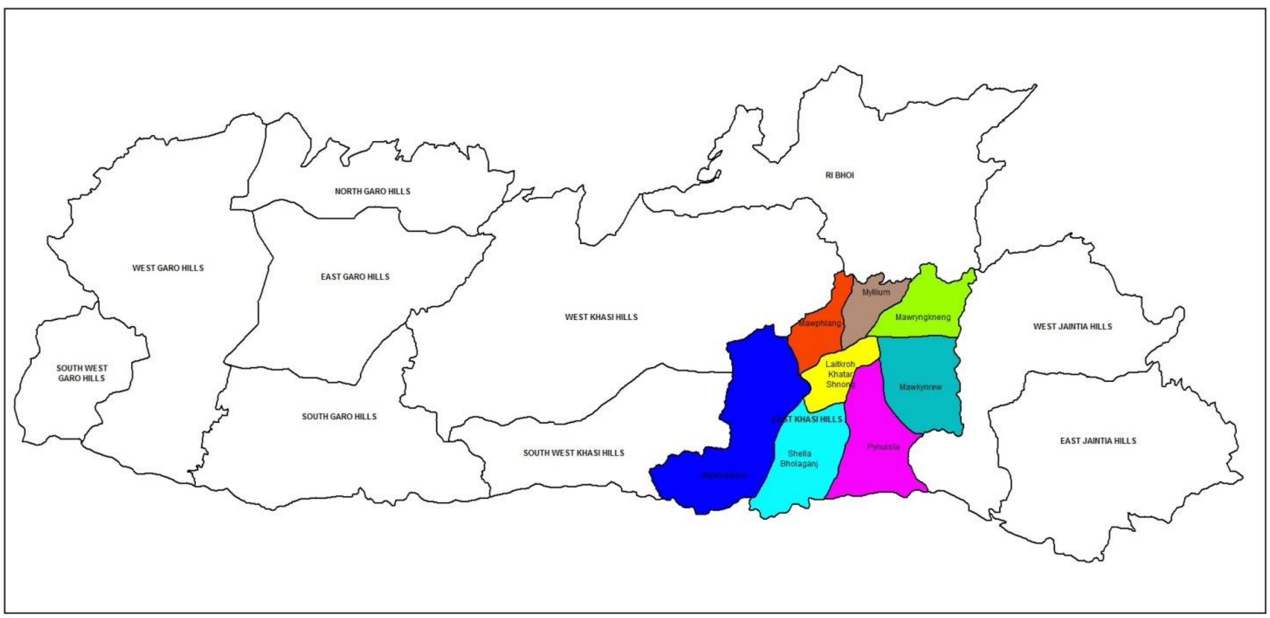
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET
EAST KHASI HILLS DISTRICT, MEGHALAYA



North Eastern Region
Guwahati
September, 2013

GROUND WATER INFORMATION BOOKLET
EAST KHASI HILLS DISTRICT, MEGHALAYA

DISTRICT AT A GLANCE

Sl. No.	ITEMS	STATISTICS
1.	**GENERAL INFORMATION**	
	i) Geographical area (Sq km) ii) Administrative Divisions Number of Blocks Number of Villages Towns	2748 8 (Mylliem, Mawryngkneng, Pynursla, Mawphlang, Mawkynrew, Shella-Bholaganj, Mawsynram, Khatarshnong-Laitkroh) 975 (including about 28 uninhabited villages) 2 (Statutory Towns) / 11 Census Towns
	iii) Population ((Provisional) (2011 census) Total Population Rural Population Urban Population	 824,059 (Decadal Growth 2001-2011 24.68%) 458,010 (Decadal Growth 2001-2011 19.53%) 366,049 (Decadal Growth 2001-2011 31.79%)
	iv) Average annual rainfall (mm) *Source: Directorate of Agriculture, Meghalaya.*	1600-12000, Mawsynram & Cherrapunjee are the world's wettest places with an average annual rainfall of about 12000 mm.
2.	**GEOMORPHOLOGY**	
	Major physiographic units	Denudational High & Low Hills, dissected plateau with deep gorges
	Major Drainages	Umtrew, Umiam, Um Khen, Um Song, Umngot, Umngi, Um Sohryngkew, Um Krem etc
3.	**LAND USE (Sq Km)**	**2010-11**
	a) Forest area	1067.52
	b) Net area sown	377.85
	c)Total Cropped area	456.26
4.	**MAJOR SOIL TYPES**	a) Red loamy soil b) Lateritic soil
5.	**AREA UNDER PRINICIPAL CROPS** (*as on 2010-11, in sq Km*) *Source: Directorate of Agriculture, Meghalaya.*	**Kharif**: Rice:56.83, Maize:20.05, Oilseeds:2.25 **Rabi** : Rice:1.11, Millets:1.84, Pulses:2.87, Oilseeds:1.16
6.	**IRRIGATION BY DIFFERENT SOURCES** a. Surface water, command area (Ha) b. Ground water (Ha)	 3347 Nil
7.	**NUMBERS OF GROUND WATER MONITORING WELLS of CGWB** No of dug wells No of Piezometers	(as on 31.3.2013) 5 0
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	a. Archaean Gneissic Complex - Granitic, Gneissic and schistose rocks. b. Shillong Group - Quartzites and Phyllites.
9.	**HYDROGEOLOGY**	
	Major water bearing formation Depth to water level • (Pre-monsoon during March 2012) • (Post-monsoon - November 2012)	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. 1.75m bgl (Shillong) to 8.47 m. bgl (Balat) 0.09m bgl (Shillong) to 4.20 m. bgl (Balat)

