

Potentiality, Utilisation, Problems and Management of Ground Water in the Northwest Bankura District, West Bengal

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Abstract

Water is regarded as the most essential matter of nature. There is no life without water. It has been estimated that almost all the vegetables and grasses contain three fourths of water out of their total weight. An adult, on an average, consumes about 9,000 litres of water in a year and he requires about 4.5 million litres of water for all the food he consumes in a year. Such huge water needs come mainly from rainfall and ground water resources. The Northwest Bankura District (NBD) in west Bengal receives seasonal rainfall, most of which is lost as run-off. So, the permanent resource of water is ground water which if it is not properly utilised and maintained, the whole environment balance will be disturbed. The main objective of this paper is, therefore, to discuss the potential, utilisation, problems and management of ground water in the NBD, so that the future becomes safe in this regard. The study reveals that in the recent years NBD has spatio-temporal variations in ground water resources because of both physical and socio-economic setups and due to the unplanned and sometimes irrational use of ground water. This is creating alarming situations a 'danger signal' in the context of development, environment and society is already looming large.

Introduction

The study area (NBD) in the North Western District of Bankura in West Bengal has altogether 397 villages under its jurisdiction (157 villages in Saltora, 75 villages in Mejhia and 165 villages in Gangajalghati). The villages are of different shapes and sizes as well as of varying socio-economic structures and environmental details. NBD is a part of outer cratonic surface of the Chotanagpur plateau (Ahmad, 1965). The area can be divided into three broad landform units: the eroded plateau of Saltora PS which is a part of the Chotanagpur plateau, the eroded plain with varying height from 120m

to 200m and the alluvial plain that varies from 80m to 120m with river basins. As regards lithology, the study area covers three major lithological zones, namely Alluvium, Gondwana and Granite-gneiss (Table 1).

This type of lithological character provides enough opportunity to surface run-off and ground water table formation. The Saltora PS and western part of Gangajalghati PS consists of unconsolidated rocks, which have relatively poor ground water potentiality. Mejhia PS and most parts of Gangajalghati PS consist of semi unconsolidated weathered rocks with older alluvium which have relatively medium to good ground water potential.

Table 1: Lithological Zones in North West Bankura District

Lithological Zones	Area (Km ²)	% To Total Area	Area Concerned
ALLUVIUM	126.93	15	The Damodar and Shali river basin
GONDWANA	42.32	5	Saltora PS just adjacent the zone of Alluvium, thinly extended
GRANITE GNEISS	676.98	80	Most of the Places of the area concerned
Total	846.23	100.00	

The two lithological zones- Quaternaries (north of Mejhia and east of Gangajalghati PS) and Gandwana Sandstone (extreme northern portion of Saltora) provide favourable permeability for formation of ground water table, and geology of this area is favourable for canals and deep tubewells. The bearing capacity of the zone Anorthosite (south of Mejhia and north of Gangajalghati) and Chotanagpur Geneiss (south and most of Saltora PS), are very high and have low permeability (Table 2) The negative contrast between high bearing capacity of soil and low permeability is favourable for the construction of small reservoirs and the low bearing capacity and high permeability are favourable for tubewell and dug well irrigation. The area is dominantly rural where primary activities play a vital role. Though known as a drought prone area, about 77.19% population is engaged in the primary sector and development of the primary sector solely depends upon the provisions of irrigation water (Prasad, N. & Sinha, M., 2005)

6.0 Data Base Methodology

The study is based on reports and maps published by different organisations. Census data and primary data from intensive field study, conducted recently. The analysis both quantitative and qualitative uses methods and suitable cartographic techniques to draw conclusions.

4.0 Ground Water Poetntiality and Utilisation

The mean level of ground water table in the area ranges from 50 to 100 metres above the mean sea level (Fig. 1). Ground water table zones are not always well-defined in the whole study area, their depth varies from 10m to 15m approximately (Table 3 & Figs. 1, 2). The advances of sophisticated means of ground water withdrawal makes the ground water easily accessible and easy accessibility causes over-exploitation which leads to a lowering of ground water table in the long run. The decline in water table during the drought year is of a cyclic nature, and

Table 2 : Geological Characteristics of North West Bankura District

Lithology	Permeability	Bearing Capacity	Foundation Characteristics	Ground Water Potentiality
Quaternaries	Cumulative High	Low 1-2Kg/Cm ²	Poor	High
Gandwana Sandstone	Moderately High to Low	Variable 1100Kg/Cm ²	Fair to Poor	Moderately High
Anorthosite	Low	Very High 1500- 2900Kg/Cm ²	Excellent	Very Low
Chotanagpur Gneiss	Low	Medium with 500 Kg/Cm ²	Moderately Good	Moderately Low

Source: Bankura District Resource Map prepared by the Geological Survey of India, Kolkata.

there is hope of recovery if the following years of rainfall are above normal. This saves the area from permanent lowering of ground water table (Table 3 & Fig. 2).

