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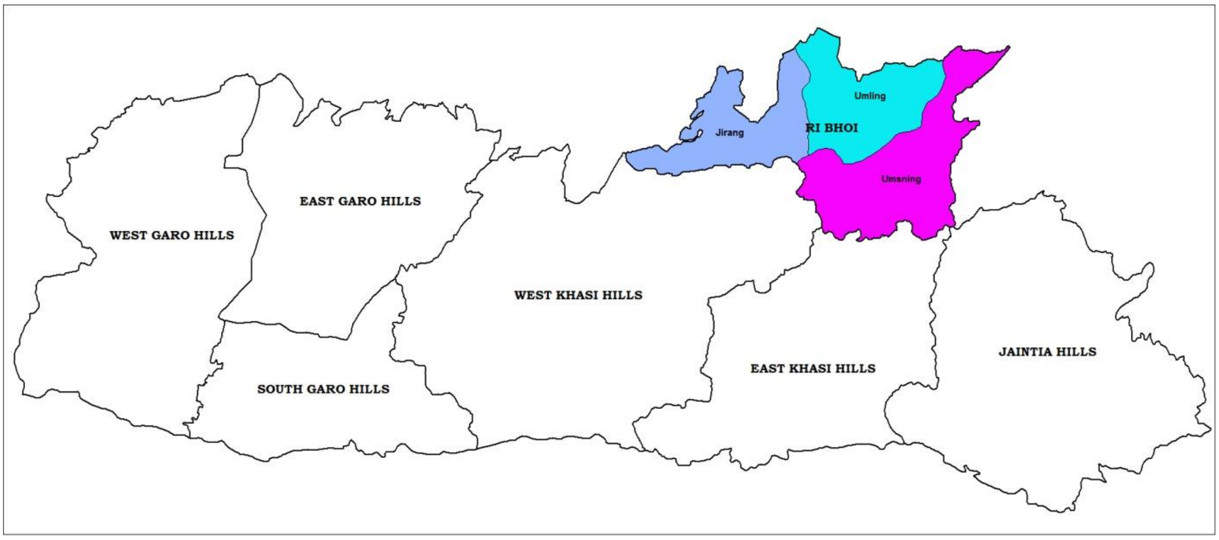
**GOVERNMENT OF INDIA**
**MINISTRY OF WATER RESOURCES**
CENTRAL GROUND WATER BOARD

# GROUND WATER INFORMATION BOOKLET
# RI BHOI DISTRICT, MEGHALAYA




**North Eastern Region**
**Guwahati**

September, 2013

**GROUND WATER INFORMATION BOOKLET**

# RI-BHOI DISTRICT, MEGHALAYA

## DISTRICT AT A GLANCE

| Sl. No. | ITEMS | STATISTICS |
|---|---|---|
| 1. | **GENERAL INFORMATION** | |
| | i) Geographical area (Sq km)<br>Administrative Divisions<br>Number of Blocks | **2448**<br><br>**3 (**Umling, Umsning, Jirang) |
| | ii) District Headquarters | Nongpoh |
| | iii) Number of Villages<br>a. Umling<br>b. Umsning<br>c. Jirang | **595**<br>211<br>266<br>96 |
| | iv) Population<br>(*as per 2011 census-provisional*) | 2,58,380 |
| | v) Average Annual Rainfall (mm) | 2935 mm (2000 to 2010) |
| 2. | **GEOMORPHOLOGY** | |
| | Major physiographic units | Denudational High & Low Hills, dissected plateau with deep gorges. |
| | Major Drainages | Umtrew, Umsiang, Umran and Umiam |
| 3. | **LAND USE (Sq. Km.)** | (*as on 2010-11, in sq Km*) |
| | a) Forest area | 869.07 |
| | b) Net area sown | 222.59 |
| | c) Gross Cropped area | 251.69 |
| 4. | **MAJOR SOIL TYPES** | a) Red loamy<br>b) Laterite<br>c) Alluvial |
| 5. | **AREA UNDER PRINICIPAL CROPS** (*as on 2010-11, in sq Km*) | **Kharif**: Rice: 94.04, Maize: 15.18, Oilseeds:1.52,<br>**Rabi** : Rice: 1.98, Millets: 0.13, Pulses: 0.28, Oilseeds: 1.48 |
| 6. | **IRRIGATION BY DIFFERENT SOURCES**<br>a. Surface water (Ha)<br>b. Ground water (Ha) | <br><br>22.98 (command area)<br>Nil |
| 7. | **NUMBERS OF GROUND WATER MONITORING WELLS of CGWB** (as on 31.3.2013)<br>No of dug wells<br>No of Piezometers | <br><br>2<br>Nil |
| 8. | **PREDOMINANT GEOLOGICAL FORMATIONS** | a. Archean Gneissic Complex<br>b. Shillong Group of rocks - Quartzites<br>c. Granites<br>d. Alluvium |

