GROUND WATER DEPLETION SURVEY REPORT

(ABSTRACT)

Prepared by Ground Water Resources Assessment Cell,

PHE Department, Government of Mizoram

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Preface

Ground water Level Survey has been carried for the last twenty years in Mizoram by PHE Department of Mizoram. During each field season, pre-monsoon and post monsoon ground water level data were collected from various locations covering all the eight districts of Mizoram. The technique of marking the locations of monitored wells evolves with times. Global Positioning Satellite (GPS) readings of the well locations viz., latitude, longitude and even altitude of the well location were now included. Incorporation of GPS readings enhances the accuracy and accountability of the data and reports.

With the advent of geo-spatial technology, efficient techniques for ground water survey and management have evolved of which Global Positioning Satellite is of great significance. I hope in the near future, more advanced technology like Geographical Information System (GIS) can be utilized for further development and collection of ground water data in our state. Application of sophisticated instruments may also ease the survey works and increase the accuracy of the output.

The present report highlighted not only the Ground water level of the state but also the general climatic conditions, topography, drainages system, geomorphology, lithology and geological structures of the state. I hope the report will be of immense use for researchers and developmental planners.

I acknowledge the sincere efforts of F. Lalbiakmawia, Asst. Hydrogeologist, and other staff of Ground Water Resources Assessment Cell. Suggestion for improvement of the report will be warmly acknowledged.

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INTRODUCTION

Majority of the states in India are depending largely on ground water resources for domestic, agricultural and industrial sectors for several decades. Mizoram used to receive adequate amount of rain water and used to have numerous perennial streams, unlike many other states in the country. However, the availability of surface water in the state seems rapidly declining owing to deforestation, urbanization and other anthropogenic activities. Potential sources of water supply viz., streams, rivulets and rivers start drying up causing alarming consequences. This erratic and declining availability of surface water harshly affect domestic and agricultural water supply in recent years.

Therefore, Mizoram has to start a new chapter in exploring, developing and conserving its available ground water resource in terms of water supply for its socio-economic progress. Since, ground water is a hidden resource, a number of parameters that are manifested on the ground had to be considered and analyzed based on deductive techniques involving complex processes for making use of this resource. One of the first and foremost step for scientific, judicious and systematic utilization of this crucial resource is to assess the ground water resource in which ground water level survey (depletion survey) plays a vital role. Prospective area of ground water can be are delineate from the ground water level survey which can be utilize for further development.

Ground water Level Survey has been carried out from the year 1999 in Mizoram by Ground Water Resources Assessment Cell (GWRAC) of PHE Department, Mizoram. Wet tape method has been has been utilized for this survey. The numbers of observation locations varies from time to time; however, at least 70 specific locations are marked and utilized consistently for measuring the ground water level for the entire state.

Prior to 2012 survey, Global Positioning Satellite (GPS) readings of the well locations were not included. However, from the 2012 season survey onwards, GPS data viz.,

latitude, longitude and even altitude of the well location were included. Incorporation of GPS readings enhances the accuracy and accountability of the data and reports.

With the advent of powerful personal computers and the advances in technology, efficient techniques for ground water survey and management have evolved of which Global Positioning Satellite is of great significance. I hope in the near future, more advanced technology like Geographical Information System (GIS) can be utilized for further development and collection of ground water data in our state. Application of sophisticated instruments may also ease the survey works and increase the accuracy of the output. The hydrogeological, geological, geomorphological and hydrological condition which controls the occurrences and distribution of ground water in Mizoram can be also been highlighted in the full report if necessary.

HYDROGEOLOGICAL CONDITIONS:

Hydrogeologically, the various rock types found in Mizoram can be grouped into two categories i.e. semi-consolidated formations and unconsolidated formations.

The entire area may be divided into two Hydrogeological Units viz. Un-consolidated unit and Semi-consolidated Unit.

The Un-consolidated formations with limited alluvial thickness are restricted along intermontane valleys, fractured valleys and shallow alluvial plain. The potentiality of ground water is found to be high within the areas of Un-consolidated unit. The sediments comprising alluvium and colluviums are by and large the important repositories of ground water. These are essentially comprised of sand, silt, and gravel, etc. The beds of sand and gravel and their admixtures form potential aquifers. The aquifer materials vary in particle size, roundness and sorting. Consequently, their water yielding capabilities vary considerably. With high amount of rainfall and good recharge conditions, the ground water gets replenished every year in these zones.

The unconsolidated formations are found abundantly in the western part of the state. However, they are widely distributed in the central and eastern parts as well.

