Volume 1, Issue 3 December 2015 ISSN NO: 2454 - 9827

North Asian International Research Journal Consortium

North Asian International Research Journal of Social Science & Humanities

Welcome to NAIRJC

ISSN NO: 2454 - 9827

North Asian International Research Journal Social Science and Humanities is a research journal, published monthly in English, Hindi, Urdu all research papers submitted to the journal will be double-blind peer reviewed referred by members of the editorial board. Readers will include investigator in Universities, Research Institutes Government and Industry with research interest in the general subjects

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CONSEQUENCES OF DEPLETION OF GROUNDWATER TABLE AND ITS MANAGEMENT IN MURSHIDABAD DISTRICT, WB.

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ABSTRACT:

Groundwater is exploited to fulfill at least 52% of agricultural uses, especially for irrigation and 50% of urban and industrial uses. Indiscriminate exploitation/development and unscientific management of the resource had led to multiple problems, one of which is that of decline in groundwater table, the problem of groundwater depletion. Groundwater depletion is often defined as long term water level decline caused by sustained groundwater pumping. It is a crucial issue associated with groundwater use. In Murshidabad district, there are two types of hydrological basins (i) Alluvial tract and (ii) semi-consolidated sandy tract basin. In May-June 2011, 2012 and 2013, summer water table declined to 05 to 20ft in Murshidabad because of low rainfall. Bhagirathi river also moved away from this district and over exploitation of groundwater due to rapid increase in population also took place. Most serious consequences of depletion of groundwater table are increased pumping costs, reduction of water in streams, lakes and wells, retarded plant growth, land degradation etc. To protect groundwater depletion many steps should be taken- Establishment of Management information system, notification of crucial areas of groundwater etc.

KEYWORDS: ***Groundwater Depletion, Management.***

INTRODUCTION:

Groundwater is an important natural resource as it fulfills the demands of domestic, agricultural, industrial and other economic activities of man. With the inception of technological innovations, its importance and use have increased. Nearly 85% of India's population is dependent upon groundwater for their domestic needs particularly as a source of drinking water in rural and urban areas. Groundwater is exploited to fulfill at least 52% of agricultural uses, especially for irrigation and 50% of urban and industrial uses. Indiscriminate exploitation development and unscientific management of the resource has led to multiple problems, one of which is that of decline in groundwater table the problem of groundwater depletion. Ground water depletion is often defined as long term water level decline caused by sustained ground water pumping. It is a crucial issue associated with ground water use. Therefore, the use of ground water resource has to be managed and planned for general prosperity.

Water resources in Murshidabad (West Bangle) include both surface and groundwater resources. Usage of groundwater has some advantage such as constant temperature. Little treatment required, small distance from source and user assurance of supply etc. over surface water and these advantages have stimulated the interest in exploiting the groundwater in Murshidabad where geological structure is also favorable. Since mid-sixties there has been a phenomenal development of groundwater resources in Murshidabad. Decline in groundwater level has

also been reported, especially in summer season in some of the Anchals of this district, tube-wells are major source of irrigation. In urban areas for water supply underground water is used indiscriminately, especially in private residential colonies. Rapid increase in urban population has led to over exploitation of groundwater in urban areas. It has vastly contributed to the development of agriculture, particularly during last six decades with tube-well irrigation. It exploitation is largely in private hands. Consequently, in many areas exploitation far exceeds annual recharge leading to decline in water table.

Groundwater occurs in very complex structures. Therefore, for assessing groundwater resources hydrological and water balance studies are required which is difficult. So Geological Survey of India, Central Ground Water Board and West Bangle State Underground Water Organization have suggested the recharge from different sources the basis of reassessing groundwater potential in the state (Groundwater = recharge from rainwater + seepage from canals etc. + seepage from irrigation). Thus the total amount of recharge from all sources in a year the amount of ground water is maintained. According to an estimate the total potential of ground water capacity in Murshidabad in a year is about 7 lakhs hectare. The water is utilized for irrigation and other purposes through tube wells and dug wells.

Groundwater can be kept in – store of is discharged naturally to streams, springs or seeps or is even transpired by plants. But in a ground water system prior to development (artificial discharge) the system is in long term equilibrium – discharge is equal to recharge, and the volume of water storage remains relatively constant. Ground water level fluctuates in time over a relatively small natural range. Once pumping / official extraction begins, this equilibrium is disturbed and water level declines just like a bank account balance must be maintained between withdrawal and recharge.