| | | |
|---|---|---|
| 9. | **HYDROGEOLOGY** | |
| | Major water bearing formation | Ground water occurs under both unconfined & semi-confined conditions in the hard rocks controlled mostly by topography & secondary porosities of weathered residuum and in joints & fractures. |
| | • depth to water level<br>Pre-monsoon, 2012<br>Post-monsoon, 2012 | 2.95 to 5.14 m.bgl<br>m.bgl |
| 10. | **GROUND WATER EXPLORATION BY CGWB**<br>(as on 31.3.2013) | |
| | No. of wells drilled<br>(EW,OW,PZ, SH. Total) | 19 EW and 2 OW<br>Total: 21 |
| | Depth Range (m) | 129 to 204 |
| | Discharge (lpm) | 43.58 to 1113 |
| 11. | **GROUND WATER QUALITY** | |
| | Presence of chemical constituents more than permissible limits | Sporadic occurrence of high concentration of Fe in few pockets in deeper aquifer |
| | Type of water | Generally good for drinking & irrigation purposes |
| 12. | **DYNAMIC GROUND WATER RESOURCES**<br>(as on March 2009) | |
| | Annual Replenishable Ground Water Resources (ham) | 2184 |
| | Net Annual Ground water draft (ham) | 2.03 |
| | Projected demand for domestic and industrial uses upto 2025 (ham) | 1147 |
| | Stage of Ground Water Development | 0.06 % |
| | Number of OE/ Critical/ notified Blocks | Nil |
| 13. | **AWARENESS AND TRAINING ACTIVITY** | |
| | Mass awareness Programme Organized | One Mass awareness Programme and Water Management Training Programme were conducted at Nongpoh (2006) and at Byrnihat (2010). |
| | Water Management Training Programme Organized | |
| | TIER III Training Programme (Aquifer Mapping) | 22nd to 23rd January 2013 at Umsning. |
| 16. | **MAJOR GROUND WATER PROBLEMS AND ISSUES** | Higher concentration of Fe is observed in few pockets in deeper aquifer of the district (higher than permissible limit prescribed by BIS, WHO) |

GROUND WATER INFORMATION BOOKLET

# RI-BHOI DISTRICT, MEGHALAYA

## 1.0 Introduction

Ri-Bhoi district has an area of 2448 sq.km and lies between E 91°20'30" and E 92°17'00" Longitude and N 25°40' to N 26°20' Latitude. It is bounded in the north by the Kamrup district of Assam, east by the Karbi Anglong district of Assam, south by the East Khasi Hills and west by the West Khasi Hills district. It has got three blocks namely, Umling, Umsning and Jirang. The district headquarters is located in Nongpoh. Ri-Bhoi district is well connected with Guwahati and Shillong by National Highway 40.

## 2.0 General Features

### 2.1: Demography, Land use pattern and drainage

The Bhois of Ri Bhoi district are the Sub - group of the main Khasi Tribe. The majority of the Bhois speak the Bhoi dialect, although they use the Khasi dialect as a major subject in their schools. In Ri Bhoi district, there is other tribes viz., Garos, who speak the Tibeto - Burman groups of language, whereas the Karbis, Marngars, Mikirs, Bodos and Lalungs use Assamese as their Lingua Franca. Some speak and write Khasi too. The Bhois follow the matrilineal system. Children bear the title of the mother and she is the safe keeper of all properties owned by her parents. As per 2011 census (provisional), Ri-Bhoi district has a total population of 2,58,380 with male population of 1,32,445 and female population of 1,25,935. The rural population is 2,33,226 and the urban population is about 25,154. The main occupation of the population in the district is agriculture.

### 2.2 Land Use

The land utilization of the district is presented in the **Table 2.1.**

**Table 2.1: Land utilization statistics of Ri Bhoi District (2010-11)**

| Land Classification | Area (sq. km.) |
|---|---|
| Geographical area | 2448 |
| Forest area | 869.07 |
| Non-Agricultural area | 140.58 |
| Cultivable Waste Land and groves | 861.91 |

| | |
|---|---|
| Fallow Land | 150.42 |
| Net Area Sown | 222.59 |
| Area Sown more than once | 29.10 |
| Gross cropped area | 251.69 |

*Source: Directorate of Economic and Statistics, Meghalaya*

The district has a forest area of 2448 sq. km. i.e., about 36% of the total area. The net area sown is 222.6 sq. km. and the total cropped area is 251.7 sq. km., the fallow land covers about 6%, net area sown is about 9%, and the total cropped area is about 10%.

### 2.3 Rainfall & Climate:

The average annual rainfall of 11 years (2000 to 2010) in the district was 2935 mm. The maximum and minimum rainfalls of the district were recorded during the year 2004 1998 respectively. The temperature ranges from 10°C in December to 30°C in the month of July and August as recorded in Umsning Station, whereas in Byrnihat station. Normally January and August record minimum (12.3°C) and maximum (35.2°C) temperatures respectively.