In 1990, the co-efficient of co-relation between monthly rainfall and monthly variation in the depth of ground water table was -0.19, this increased substantially to 0.35 in 2000 (Table 3, Fig 2), which is no doubt a positive sign of (renewable) resource recovery. This improves the soil permeability which is enriched by intensive and extensive tilling through power tiller. The tilling through traditional methods 'langal' allows penetration upto 12 inches in the sub-soil but the power tiller can increase it up to 2.5 ft.. Recently the number of power tiller use has increased and the cultivated area has also been extended, which acts as impetus to ground water nourishment. The increased rainfall which is reflected in the mean values of rainfall in the years 1990 and 2000 (Table 3) provide sufficient opportunity to surface run-off and helps to maintain the cyclic nature of the ground water table

But the unrestricted withdrawal of water causes permanent lowering of the water table (Fig.3). The cyclic variation of water table is a normal phenomenon (Table 4 & Fig. 2) but the trend line of the water table from 1990 to 2000 has moved downward; which signifies that the water table is fast declining. The high population density creates further scarcity of potable water, while increase in the cultivated area, irrigated area and irrigation intensity are pushing up the demand for water, both for domestic and irrigation purposes. Figure 4 shows the gross ground water potentiality in the Northwest Bankura District.

5.0 Ground Water Withdrawal and Problems

The shallow and deep tube-wells, dug-wells etc. are spread over the area to solve water scarcity and meet the rising demands for pure drinking water. This has given rise to following impact on ground water in the study area

Table 3 : Monthly variation of Ground Water table & its relation with rainfall

Years		January	February	March	April	May	June	July	August	September	October	November	December
1990	Depth of G.W.T. in metres (X)	1	2	3	4	5	6	7	8	9	10	11	12
	Rainfall in millimetres (Y)	3.96	4.57	5.49	7.01	6.26	9.75	8.53	2.43	1.52	2.13	2.74	3.35
		$\Sigma XY=7038.46$, $\Sigma X=57.74$, Mean (X)=4.81, S.D.(X)=2.53, $\Sigma Y=1670.2$, Mean (Y)=139.18, S.D.(Y)=172.68. Covariance of (XY)=-82.92, $r=-0.19$, S.E. =0.27											
2000	Depth of G.W.T. in metres (X)	4.57	4.27	5.18	7.32	9.45	10.67	8.84	2.47	1.52	2.13	2.74	1.05
	Rainfall in millimetres (Y)	0	20	0	80	137.3	294	339	117	377	60.5	0	0
		$\Sigma XY=9093.12$, $\Sigma X=62.21$ Mean (X)=5.18, S.D.(X)=3.00, $\Sigma Y=1424.8$, Mean (Y)=118.74, S.D.(Y)=134.57. Covariance of (XY)=142.26, $r=0.35$, S.E.=0.25											

Source: Calculated on the basis of data available from Bankura District Agricultural Office, West Bengal