10.	**GROUND WATER EXPLORATION BY CGWB**	(as on 31.3.2013)
	No. of wells drilled	EW-16 OW-1 Total-17
	Depth Range (m)	60-247.6
	Discharge (lps)	0.15 to 7.46
	Transmissivity (m^2 /day)	Of the order of 7.46
11.	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limits	Good and potable, except high iron content in some places.
	Type of water	Generally good for drinking & irrigation purposes
12.	**DYNAMIC GROUND WATER RESOURCES** (2008-09) (in ham)	
	Annual Replenishable Ground Water Resources	37264 ham
	Net Annual Ground water draft	6 ham
	Projected demand for domestic and industrial uses upto 2025	3576 ham
	Stage of Ground Water Development	0.02%
13.	**AWARENESS AND TRAINING ACTIVITY**	
	Mass awareness Programme Organized	26th March, 2004 - Auxillium Convent School, Shillong
	Water Management Training Programme Organized	24th & 25th March, 2004 - PHED conference Hall, Shillong 28th & 29th March, 2005 - PHED conference Hall, Shillong 30th March, 2005 - Shillong Club, Shillong 24th January 2011 - Hotel Pegasus Crown, Shillong,
	TIER II training (Aquifer Mapping)	3rd to 7th December 2012, Shillong
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Project Completed by CGWB (No. & amount spend)	6 no., Rs 20.32 lakh under Central Sector Scheme executed by WAPCOS.
	Project under technical guidance of CGWB (nos.)	10 RWH structures in rural Govt. schools executed by NGO through GRHC
15.	**GROUND WATER CONTROL & REGULATION**	
	Number of OE Block	Nil
	Number of Critical Block	
	Number of Blocks notified	
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	1. Management and utilization of Groundwater. 2. Limited natural recharge in hilly areas. (It has created some water deficient areas in the district). 3. The approach and accessibility to the hamlets and villages is a difficult task and a major impediment in developing the ground water resources. 4. Some pockets are affected with higher concentration of Iron in water (higher than permissible limit prescribed by BIS, WHO). 5. In absence of solid and liquid waste disposal management system in the district, surface and ground water are being polluted, due to practice of dumping municipal waste along the streams

GROUND WATER INFORMATION BOOKLET

EAST KHASI HILLS DISTRICT, MEGHALAYA

1.0 Introduction

East Khasi Hills is one of the seven districts of Meghalaya covering an area of 2748 sq. km. Shillong is the district headquarters of East Khasi Hills which is also the capital of Meghalaya. Shillong is well connected by road with other places in the district as well as with the rest of the Meghalaya and Assam. Shillong is connected by road with all major north eastern states. Two major National Highways pass through East Khasi Hills District -National Highway 40 connects Shillong to Jorabat, Assam in the north and extends southwards to Dauki, at Bangladesh border and National Highway 44 connects Shillong to states of Tripura and Mizoram. As per 2011 census (provisional), the total population of the district is about 824,059 with male population of 410,360 and female population of 413,699 (a sex ratio of about 1008 females per thousand males), with rural population of 458,010 and urban population of 366,049. The main occupation of the population in the district is agriculture. The district has been divided into eight blocks as shown below