There are different types of aquifers having different discharge and water yielding capacities. There is an inter-relationship between ground water occurrence and the hydrological properties of rocks i.e. porosity, permeability etc. and these properties determine the limits of hydrological basins.

In Murshidabad there are two types of hydrological basins (i) Alluvial tract and (ii) the semi – consolidated rocky tract basins.

1. The alluvial tract spreads over the entire Murshidabad plain. It is a region of unconsolidated freshwater deposits composed of fine clay, and sand. All these are porous. Sand, gravel and coarser fragments and their mixtures make good quality aquifers capable of yielding good water supply. The proportion, thickness and number of aquifers capable of yielding good water supply. The proportion, thickness and number of aquifers increase northwards as the thickness of alluvium increases. Shallow aquifers are also found. Alluvial tract can be divided into (a) low yield zone, (b) moderate yield zone, and (c) high yield zone. (Singh, R.P. 2002).

2. The semi – consolidated rocky tract is of tertiary gravel deposits and is found in the southern fringe of the state in limited are. The resource potential is also low. (Singh, R.P. 2002) The alluvial tract is the main repository of ground water in Murshidabad district.

Underground water resource of Murshidabad (million hectare meter / year) under different heads; (a) Total Rechargeable ground water = 2.70. (b) Ground water Available for irrigation = 2.29, (c) for Domestic,

Industrial, etc. Uses = 0.40, Net use = 1.06. Development level in% = 46.35 (Central Ground Water Board). (Tiwari, R.C. 2011).

OBJECTIVES:

Major objectives of the study are-

1. To show the present condition about the depletion of groundwater of the district.
2. To identify the vulnerable effect for groundwater depletion.
3. To indicate the measurement and suitable management of groundwater for people of the district.
4. To take part of the Govt. by the implementation of various programed and policies.

DATABASE AND METHODOLOGY:

The present study basically based on overall observation. Information regarding the study area has been collected from different Govt. departments and daily newspaper. Data are compiled for proper understanding the present condition and 1: 250,000 the thematic maps are used in MapInfo software for presenting the actual condition of the district at block level. An over view report is described by using several data from secondary sources and graphical presentations are also notified.

STUDY AREA:

Murshidabad District is located in eastern part of India extending $88^0$46’ E to $87^0$46’17” E and $23^0$43’30” N to $24^0$50’20” N. It is the northern most segment of lower Gangetic plain. The district Murshidabad is bounded by Malda district in north by Jharkhand state boundary and Birbhum district in west, Burdhaman and Nadia district s in the south and Bangladesh international boundary in the east. Bhagirathi passes through the middle of the district from north to south. The district is divided into two parts by the Bhagirathi river. The western part having stiff clay soil, reddish in colour and undulated topography is called “Rarh” and simultaneously the eastern part of the Bhagirathi containing alluvial and fertile soil is known as “Bagri”.

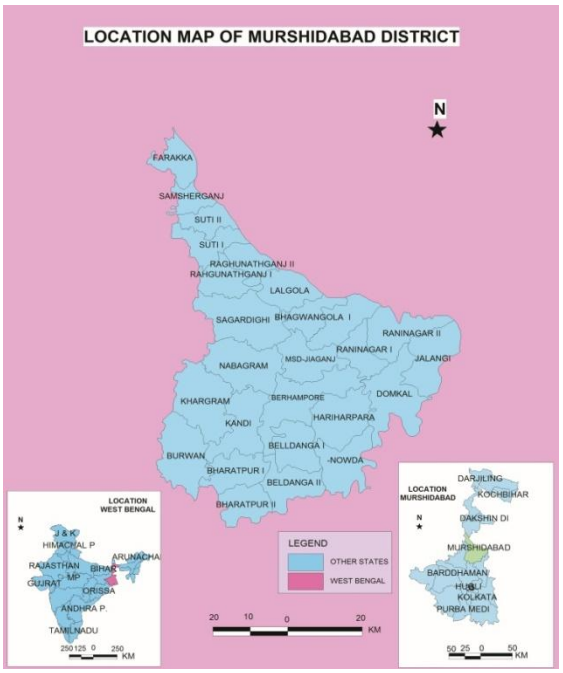

Figure No-01 Location Map of Murshidabad District

The district covering an area of 5324 sq.km and population density is 1334 (2011). Murshidabad district is the 5th populated district in West Bengal. Net shown area of the district is 395.96 (2011) and cropping intensity is 225 (2011). Average population decadal growth rate is 21.07% (2011) and literacy rate is 67.53 % which is lower than national average (74.04%) among which males are 69.95 % and 63.09% are female (2011). The district has annual rainfall 1400 millimeter and temperature ranges between 38.6^0C to 7.8^0C. Average height from MSL is 19m.