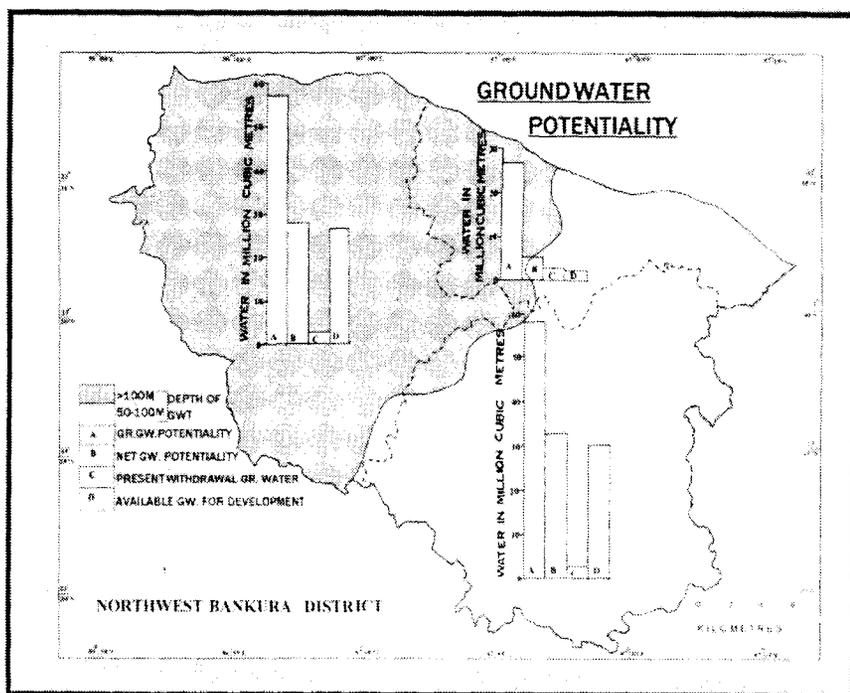


Fig. 1 Ground Water Potentiality

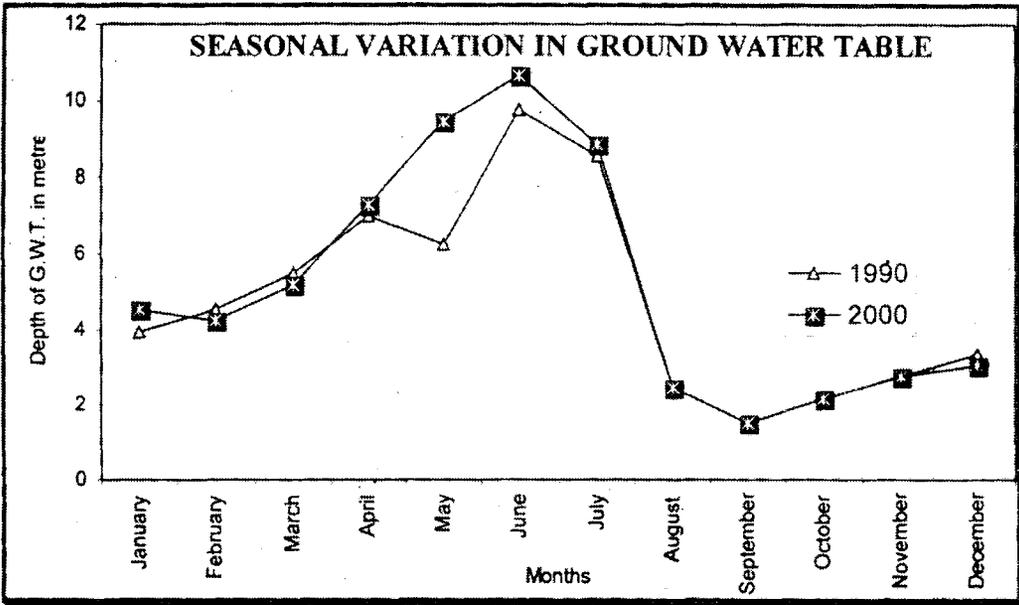


Fig. 2 Seasonal Variation in Ground Water Table

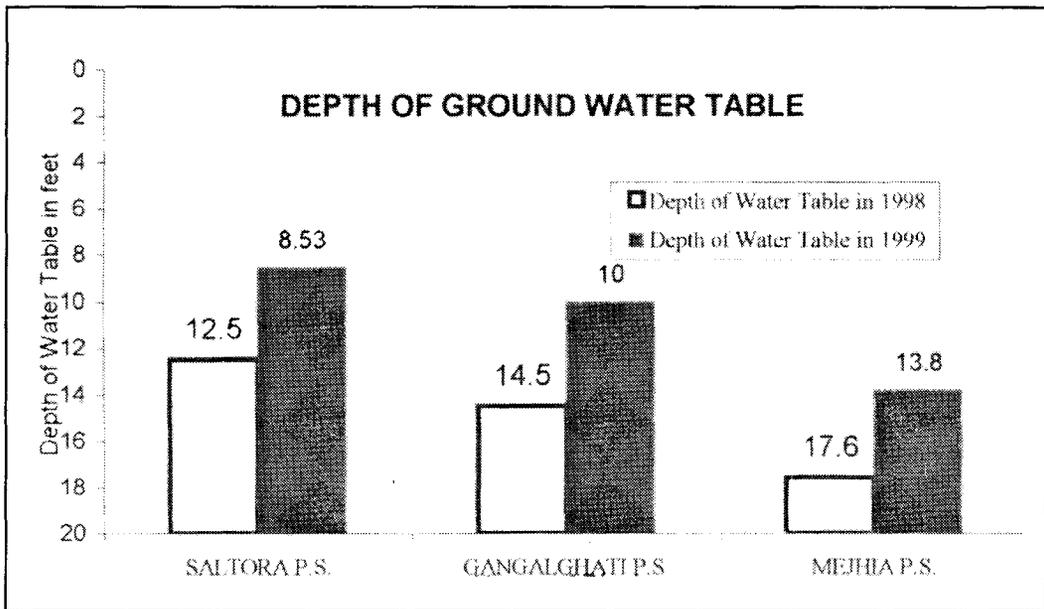


Fig.3 Depth of Ground Water Table

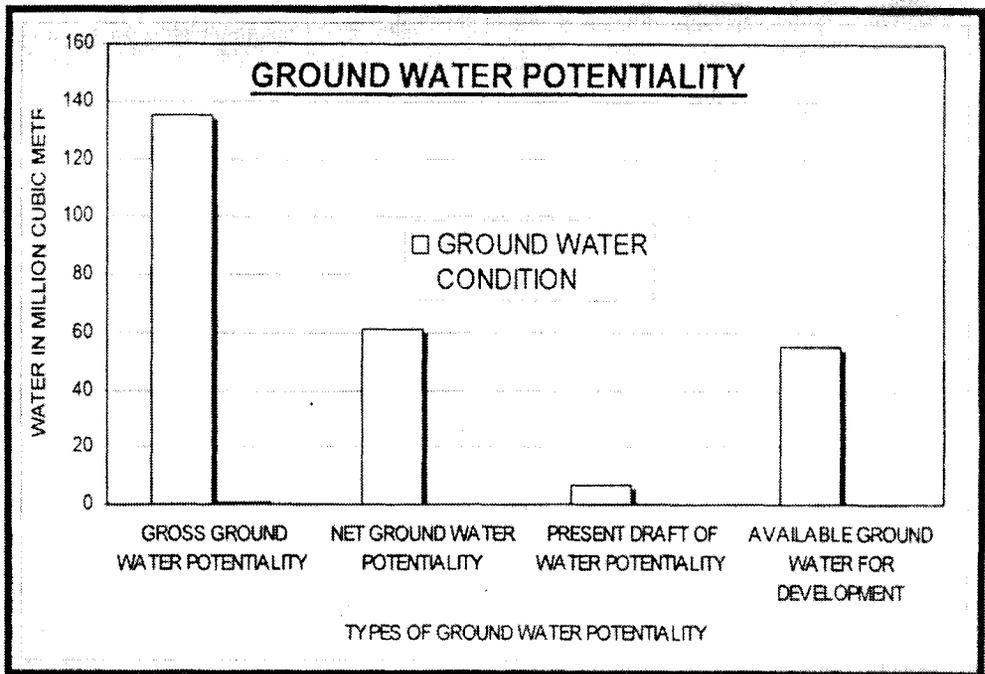


Fig. 4 Types of Ground Water Potentiality

- * In the study area the rate of annual average lowering of water table is approximately 0.60 cm. (0.02 ft.) (Table 3 & Fig. 2).
- * In the NBD, the ground water withdrawal is largely through tube-well by means of an iron pipe line, which is the most economical means of water withdrawal. This causes heavy iron contamination due to rusty water and bacteria like 'Crenothrix' and 'Gallionella' cause health problems. (Goel, 1997). Though iron in itself is beneficial but excess quantities can pose several problems in domestic use. It can discolour laundry and utensils, iron in tea and coffee combines with tannin and gives an inky appearance and an unpleasant metallic taste. Potatoes boiled in iron rich water get oxidised and turn black (Goel, 1997). Such incidents are very common in Ranbhal (J.I. No.103), Salbedia (J.L.No 119), Thum Kora (J.L.No 102) and Ukharadihi (J.L.No.85) of Gangajalghati Block.
- * Fluoride is physiologically very active and up to certain limit, it is not harmful for dental care but excessive fluoride in drinking water causes fluorosis by mottling of teeth and skeletal damage (Goel, 1997, p.198). This is also commonly observed in most villages of the study area.
- * The new technology has improved the situation of village folks who had to travel long distances for daily drinking water for domestic purposes, but this convenience has encouraged indiscriminate use of ground water.