Name of Block	Inhabited villages
a Mawphlang	184
b MyIliem	97
c Mawrynkneng	36
d Mawkynrew	71
e Mawsynram	166
f Shella Bholaganj	139
g Pynursla	156
h Khatarshnong-Laitkroh	98

1.1 Land Use

The land utilization of the district is presented in the **Table 1.1.**

Table 1.1: Land utilization statistics of East Khasi Hills District (2010-11)

Land Classification	**Area (sq. km.)**
Geographical area	2748
Forest area	1067.52
Non-Agricultural area	206.69
Cultivable Waste Land and groves	544.76
Fallow Land	105.41
Net Area Sown	377.85
Area Sown more than once	78.41
Gross cropped area	456.26

Source: Directorate of Economics and Statistics, Meghalaya

The district has a forest area of 1068 sq. km., i.e. about 39% of the total geographical area. The net area sown is 377.85 sq. km. and the total cropped area is 456.26 sq. km. Fallow land covers about 4%, net area sown is about 14%, while the total cropped area is about 17%.

Principal crops grown in the district are rice, maize, millets, oilseeds and pulses. Horticulture products include orange, pineapple, pears, peaches, plums, sohiong, sophi, betel nut and many local fruits. Vegetables like potato, sweet potato, ginger, garlic etc. are also grown.

1.2 Drainage

The topography controls the drainage system as it divides the state into two watersheds namely the Brahmaputra system in the North and Meghna /Surma system in the South. Drainage of the district in the north flows toward the Brahmaputra River and in the south, the rivers flow towards the Bangladesh plains into Surma river. The important rivers in the northern part are Umtrew, Umiam and Umkhen. The Umtrew (or Digaru) River originates from the west of the Sohpetbneng range in East Khasi Hills District, near Lum Raitong. It flows towards the west till it meets the waters from the Umiam River which is being diverted by the Umiam Hydel Project. In the southern part, rivers Umiew (or Shella, also known as Bagra), Umngot, Umngi (Balat), etc. all tributaries of the Surma, originating from southern slopes of Khasi Hills, drain one of the world's heaviest rainfall areas and flow southwards into Bangladesh, have violent flows. The drainage pattern is structurally controlled and parallel to sub-parallel in nature.

1.3 Rainfall & Climate

The district has the unique distinction of having the wettest place on earth i.e. Mawsynram with an average annual rainfall of about 12,270 mm. This is followed by Cherrapunjee with an average annual rainfall of 11,600 mm. Southwest monsoon originating from the Bay of Bengal and the Arabian Sea directly influences this high rainfall. The high altitude areas of the district experience temperate humid climate and low altitude areas experience tropical to sub-tropical humid climate. The whole year can be divided into four seasons namely summer, rainy, autumn and winter. The temperature varies from 1.7 °C to 24 °C

2.0 Geomorphology & Soil Type

Geomorphologically, the East Khasi hills is an undulatory one. It comprises of denudational high and low hills with deep gorges. The district represents a remnant of ancient plateau of Indian Peninsular Shield which is deeply dissected suggesting several geotectonic and structural deformities that the plateau has undergone. The northern portion of the district is a dissected Shillong plateau gradually rising southwards to the rolling grasslands with gentle river valleys, then falls sharply in the Southern portion forming deep gorges and ravines in Mawsynram and Shella-Bholaganj, bordering Bangladesh. In the southern border areas, there are fringes of alluvial plains that are localized in nature.

Soil type of an area is dependent on factors like geology, relief, climate and vegetation. Red Loamy soil is a product of weathering of rocks like granites, gneisses etc which are relatively rich in clay forming minerals. This soil type are rich in organic matter, nitrogen and acidic in nature. They are found exposed in the central part of the district. Laterite soil is a weathering product of rocks like quartzite, schist, conglomerate etc, which are found exposed in the northern area of East Khasi Hills. The soils are rich in iron and aluminium. Alluvial soils are found exposed in the southern part of the district that are rich in potash but poor in phosphate content. They are acidic in nature.