The semi-consolidated formations mainly comprise shale, sandstones and limestone. Major part of the State is occupied by Semi-consolidated unit which constitutes

sandstone and shale. The Semi-consolidated formations developed secondary porosity due to tectonic disturbances. As the state is entirely occupied by hills with gentle to steep slopes, most of the rainwater flows out as surface runoff. In this type of terrain, the scope for ground water storage is limited to mostly secondary porosity and structural control in the higher elevation aquifers. These aquifers are the main source for springs. Ground water stored in the hill slopes emanates in the form of springs, which are being used as a source for water supply.

GROUND WATER DEPLETION:

In areas with frequent water stress and large aquifer systems, groundwater is often used as the main water source. If withdrawal of groundwater exceeds the natural groundwater recharge for extensive areas and long times, groundwater depletion occurs. The deterioration in ground water levels can also be attributed to a various reasons like the failure of monsoons, and lack of rainwater harvesting. Some of the negative effects of ground water depletion are mentioned below:

1) Excessive pumping can lower the groundwater table and cause wells to no longer be able to reach ground water.

2) As the depth to water increases, the water must be lifted higher to reach the land surface. As the lift distance increases, so does the energy required to drive the pump. Thus, power costs increase as ground-water levels decline. Depending on the use of the water and the energy costs, it may no longer be economically feasible to use water for a given purpose.

3) Ground-water levels may decline below the bottom of existing pumps, necessitating the expense of lowering the pump, deepening the well, or drilling a deeper replacement well.

4) The yield of the well may decline below usable rates.

5) Depletion of ground water may also leads to land subsidence. The basic cause of land subsidence is a loss of support below ground. When water is taken out of the soil, the soil collapses, compacts, and drops. This depends on a number of factors, such as the type of soil and rock below the surface. Land subsidence is most often caused by human activities, mainly from the removal of subsurface water.

METHOD OF SURVEY:

The Wet tape method is used for surveying the ground water level within the entire state. Graduated steel or cloth tapes were used to measure the ground water level. The advantage of this method is that it offers great flexibility when measuring water levels. Almost any well is accessible with a steel tape as long as there is enough of a gap in the casing to thread the tape through.

One of the drawbacks to the wet tape method includes the possibility of the tape coming into contact and tangled with other objects in the borewell, or breaking and falling into the well.

The following steps are carried out in the wet tape method:

1) The most recent measurement is referred at the initial step. Depending on aquifer characteristics, the graduated steel tape is inserted approximately 2–4 metres deeper than most recent measurement.

2) Protective gloves are used then at least the first five feet of the graduated steel tape is completely chalked.

3) The graduated steel tape is slowly lowered/ slowly feed in the hole.

4) The tape will begin to feel a little heavy or “weighted”. If the “weighted” feel is lost while feeding tape, the tape is reeled up the hole and then tried to feed past the obstruction.

6) Once the desired depth is reached the tape was hold for 3 to 5 seconds.

7) The tape is then reeled up the well at a rapid pace so the wetted mark does not dry before reaching the surface. If an obstruction is encountered, the tape is lowered again below the obstruction and then the tape was carefully worked past the obstruction.

8) The wetted mark on the end of the tape was noted down after reading the graduation on it.

9) We subtract the depth of the inserted tape from the wetted mark on the tape.

For example, if the tape was lowered to 12 m and the wetted mark was at 1m the calculation is: 12 – 1 = 11m). The result (in the above example 11m) is the depth to water from the ground level.

10) The graduated tape was then dried and if possible disinfectants were applied to prevent cross contamination of wells.

SURVEY RECORDS:

Ground water Level Survey has been conducted from 1999 to 2019 in Mizoram by Public Health Engineering Department. The records include annual ground water level for pre-monsoon and post monsoon seasons.

During 1999-2011, the entire state is represented as a single unit. From 2012 onwards ground water level data are represented in district-wise as well. The ground water level is measured in metres below the ground level (bgl).

It was observed that the level of ground water is consistent with depth ranging from 8.80-13.25m below ground level. The rate of decadal (1999 to 2009 and 2010 to 2019) depletion of ground water in Mizoram is about 0.50m, where the depletion of ground water during pre-monsoon season is 0.32m and that of post monsoon is 0.57m during the last decade.