## 3.0: Geomorphological Features and Drainage

### 3.1 Geomorphology

Geomorphologically, Ri-Bhoi district is a hilly one with intermontane valleys. The western and northern part of the district comprises of the denudational high hills with deep, narrow intermontane valleys covered with or without colluvium. Lithologically, the hills comprise Archaean Gneissic complex rocks, which are highly deformed, fractured and fissured in nature. These rocks also form highly dissected plateau with steep slopes and deep, narrow valleys exposed in the southwestern part of the district. In the central and eastern parts, denudational high hills with deep valleys are found to exist which comprise intrusive Granites. Further in the southeastern part, denudational low hills are found to occur with valleys and comprise granite with fracture zones. Large number of narrow intermontane valley occurs mostly in the southern part of the district, which are good recharge areas and have highly productive shallow aquifer zone.

Deeply dissected plateau comprising the Precambrian Shillong Group of quartzites and phyllites occurs as highly undulating terrain having more than 20 m deep valleys in the area. The quartzites are moderate to steeply dipping rocks having a trend in NE-SW direction. They are intruded by basic and ultramafic rocks, which occur as linear or curvilinear ridges.

### 3.2 Drainage

The drainage system is controlled by topography. The drainage pattern shows annular, trellis, sub-dendritic types, which also indicate the structural control. The important river includes the Umtrew, Umsiang, Umran and Umiam rivers.

## 4.0 Geological Set-up

The rocks of Gneissic Complex, comprising quartzo-feldspathic gneiss with enclaves of granites, amphibolites, schists etc., occupy major part of the district. Shillong group of rocks consisting of quartzite & phyllites are laid down as sedimentary deposits during Pre-Cambrian times and have been metamorphosed over time, are exposed in the south-eastern part of the district. These rocks were intruded by epidiorite rocks known as Khasi green stone. These metabasic rocks occur mostly as sills being concordant with the formations they intruded. Grainite Plutons occur as porphyritic coarse granite, pegmatite, aplite / quartz vein traversed by epidiorite, dolerite and basalt dykes, occupy a large area in the central and eastern part of the district and are also encountered in the sub-surface. The Quaternary fluvial sediments occur in the extreme northern part of the district bordering Assam, forming part of Brahmaputra valley, with a thickness ranging between 3 to 20 metres.

Generalised geological succession of the area is given in **Table. 4.1**

**Table 4.1General Geological Succession**

| Geological Age | Group | Formation | Rock Type |
|---|---|---|---|
| Quaternary | | | Undifferentiated fluvial sediments |
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ Unconformity ~~~~~~~~~~~~~~~~~~~~~~~~~~ | | | |
| Neo-Proterozoic – Lower Palaeozoic | Nongpoh Granite | Granite Plutons | Porphyritic coarse granite, pegmatite, aplite/quartz vein etc. |
| Intrusive Contact | | | |
| Proterozoic (Undiff) | Khasi Basic-Ultrabasic intrusives | | Epidiorite, dolerite, Amphibolite and pyroxenite dykes and sills |
| Palaeo-Mesoproterozoic | Shillong Group | Upper Division | Mainly Quartzites intercalated with phyllites. |
| | | Lower Division | Mainly schists with Calc Silicate rocks,carbonaceous phyllite and thin quartzite layers. |
| ~~~~~~~~~~~~~~~~~ Unconformity (Shared conglomerate) ~~~~~~~~~~~~~~~~~ | | | |
| Archaean(?)-Proterozoic (Undifferentiated) | Gneissic Complex (Basement Complex) | | Mainly quartzofeldspathic gneiss with enclaves of granites,amphibolites, schists etc. |

## 5.0 Ground Water Scenario

### 5. 1 Hydrogeology

Hydrogeologically, the district can be divided into three units. The hydrogeological map is presented in the plate.

### 5.11 Occurrence of Ground water in Gneissic formation

The gneissic rocks are exposed in the north, central and southern parts of the area. The occurrence of ground water in this formation is largely controlled either by weathering and or by fractures patterns. In fractured rocks, ground water movement mainly takes place along the fractures and their openings. Groundwater in these formations occurs under phreatic conditions in weathered mantle and under semi-confined conditions in the fractured rocks, which is governed by topography and drainage.  The rocks are weathered and the degree of weathering is found to be higher in the topographic depressions. In the hard and massive rocks the structural plane of weakness such as joints, fractures etc, act as storage of ground water and the inter-connected joints and fractures, act as conduits for the movement of water. In the gneissic formation, majority of the well-recorded depth to water level in the range of 2 m bgl to 4 mbgl. The deepest water level of 4.14 m bgl (May & June 2006) and shallowest  water level of 0.09 m bgl (Nov'06 to Jan 2007) were recorded at Umsning and Umran respectively.