Table 4: Monthly variation of working hours of water withdrawing pumps 2001-2002

January	February	March	April	May	June	July	August	September	October	November	December
1	2	3	4	5	6	7	8	9	10	11	12
<i>In hours</i>											
1.05	1.00	1.20	1.20	2.10	1.30	0.30	0.30	0.40	1.00	2.05	2.40

Source: Model Question Survey (2001-2002)

* After the 1960s, rapid electrification has no doubt improved the quality of life, but 'rural electrification has also put pressure on ground water resource' (Dhawan, 1998). In NBD, electric pump-sets are best suited for continuous pumping water from any depth and electric power is heavily subsidised in comparison to alternative sources of energy for lifting water. 'The linking of power tariff with horse power of a motor instead of actual consumption of power in many States makes the well-owner behave as if the marginal cost of pumping water is zero' (Dhawan, 1998, p.44). In NBD, the monthly average working hours of water withdrawal pumps is 01 hour 19 minutes (approximately) and here villagers on an average are getting electric facility for 10 hours 05 minutes (Tables 4 & 5). The water withdrawal pump is running proportionally to the available hours of electricity in different villages. It means that far more hours a village enjoys electricity, the pump is running for more and more hours (Table 5 & Fig.5). The intensive withdrawal occurs mainly in the Niyandapur G.P. and Pirraboni G.P. of Gangajalghati Block and Mejhia Block.

* In inhabited areas, the frequency of dug wells is more than permissible level of 10 to 13 dug wells within a distance of 200 metres. Overcrowding is very common in the Gangajalghati, Amarkanan, Latabani G.P. of Gangajalghati Block and Mejhia G.P. of Mejhia Bolck.

6.0 Strategies for Water Management

Modern society cannot step back for the sake of preservation, but at the same time, we must not be hostile towards natural resources and development must be sustainable in the long run. In the NBD, the following strategies for water management may be undertaken.

- The Ground Water (Control and Regulation) Bill of 1974 is yet to be enacted by the State legislatures.
- One of the measures could be to keep a strict control on well density. Lataboni G.P. and Gangajalghati zone of Gangajalghati Block as well as Mejhia G.P. are densely crowded by dug wells. Consequently, the rate of water discharge has been reduced
- The crushers, shaw mills, brick kiln and tally making industries use water. If there is ground water regulation on the lines