THE PROBLEM:

Many area of the district Murshidabad is experiencing ground water depletion in summer season. This district has become a matter of concern for monitoring agencies. The ground water Directorate of the Government of West Bangle has been conducting weekly measurement of the ground water level at its 240 Hydrograph Network Stations (HNS). On the basis of its study in the first week of March, 2011, the HNS has cautioned about the possibility of water crisis in coming months. The measurement of ground water level in the pre-monsoon period of March 2011 compared to that of May – June in the past two years showed a plunge 26 blocks in of this district, the decline was of more than one metre in 17 blocks of this district. Similarly a decline in water table in major areas of Murshidabad was indicated in the report of the Central Commission Groundwater, Mid–Eastern Region (CCWBMER), Kolkata(Table–1). There was scarcity of water in 7 blocks because of decline of water table upto 02-03 meters, Ground water is the main source of fresh water for drinking. Many wells were dry and tube-wells were not able to supply water. This decline was attributed to poor rainfall in last two – three years. In Lalgola,Domkal and Burwan blocks the plunge in water table was of more than three meteres which is alarming. The decline was up to two meters in Bhagwangola I and II, Kandi, Nowda, Samserganj and Sagardighi blocks. Tube-wells were dry in Nowda,Sagardighi and Domkal blocks. In May-June 2011, summer

water table declined to 05 to 20ft. in Suti–I block because of low rainfall. River Ganga also moved away from Suti–I and over exploitation of ground water due to rapid increase in population also took place. The discharge was more than recharge. Similarly in 2010 there was plunge in water level in Lalgola and Nowda causing scarcity of drinking water. This was due to poor urban infrastructure, unorganized land-use, unplanned growth and poor drainage system. (The Telegraph, March 22, 2001).

District and Block wise Decline in Water Table (March 2011) of Murshidabad

Blocks	**Amount of decline in water table**
Lalgola,Burwan	> 03 m
Behrampore	> 01 m
Beldanga – I and II	> 01 m
Hariharpara	> 01 m
Bhagwangola – I, II	> 02 m
Khargram	> 01 m
Bharatpur – I and II	> 01 m
Farakka	> 01 m
Kandi	> 02 m
Domkal	> 03 m
Suti – I and II	01 m
Raghunathganj–I and II	>01 m
Murshidabad–Jiaganj	>01 m.
Nabagram	>01 m.
Nowda	>02 m.
Jalangi	>01 m.
Samserganj	>02 m.
Sagardighi	> 02 m.
Raninagar – I and II	01 m

Source : The Telegraph, March 22, 2011

The annual report of GOWB-MER, Ground Water in Murshidabad, an Overview" published in 2010 indicated a long – term trend of decline in ground water level. The fluctuation in ground water level in pre-monsoon period of May 2010 with respect to the decadal man the water table in the month of May 2000-2009 indicates a plunge by 78% in 317HNSs of CGWB-MER. A fall of 0.12m was observed in 59% of the HNSs and fall of 2-4m was observed in 13% of the stations. A decline in water level of more than 04 meter for the same period was observed in 6% of the HNSs covering areas of lalgola, Burwan and Domkal.