### 5.12 Occurrence of Ground water in Granite pluton

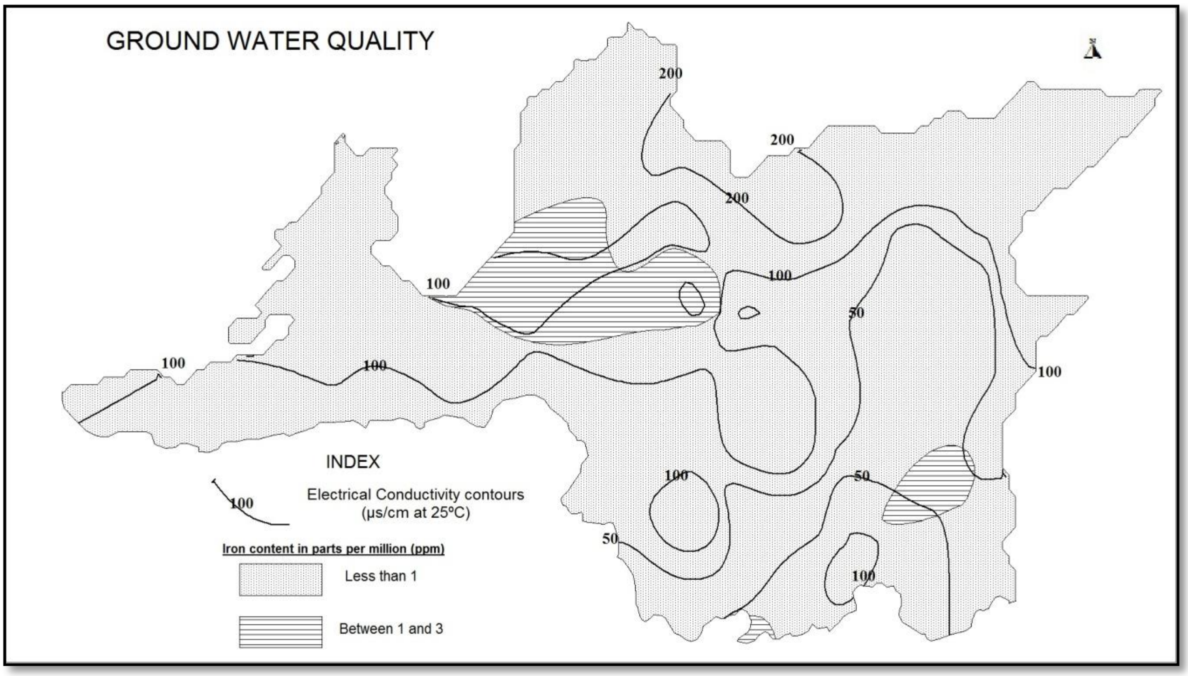
There are two major granitic plutons, (i) The Kyrdem granite in the southeast and (ii) Nongpoh granite in the northeastern part.  Ground water occurs in these formations under unconfined and semi-confined conditions. It can be seen that majority of the dug well in the formation recorded depth to water level within the range of 0 to 1 m. The deepest and shallowest water levels were recorded at Bhoilynbong and Nongpoh key wells having 3.3 mbgl (May & June 2006) and 0.40 mbgl (May & June 2006) respectively. The maximum water level fluctuation was recorded at Bhoilymbong having 0.76 m and minimum fluctuation at Umsiang of 0.01m respectively.

### 5.13 Occurrence of Ground water condition in Quartzite formation

The Quartzite and Phyllites are exposed trending NE-SW in the southern parts of the district. Ground water occurs in the area under water-table conditions in the top weathered quartzite and in semi-confined to confined condition in the interconnected joints, fractures etc of the underlying hard quartzite. The deepest water level was recorded at Umbang (4.14m bgl) during May & June 2006 and shallowest at Barapani (0.29m bgl) during November 2006 and January 2007 respectively. The water level fluctuation in the formation ranges between 2.47 m and 0.60m.

### 5.2 Ground Water quality

According to Bureau of Indian standards (BIS:IS:10500, 1991) the chemical constituents present in the ground water of the district are all within the desirable limits set for drinking and irrigation water standards except Fe which is slightly higher by drinking water standards. In the pockets where high concentration of Fe is detected, the ground water can be treated by adopting iron removal procedures, so as to use it for domestic consumption.




### 5.3 Ground Water Resources

The dynamic groundwater resources have been assessed based on Ground Water Resources Estimation Methodology of 1997 (GEC 97). In this methodology, two approaches are recommended – water level fluctuation method and rainfall infiltration method. As the data of ground water level is insufficient, the rainfall infiltration method is used for calculating the resource estimation of the district. Moreover, hilly area having slope of more than 20% are not taken into consideration as they are not worthy of recharge. Hence, the remaining area is delineated into command and non-command area and assessment is done for both monsoon and non-monsoon seasons. As per the Rainfall Infiltration Factor method, recharge from rainfall is given by the following formula.

$(R_f)$ = RIF *A * NMR

Where RIF = Rainfall Infiltration Factor

A = Area of computation for recharge.

NMR = Normal Monsoon Rainfall

Recharge from sources other than rainfall, ground water irrigation, recharge from ponds and tanks, check dams, nalla, bunds are taken as **nil** for the district and only surface water irrigation is taken into account. The total annual recharge is obtained as the arithmetic sum of recharge from rainfall and the recharge from sources other than rainfall. Thus, Ground Water Resource Potential (as on March 2009) in ham is as follows (Table 5.1 and Table 5.2).

