	11.5	69.2
12	5.5	58	25	12	69.3
13	6	60.1	26	12.5	69.4

Test load corresponding to chosen penetration standard load for same penetration.
Standard load:- for 2.5mm = 1370 kg
for 5.5mm = 2055 kg

$$CBR = \frac{\text{Observed load at 2.5mm or 5.0mm penetration}}{\text{Standard load at same penetration}} \times 100$$

∴ For 2.5mm, CBR =(38.7/1370) x 100 = 2.82
And for 5.0mm, CBR = (55.7/2055)x 100 = 2.7
If CBR of 2.5mm penetration is less than CBR of 5.0m penetration then test is repeated. Choosing highest value i.e. 2.82 .
RESULT- The CBR value of this specimen is 2.82.

V. APPLICATION OF WATER BANKING CONCEPT

The calculation for quantity of water to be used by the people, and how much quantity water will retain for further use is shown as follows:
Population of Manmad is = 800000
Water of railway dam is supplied to:
i.Railway quarter's population = no. of railway quarters x family members (Considering average members in each family = 5)
∴ Railway quarter's population = 1250 x 5 = 6250
∴ Water required = 6250 x 90 = 5,62,500 lit/day
ii.Railway station = 30,000 lit/day
iii.Train watering = 30,000 lit/day
iv.Railway workshop = 40,000 lit/day
Total water usage from railway dam supply = 6,62,500 lit/day
So, for 8 months excluding 4 months of rainy season = 662500 x 30days x 8 months = 15,90,00,000 lit/8months
Storage capacity of the dam is = 36,00,00,000 litres
Remaining quantity of water = 36,00,00,000 - 15,90,00,000 = 20,10,00,000 litres
Losses – Huge quantity of water is generally lost from an impounding reservoir due evaporation, absorption and percolation. Depending upon which, the following losses may occure from such reservoir evaporation, transpiration, interception, infiltration.From above losses, evaporation is a major loss which depend on surface area, temperature, humidity, water depth, wind velocity, atmospheric pressure and quality of water.As it is small dam having small surface area all other factors do not affects rather than temperature affects. Manmad having moderate temperature but it rises and goes higher and higher in summer. It rises up to 47ºC.
∴ Precipitation – surface runoff = Total loss (Evaporation + transpiration + interception + Infiltration)
∴ Total loss (Evaporation + transpiration + interception + Infiltration) = Precipitation- surface runoff.
Taking all these losses as 1%, because of small surface area i.e. catchment area.
1% of 20,10,00,000 litres = 20,10,000 litres
∴ 20,10,00,000 - 20,10,000 = 19,89,90,000 litres
This much quantity of water is left for future use. If 50% of this quantity is given to people other than railway's i.e. to Manmadkars, then 9,94,95,000 liters of water is BANKED in the dam for next year. If next year, there is drought season, 9,94,95,000 litres of water will be available.Thus, here we get the Banking concept by which this much quantity of water we can CONSERVE.
As it defines, water can be saved, stored for future use, drought problem if it occurs, as today we deposite and save money in bank for future use or future problem. We should always be prepared to face future problems.
Therefore, by the minimisation of water usage and its best utilisation we will successfully obtain our goal of water conservation and we will be prepared to face future drought problem.

VI. DESILTATION OF RAILWAY DAM

On 15th April, 20 farmers got permission to excavate and carry this silt to their farm at their own expenditure by using machineries like JCB, pokland, tractor, dumper etc. On 17th April, DRM Bhusawal, AEN Manmad visited the site and marked boundary

line for the excavation. And on 18th April, the work is started. Disiltaion progress shown in following fig.2 and fig.3.

Fig.2

Fig.3

VII. RESULTS

- By studying and conducting this project, it results in to the increase in storage capacity of the dam by removing 270000 cubic metre silt.
- From results of testing, it is shown that this soil (silt) (Chicken Poyta) is very useful for farming, gardening, and for bricks making.
- Thus by excavating total silt, storage capacity is increases by 75% and dam will store 36 cr.lit quantity of water as originally it was. If dam store this much quantity of water and if people reduces the usage of water and can survive in 90lit/capita/day, then 9,94,95,000 litres of water is BANKED in the dam for next year. And if in next year, there is drought, 9,94,95,000 litres of water will be available.
- It also results in to increase in ground water level of near about 40% of total area of Manmad. Dried wells and bore wells will increase their ground water table.
- As farmers are excavating by their own expenditure, this project is so economical for Railway, farmers and thus for whole Manmad.
- Excavated silt will give best quality crops, and it will not require any other chemical fertilizers for next 10 years which results in saving money and thus economy achieves.

CONCLUSIONS

- From the whole project, we can conclude that the selected site of Railway Dam is feasible to solve and face the water scarcity problem in Manmad.
- 90 lit/cap/day water is more than enough for people, when they can also survive in just 30-35 lit/cap/day.
- Depending upon water availability in the reservoir, we can supply from 35 – 90 lit/cap/day water i.e. for EVERYDAY. And this is possible by implementing the 'Water Banking' concept by conserving water for future use also.
- Like this, many regions having consistent rainfall can be prepare themselves to face and survive for the drought by studying, understanding and implementing the "WATER BANKING" concept.

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