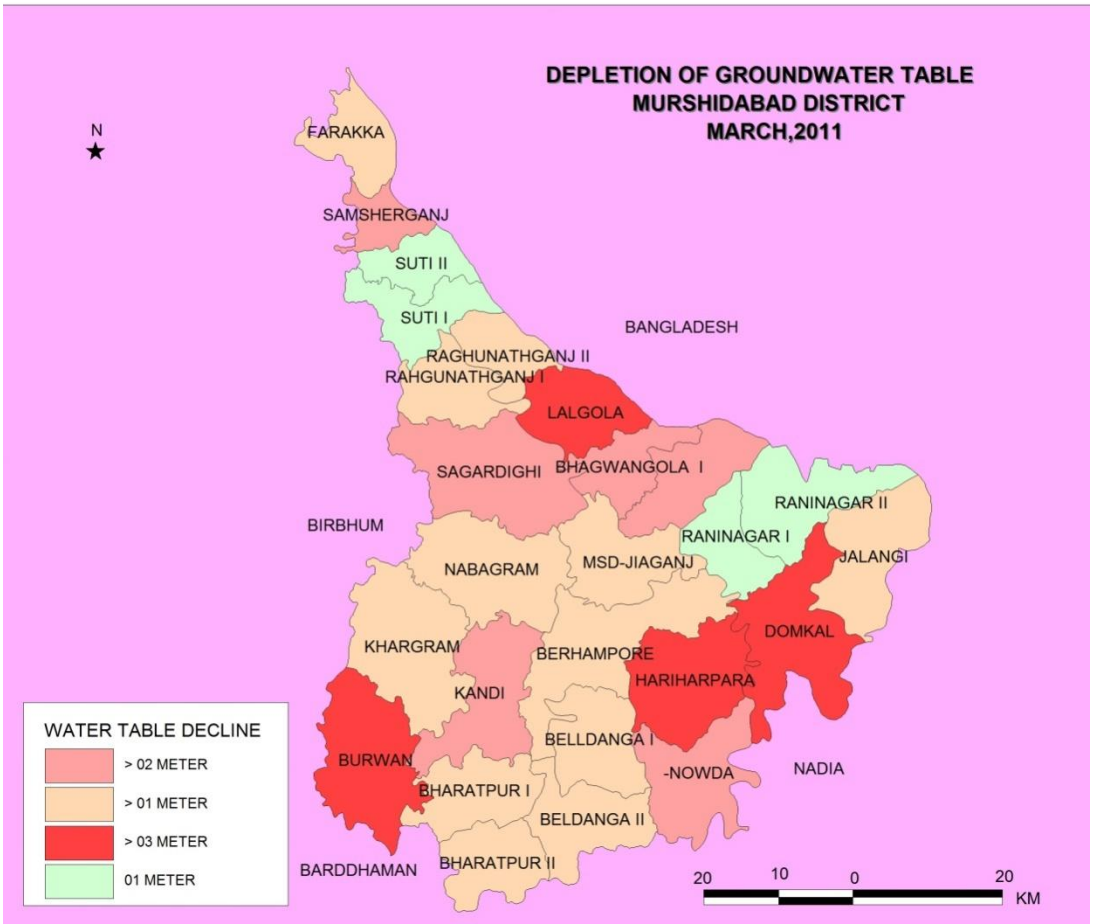

Figure No – 02 Groundwater Depletion of Murshidabad District, March,2011.

This report thus raised serious concerns at the administrative level for declining water table in Murshidabad. Ground Water Directorate of Government of West Bengal advised all those extracting shallow water to tap deeper levels as the main concern was depletion of shallow aquifers. By May-June 2011 summer water table declined from 5-20 ft. in Patna urban center and Muzaffarpur (The Telegraph March 22, 2001) the dip in water table was very drastic.

FACTORS RESPONSIBLE:

According to the government the plunge in water level was due to poor rainfall in last two – three years and excessive extraction of shallow water for drinking and irrigation purposes.

In urban areas unplanned growth, unorganized land-use, poor drainage system confined the ground water problem. In fact the very process of urbanization in Murshidabad has led to phenomenal decrease of natural recharge due to paved roads and soil compactness, rapid population growth and increasing demands of ground water for domestic use and drinking purpose. There has been over exploitation of ground water promoting imbalance in the overall ground water budget. Discharge was more than recharge. The decline was mainly attributed to low rainfall in last two – three years but it was the cumulative effect of all these factors. Now with

the construction of metalled roads to all villages the process of recharge through percolation of rainwater will further decrease.

A phenomenal development of ground water extraction was registered in Murshidabad 1960. During 1960-1998 dug wells increased and during 1980-1998 the number of tub-wells increased more than three times ground water became the most important source of irrigation with more than 54% of irrigated area being irrigated by wells and tube – wells mostly in the blocks of this district, where more than 80% of irrigation is by tube-wells. Both diesel and electric pumps are used. Private and government tube wells are found but private tube-wells have become very important because rural areas in district face electricity problems. This large scale extraction has led to overdraft and fall in water table in some areas especially if there is decline in rainfall.