**Table 5.1: Net ground water availability (ham)**

| Annual Replenishable GW resources | | | | Total annual ground water recharge | Natural discharge during non-monsoon season | Net ground water availability |
|---|---|---|---|---|---|---|
| Monsoon season | | Non-monsoon season | | | | |
| Rainfall recharge | Recharge from other source | Recharge from rainfall | Recharge from other source | | | |
| 1680 | Nil | 504 | Nil | 2184 | 218 | 1966 |

**Table 5.2: Categorization of ground water resources**

| Net Ground water availability | Annual GW draft | | | Domestic and industrial uses upto 2025 | Ground water availability for future irrigation | Stage of ground water development (%) | Categorization |
|---|---|---|---|---|---|---|---|
| | Irrigation | Domestic and industrial uses | Total | | | | |
| 1966 | Nil | 1.25 | 1.25 | 1147 | 819 | 0.06 | **Safe** |

The total annual ground water recharge in the Ri Bhoi District is 2184 Hectare metre (ham). The Net annual Ground Water Availability of the District works out to be 1966 ham after deducting the natural discharge during non-monsoon season. At present there is no Ground Water draft on account of irrigation and the annual domestic draft is 1.25 ham, the Gross Ground Water draft for all uses is 1.25 ham. The annual allocation for Domestic and Industrial uses has been made as 1147 ham based upon the population data projected upto year 2025. Thus the Net Ground Water Availability for Future Irrigation use works out to be 819 ham. The over-all stage of ground water development of the Ri Bhoi District is a meager 0.06% and is categorised as '**SAFE**'.

Though there is good ground water recharge, most of it flows out in the form of springs and streams. Good ground water development prospects in the Ri Bhoi District exist, mainly in the valley areas where ring wells, shallow as well as deep bore wells are the feasible structures. Apart from this, ground water resources in Ri Bhoi District can be developed through spring development also.

### *5.4 Ground Water Exploration*

The ground water development is yet to be picked up in the district. As part of ground water exploration programme of CGWB, the Board had drilled 19 exploratory wells and 2 observation wells in the district as on March 2011.

From the drilling data it is found that the discharge of wells varies from 43.58 lpm to 1113 lpm. The variation in the discharges is attributed to its geological location such as lineament, joints and fractures. Two bore wells drilled by CGWB in Barapani (ICAR complex) area which are free-flowing in nature. The discharge of these two bore wells are 594 lpm and 1113 lpm respectively. The depth of weathered zone ranges between 8 to 37 m bgl as ascertained by the depth of casing lowered in the exploratory wells of New Jirang (8.55 m) and Mawhati (37.30 m). Deep-seated prolific aquifers are also present in the district as indicated by the presence of a fracture encountered at 204.00 m bgl depth at Nongpoh EW.

**Table: Summarized Details of Ground Water Exploration**

| S. No | Location | Depth drilled (m) | Aquifer type | Aquifer zones tapped (m. below ground level) | DTW (m.bgl) | Discharge ($m^3$/hr) | DD (m) | T ($m^2$/day) |
|---|---|---|---|---|---|---|---|---|
| 1 | Byrnihat | 159.9 | Granitic gneiss | N.A. | | poor | | |
| 2 | ICAR Barapani | 180.8 | Quartzite | 74.1-92.4, 92.4-180.8 | Free flow | 66.78 | --- | --- |
| 3 | Umsiang | 135.1 | Granitic gneiss | 41.6-42.6,47.7-48.2,52.8-53.8,66-66.5,93.5-94.5,132-133 | --- | 62.4 | | |
| 4 | Umroi | 167.07 | Granitic gneiss | 12.3-87.77,93.87-124.37,130.47-160.97 | 3 | 56.53 | --- | --- |
| 5 | Warmawsaw | 129 | Gneissic complex | 37.6-41.5, 89.5-92, 125.5-129 | 4.01 | 38.79 | --- | --- |
| 6 | ICAR Barapani | 201.45 | Quartzite | 45-122.5,122.15-152.15,152.65-201.45 | Free flow | 35.64 | --- | --- |
| 7 | Mawrong | 201.7 | Granitic gneiss | 30.7-85.4, 91.5-122, 140.3-189.1 | 4.55 | 35.64 | --- | --- |
| 8 | New Jirang | 135 | Gneissic complex | 11.5-15, 27.95-31.05,101-104.25, 133.5-135 | 3.48 | 35.53 | --- | --- |
| 9 | Mawhati | 171 | Gneissic complex | 108-116, 140-170 | 7 | 29.4 | 4.49 | 18.25 |
| 10 | Paham | 154.82 | Gneissic complex | 59.1-61, 68.5-72.9,101.5-103 | 2.95 | 21.73 | 6.03 | 26.93 |
| 11 | Umsning | 124.05 | Granitic gneiss | 62-63.2,84.5-85.7,106-107,112.5-113.5 | 8.52 | 20.4 | 19.62 | 4.4 |
| 12 | Nongpoh | 204.6 | Granitic gneiss | 20.6-24.6, 48-66.3, 96.8-109, 115.1-124.3,130.4-142.6, 154.8-167, 179.2-188.3 | 4.77 | 19.8 | | --- |
| 13 | Umritdarbar | 202.15 | Granitic gneiss | 43.95-48, 98.5-103.5, 110-116 | 5.92 | 17.31 | 9.25 | 12.75 |
| 14 | Mawhati | 201.8 | Gneissic complex | --- | 8.31 | 17.04 | 10.17 | 23.87 |
| 15 | New Jirang | 200.3 | Gneissic complex | 92-97,122.5-129.0 | 2.61 | 15.32 | 6.98 | 29.44 |
| 16 | Mawlong | 203.5 | Granitic gneiss | 17.4-23, 72.3-78.4, 197-203 | 8.66 | 11.82 | --- | --- |
| 17 | Patharkammah | 202.51 | Gneissic complex | 37.81-41.8,120.21-123,145.5-147.5,175.11-178 | 1.18 | 8.77 | 19.02 | 2.93 |
| 18 | Bhoirymbong | 199 | Granitic gneiss | 54.5-55.5,64-65,71-72,100-101,136-137,143-144,167-168,178-179.5 | 5.97 | 5.3 | 43.98 | 0.27 |
| 19 | Umden | 171 | Granitic gneiss | 51-70,73-77,92-106,120-122 | 3 | 3.12 | --- | --- |
| 20 | Margar | 180.05 | Gneissic complex | 41-43.85, 151-154 | 41.7 | 2.63 | --- | --- |
| 21 | Byrnihat | | Granitic gneiss | | | | | |