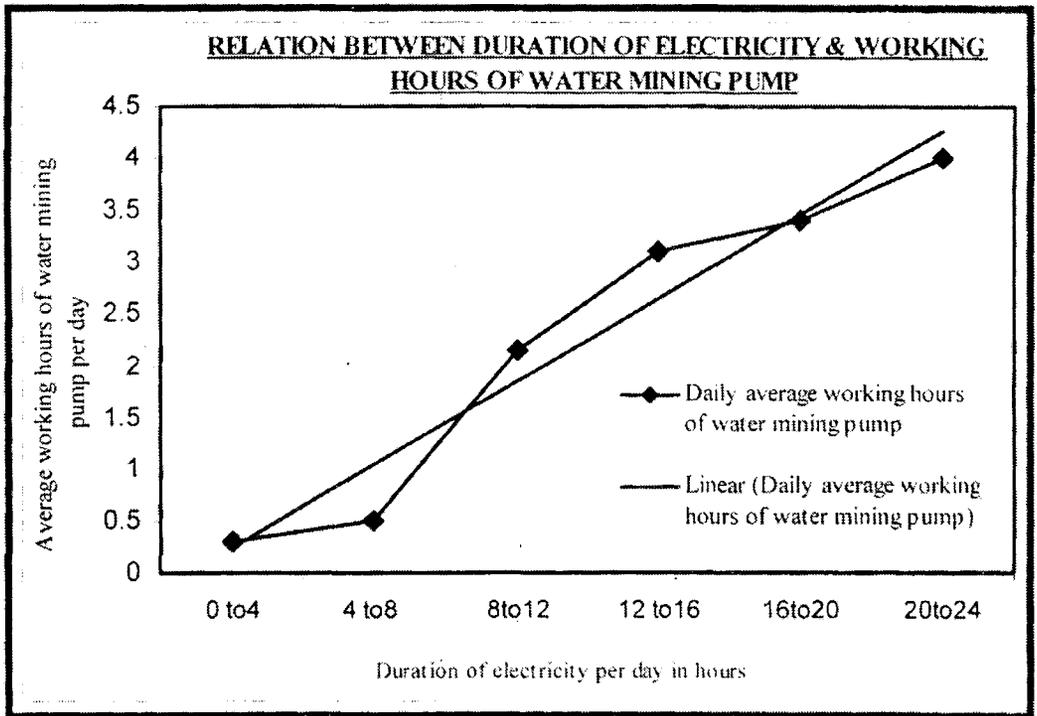


Fig. 5 Relation between Duration of Electricity & Working Hours of Water Mining, Pump

Table 5 : Relation between Duration of Electricity and Working Hours of Water Withdrawing Pumps, 2002-2004

Electricity Duration In hours	Pump Working In hours	Number of Villages Availing the Electricity	Electricity Duration(X) Number of Villages Availing the Electricity(f)	Electricity Duration(X) Working hrs of Water Withdrawal Pump(f)
0 to 4	0.30	44	$n=294, \Sigma xf=2956,$	$n=294, \Sigma xf=217.7$
4 to 8	0.50	41	Mean (X)=10.05,	Mean (X)=0.70.
8 to 12	2.15	88	Electricity Duration(X), Working hrs of	
12 to 16	3.10	112	Water withdra Pumps (Y)	
16 to 20	3.40	6	$\Sigma XY=217.7, \Sigma X=72.$ Mean (X)=12 S.D.(X)=6.83,	
20 to 24	4.00	3	$\Sigma Y=13.452.$ Mean (Y)=2.24, S.D.(Y)=1.41,	
			Covariance of (XY)=9.4, $r=0.97,$ S.E.=0.02	

Source: Model Question Survey (2002 -2004).

of our industrial licensing scheme, that will control both location of wells and ground water withdrawals by each well owner. The Saltora Block has numerous, saw mills, brick kilns and tally making industries but there is no provision of industrial licensing scheme to restrict the use of ground water.

- There is no available method to the common farmers to estimate the actual volume of water for their field. This kind of lack of awareness and due to subsidised electricity tariff unrestricted withdrawal of ground water causes overuse and misuse. Actually, the policy of giving free electricity and water is not only short-sighted but also suicidal. The structural distortion in power tariff comes about because the state electricity boards fail to collect electricity bills from farmers who, in connivance with lower functionaries of the electricity department begin tinkering with electricity meters.
- For maintenance of the ground water quality and to avoid pollution from arsenic, lead fluoride, the *Gram Panchayet* has a rule not to extend the tube-wells beyond depth of 15 metres. For this purpose, permission of *Gram Pradhan* is essential. This is an important policy to check the lowering of ground water table. In reality, this ruling has no meaning since it is difficult to enforce. What is required is mass awareness, hence it is the duty of people to preserve these valuable resources for the coming generations.
- Most of the brick kilns leave ditches evading the existing rule in this regard instead of discharging duty of making these ditches as fields for aqua-culture.

These type of ditches are very common in the Saltora Block near the brick kiln. The net result is a breeding ground for mosquitoes which also pollutes the adjacent water bodies.

- The eco-friendly crop combination in NBD will help regulate the water scarcity problem. Though paddy has great demand in NBD, double cropped paddy (mainly in Gangajalghati Block) and annual cereal cultivation will not lower the total volume of food grain production, rather it will minimize water scarcity in NBD.
- The Farmers' Managed Irrigation System (FMIS) which is a user-oriented irrigation method and the *PANI PANCHAYAT* programme like the one in the State of Maharashtra (Rajle, K. V., and Maloney G. 1998), can make villagers more aware and the villagers themselves can take the initiative to save their life supporting potable water resources in NBD. In this context the Shali Reservoir of Baldhia mouza is significant.
- Maintenance of existing water bodies is an essential step to maintain the balance in the hydrological cycle in NBD.
- Though the study provides valuable leads in water conservation, it is not yet clear how people's participation can help the resolution of the twin problems of over exploitation and overcrowding in ground water irrigation in this vulnerable regions (Dhawan, 1998). Mass awareness helps and it is essential to undertake these programmes. *Shali* Diversion Scheme in this context is very

important in creating awareness among the common people to augment water availability.

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