MOST SERIOUS CONSEQUENCES OF DEPLETION OF GROUND WATER TABLE ARE:

(i) **Increased Pumping Costs** – As the depth of water table increases the water is to be lifted from a greater depth and more energy is required which leads to higher cost in the pumping of water.

(ii) **Reduction of water in streams, lakes and wells** – the surface and ground water systems are interlinked. Therefore, groundwater pumping can affect/ after the flow of water in streams or lakes. Speedy depletion of ground water aquifers may affect the water level of interconnected lakes or even streams. Some shallow ponds may even dry up.

(iii) **Retarded plant growth**: In areas along river banks and in wetlands plant growth is retarded because of depletion of water table. It may even lead to loss of wetlands. It may even lead to loss of wetlands. There is an overall loss of riparian vegetation and wildlife.

(iv) **Land degradation**: Depletion of water table may also lead to decline in soil moisture and the quality of soil leading to reduce the fertility of soil and productivity of land.

Ground water depletion will have many negative effects on man and land. It will first of all create drinking water problem for man and animals. Secondly, it will increase irrigation cost. Thirdly high irrigation cost will decrease agricultural output and increase production cost for agricultural raw materials of agro – based industries. Fourthly, fisheries will also be affected.

Ground water resource is used for irrigation in areas of low rainfall but depletion is due to over exploitation and low rainfall then how can it be a good resource for irrigation in low rainfall regions?

CLIMATIC CHANGE AND GROUND WATER TABLE:

The occurrence, pattern and volume of ground water depend primarily on soil types, geology and rainfall. The inter-relationship of these factors creates complex patterns. Climatic change will affect these factors by modifying rainfall and evaporation. Change in precipitation and evaporation will lead to shifts in soil moisture deficits, surface water runoff, and ground water recharge. The amount and volume of rainfall temperature, soil-vegetation conditions and land use all these are important along with the storage capacity of aquifers which are affected by climate change. The increases in the intensity of rainfall may lead to decrease in the opportunities of recharge. Large amount of withdrawals is made and if frequency and length of large spells of dry seasons

increased the recharge of aquifers will decline leading to plunging of water level. Thus climate change is related to ground water resource. Weather ground water based irrigation could provide climate resilience is a big question because the very source is dependent on climatic conditions or rainfall. Regional depletion of ground water, especially in areas where it is the primary source of irrigation is more likely if there is no regulation on its use.

CONSERVATION AND MANAGEMENT OF GROUND WATER:

To protect ground water depletion following steps should be taken:

1. **Establishment of Management Information System:** An interdepartmental MIS be developed for collecting, processing and presenting water related information. The department should include the provisional mapping of vulnerable areas of ground water depletion.
2. **Notification of Crucial areas of Ground water**
3. **Notification for banging commercial sale of ground water.**
4. **Environment impact studies for ground water.**
5. **Mass awareness and Training Programmer** for judicious use and conservation of ground water.
6. **Direction to industries/ mining / commercial establishments** to restrict over exploitation of ground water.
7. **state Legislation and Regulation for Ground water Use :**

The state government should make policies and legislations related to the exploitation of ground water. Water extraction especially in water scarce areas should be regularized through legal provisions.

(i) Bylaws for conservation of water and recycling of water in urban areas should be made.

(ii) Ownership of groundwater in India is governed under section 7 of the India Easement Act, 1882 (Geography & You, 2009) which refers to the right of every owner for land.

(iii) Collect and depose all water under the land which does not pass in a defined channel.

These property rights provide unlimited power to individuals to exploit ground water. To check, control and regulate the over exploitation of ground water government of India circulated a Model Ground water Bill in 1990 to the States to constitute regulatory bodies. It also constituted Central Ground water Authority in 1997 under the Environment Protection Act 1986. (G N Y, 2009) But the rule to check overexploitation are still not finalized and notified. Only a few states have proceeded to make legislations for ground water regulations.

CONCLUSIONS:

Finally, the condition in Murshidabad is not yet very bad if pre-caution is immediately taken. If over exploitation of ground water is not controlled and dry spells continue, there will be drastic decline in water table in this district as well especially in south of district of Murshidabad. Therefore, for control of depiction of water level and sustainable use of ground water resource, formulation of appropriate regulation and judicious use is required.

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