## 6.0 Ground Water Management Strategy

### 6.1 Ground Water Related Issues and Problems

Ri Bhoi district is basically a hilly one. Steep slopes and rugged terrain offers limited scope for recharge and development of ground water. Moreover, approachability is a big constraint for assured water supply in the hamlets / villages situated on hilltops or steep slopes. Population stress and thereby scarcity of potable water is rising day by day in the district. Irrigation utilizing ground water, by constructing bore well is negligible in this district. Spring catchment areas need to be protected. It is observed that peoples are destroying the spring catchment by construction of houses or through agricultural practice where by the soil is eroding. No specific data is available with the State Government that how much area of the district is irrigated by utilizing spring water.

### 6.2: Ground Water Development

As major part of the district is underlain by consolidated formations, the fractures and joints act as good repository for the development of ground water. Lineaments studies through Remote Sensing and Electrical Resistivity Surveys can be of great help in this field. Structures like ring wells, shallow as well as deep bore wells are the feasible ground water structures.

All the irrigation schemes in the district are dependent upon the surface water resources. As per ground water resource estimation by CGWB, the stage of ground water development is only 0.06 % and there is enough scope for future development of ground water resource in the district. Ground water development is being done through dug wells and bore wells in the intermontane valleys. This is mainly used for domestic purposes such as washing and drinking. Springs play a pivotal role in rural water supply scheme. The development of springs as a source of water supply is seen mainly along the foothills or fracture zones. As a part of ground water exploration programme of CGWB, the Board had drilled 21 exploratory wells in the district. The depth of the exploratory well ranges from 129.00 to 204.00 m below ground level. The depth to water level ranges from 2.95 to 41.7 m below ground level and bore wells at ICAR, Barapani have free flowing artesian conditions. The discharge of the wells varies from 43.58 to 1113 lpm. However, the ground water development is yet to pick up in the district

## 6.3: Recommendations

As development of ground water is still in nascent stage, there is ample scope for future development of ground water in the district. It is being done through dug wells and bore wells in the intermontane valleys and linear ridges. In the foothills where most of the precipitation get wasted as surface runoff, rain water harvesting should be promoted by constructing structures such as gully plugs, check weirs and check dams and also roof-top rain water harvesting structures. In doing so, the water level on the upstream can be raised to a considerable extent. For roof-top rain water harvesting, rainwater can be collected from the PVC/GI or concrete rooftops through bamboo, GI or PVC gutters and pipes. This water can be used for domestic uses including drinking purposes after treatment.

The intermontane valleys are the most favourable places for ground water development. Structures like ring/dug well, shallow and deep bore well are feasible ground water abstraction structures. Hydrogeological studies have indicated that lineaments, joints, fractures and faults are the main controlling factors for the occurrence and distribution of ground water. These structures can be targeted for ground water development. Thus, the potential fractured zones must be confirmed by Geophysical Survey and lineaments studies by Remote Sensing Studies.

As the people in the rural areas are mainly dependent on spring water, there is an urgent need for scientific approach for proper development and management of these springs. It will be appropriate to develop the springs with reasonable discharge, to cater to the domestic water requirements to a large extent.