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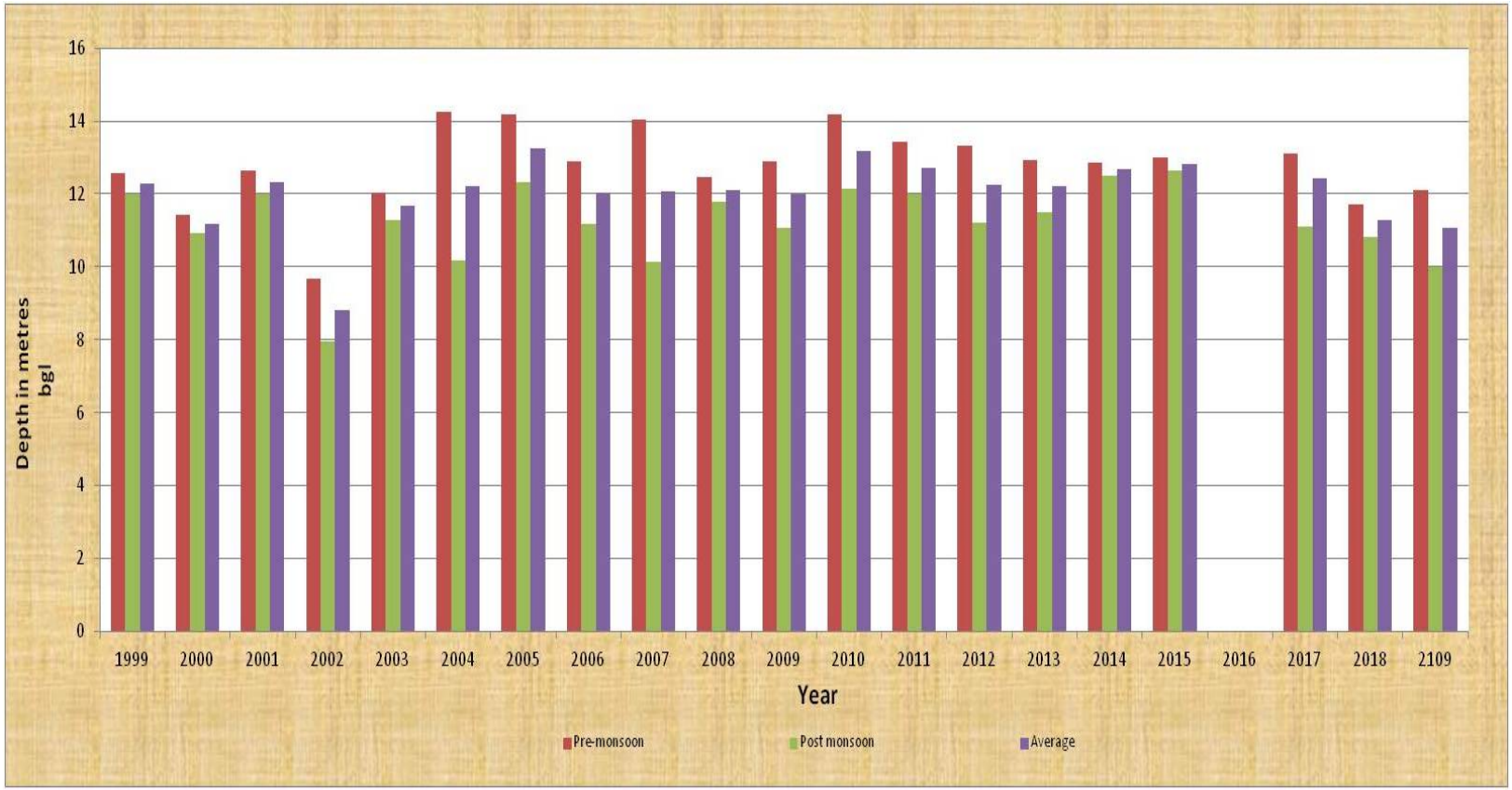

Pre-monsoon, post monsoon and average Ground Water Level in Mizoram,

Year	Pre-monsoon	Post monsoon	Average
1999	12.56	12.00	12.28
2000	11.43	10.92	11.17
2001	12.63	12.01	12.32
2002	9.68	7.94	8.81
2003	12.05	11.29	11.67
2004	14.24	10.19	12.22
2005	14.19	12.31	13.25
2006	12.88	11.16	12.02
2007	14.02	10.12	12.07
2008	12.45	11.79	12.12
2009	12.90	11.08	11.99
2010	14.18	12.15	13.17
2011	13.44	12.00	12.72
2012	13.31	11.21	12.26
2013	12.91	11.50	12.21
2014	12.84	12.51	12.68
2015	13.01	12.64	12.83
2016	Data gap	Data gap	Data gap
2017	13.09	11.11	12.41
2018	11.72	10.83	11.28
2019	12.09	10.01	11.05

Pre-monsoon, Post monsoon and average ground water level in Mizoram, 1999-2019

Note: The rate of decadal decline of ground water level is about 0.50m, indicating depletion of ground water in the state of Mizoram.

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