The chemical quality of ground water indicates that groundwater in the area is good for domestic, irrigation and industrial uses. Chemical analysis shows that the spring water is of excellent quality and is suitable for drinking purposes as per BIS standard. However, sporadic occurrences of high concentration of Iron in ground water have been reported in some pockets in the district. So, the water supply agencies should take precautionary measures to provide Iron free water for domestic / industrial purpose.

Mass Awareness Programme to the users and stakeholders on water consumption and protection of water quality will help in managing the precious resource in scientific ways for optimum benefits.

**Rainwater Harvesting**

Rain water harvesting is the technique of collection and storage of rain water at surface or in sub-surface aquifers, before it is lost as surface run-off for use during the lean days. Rainwater harvesting besides helping meet the ever-increasing demand for water, helps reduce run-off which chokes storm drains, reduce flood hazards, augment the soil moisture and groundwater storage and control the decline in the water level, improve quality of groundwater and reduce soil erosion. This is considered to be an ideal solution for water problem, where there is inadequate groundwater supply or where surface resources are either not available or insufficient. Rainwater is bacteriologically pure, free from organic matter and soft in nature. The rainwater harvesting structures are simple, economical and eco-friendly multi-purpose measures, mutually complementary and conducive to soil and water conservation, afforestation and increased agricultural productivity. The structures commonly suited to hilly areas are bench terracing, contour bunds / trenches, gully plugs, *nalah* bunds / Gabion structures, check dams and percolation ponds as also roof-top rain water harvesting for buildings.

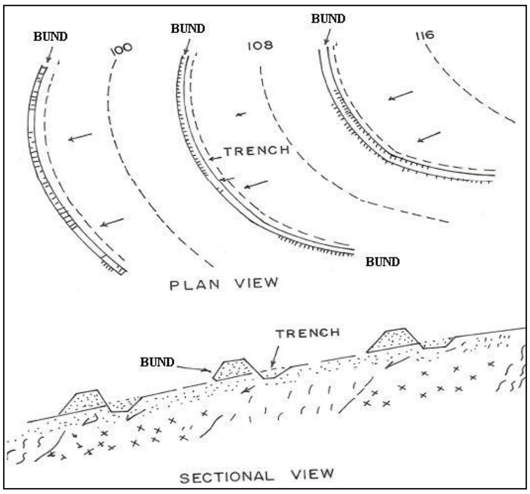



*Fig. 1. Schematic Diagram of Contour Bund/Trenches*

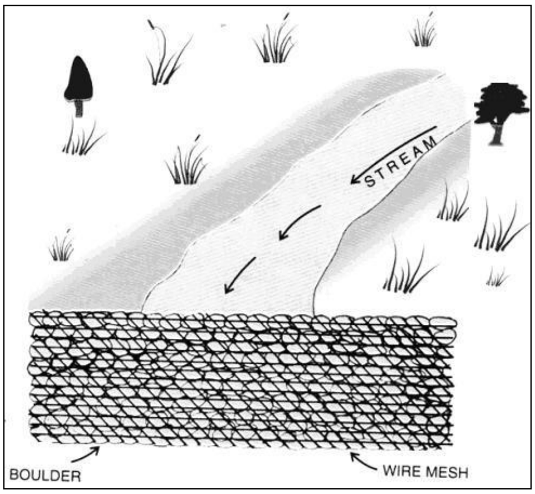



*Fig. 2. Schematic Diagram of a Gabion Bund*

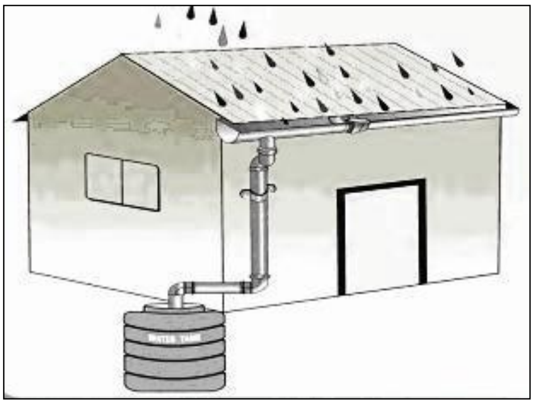


*Fig. 3. Schematic Diagram of Roof Top Rainwater Harvesting*

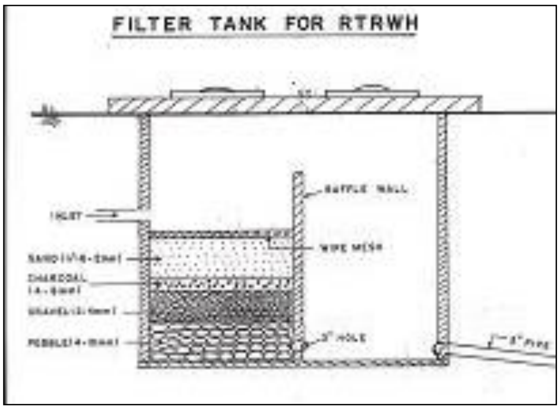
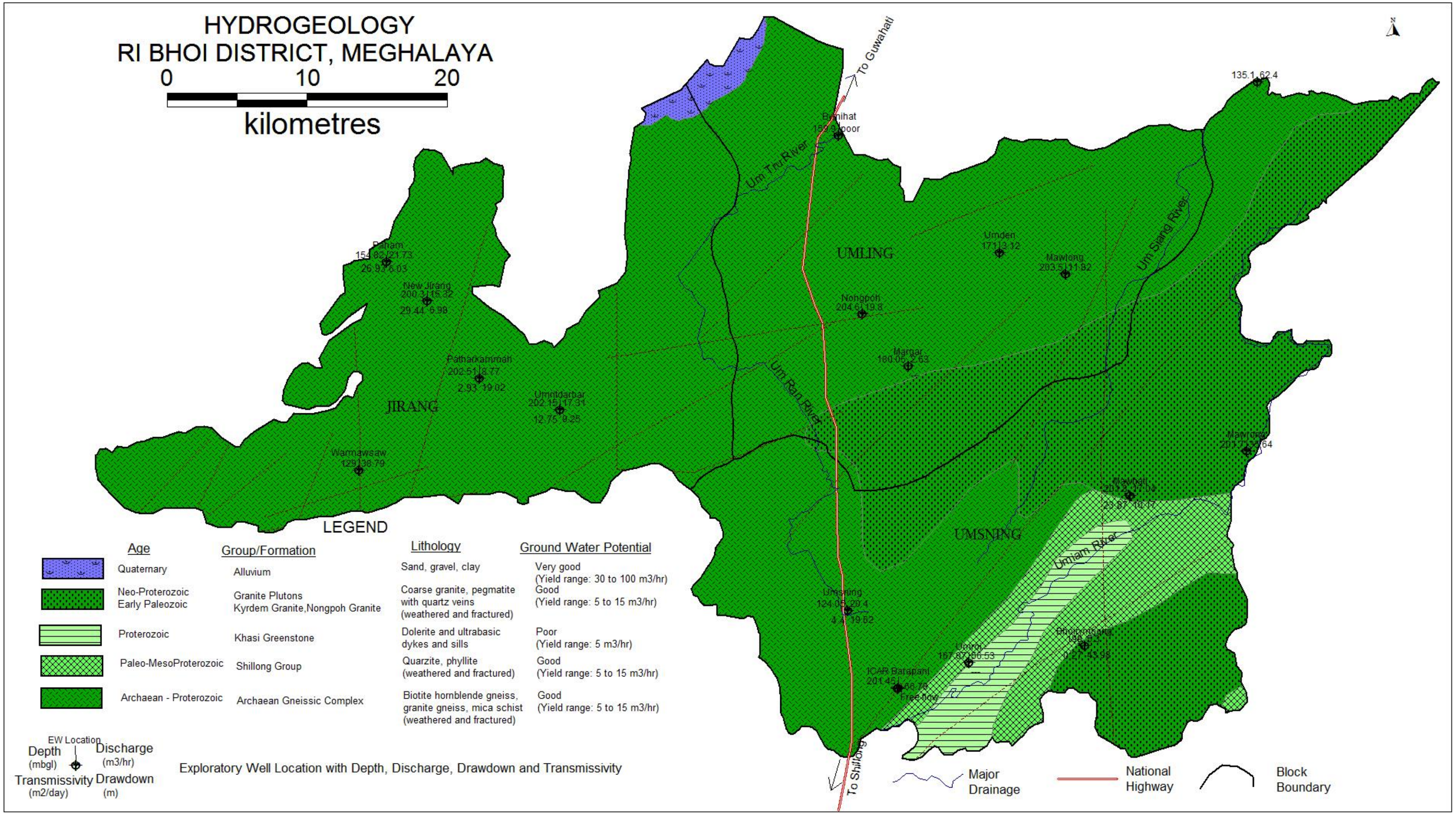



*Fig. 4. Schematic Diagram of Filter*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Age
Group/Formation
Lithology
Ground Water Potential
Quaternary
Alluvium
Sand, gravel, clay
Very good (Yield range: 30 to 100 m3/hr)
Neo-Proterozoic Early Paleozoic
Granite Plutons Kyrdem Granite,Nongpoh Granite
Coarse granite, pegmatite with quartz veins (weathered and fractured)
Good (Yield range: 5 to 15 m3/hr)
Proterozoic
Khasi Greenstone
Dolerite and ultrabasic dykes and sills
Poor (Yield range: 5 m3/hr)
Paleo-MesoProterozoic
Shillong Group
Quartzite, phyllite (weathered and fractured)
Good (Yield range: 5 to 15 m3/hr)
Archaean - Proterozoic
Archaean Gneissic Complex
Biotite hornblende gneiss, granite gneiss, mica schist (weathered and fractured)
Good (Yield range: 5 to 15 m3/hr)
EW Location
Depth (mbgl)
Discharge (m3/hr)
Transmissivity (m2/day)
Drawdown (m)
Exploratory Well Location with Depth, Discharge, Drawdown and Transmissivity
Major Drainage
National Highway
Block Boundary