3.0 Geological Set-up

The Generalised geological succession of the area of East Khasi Hills District is given in **Table. 3.1**

Table 3.1General Geological Succession

Geological Age	Group	Formation	Rock Type
Quaternary			Undifferentiated fluvial sediments (occurring as valley fill deposits)
Unconformity			
Mio- Pliocene		Chengapara	Coarse sandstone, silstone, clay and marl
Unconformity			
Palaeo- Eocene	Jaintia Group	Shella (600m)	Alteration of sandstone and limestone.
Cretaceous	Khasi Group	Mahadek (150 m)	Arkosic sandstone (Often Gluconitic & Ureniferous)
Unconformity			
Cretaceous	Sylhet Trap (600 m)		Basalt, Rhyolite, acid tuff.
Unconformity			
Neo-Proterozoic – Lower Palaeozoic		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 (Undiff)	Gneissic Complex (Basement Complex)		Mainly quartzofeldspathic gneiss with enclaves of granites,amphibolites, schists etc.

The district area falls mainly within the Shillong or Meghalaya Plateau which is constituted mainly of Precambrian rocks of gneissic composition in which granites, schists, amphibolits, calc-silicate rocks occur as inclusions of various dimensions.

The gneisses form the Basement Complex for the overlying Shillong Group of rocks and is separated from the later by an unconformity indicated at places by the occurrence of a conglomerate bed. The presence of primary structures like current bedding, ripple marks etc. indicated that quartzites of the Shillong Group are of sedimentary derivative later metamorphosed to quartzites. These occur mostly as thick layers. The Khasi basic ultrabasic Intusives comprising basic intusive like epidiorite, metagabro, metadoleraite etc occur mostly as sills, dykes in the various sub-facies of Shillong Group. In the study area one such exposure noticed in the North-Western part of the district where it intruded the Basement Gneissic Complex.The rocks are generally dark green, medium to coarse graines and massive.In weathered outcrops, the basic rocks give a reddish brown colour. Grainite Plutons occur as isolated patches in the district and cover an area next to area covered by Basement Gneissic complex.The South Khasi Granites (?) occur as intrusive body in the Basement Gneissic complex. Both Porphyritic and fine-grained pink granite form the South Khasi Granite.

The Sylhet Traps are of the nature of plateau basalts exposed in a narrow E-W strip along the southern border of the area and their anticipated thickness is 550-680 m. The Sylhet traps comprise predominantly basalts, rhyolites and acid tuffs.

The Cretaceous sediments exposed in the Meghalaya Plateau are classified as Khasi Group. The Mahadek Formation, the top unit of the Khasi Group, consisting of coarse arkosic sandstone, often gluconitic, are found exposed in the extreme southern part of the district. The Shella Formation of Jaintia Group consists of alteration of sandstone and limestone occurs in the south-central and south-western part of the district. The Quaternary fluvial sediments occur in the extreme northern part of the district bordering Assam.

4.0 Ground Water Scenario

4.1 Hydrogeology

The district of East Khasi Hills is covered mainly by crystalline rocks with Tertiary sedimentary rocks. The secondary porosity in consolidated formation e.g. fractures; joints, etc developed due to major, minor tectonic movements, prolonged physicochemical weathering, form the conduits as well as reservoirs of ground water. The weathered mantle varies from 10 to 30 m bgl. Ground water occurs under water table condition in the top weathered quartzite and in semi-confined condition in the fractured and jointed rocks. At hydrogeologically feasible locations, well drilled down to the depth of about 80 -150 m below ground level may yield a moderate discharge of 5-15 m^3/hr in Archaean and Pre-Cambrian Group of rocks. Depth to water level is found to occur between 2 and 15 m bgl. The valley areas are found to be favourable for the construction of dug wells and bore wells in other steep areas. It should be borne in mind that the zones are not uniform in characteristics as the aquifer material, fracture density and distribution and hydrogeological characteristics vary widely over short distances. Consequently, their water yielding capabilities vary considerably.

Ground water development in the district is mainly through dug /open well tapping the water in the weathered zone and bore wells are constructed to tap ground water from the fractures/joints in the hard rocks. In the shallow aquifer, the depth to water level ranges from less than 2 m bgl to 6 m bgl.

Springs play a major role to cater water requirement of the people throughout the year. Most of the springs are gravity springs. It is observed that discharge of most of the springs lie within the range of 5000-25000 lpd in pre- & post monsoon period.

4.2 Ground Water Exploration

In the district of East Khasi Hills, the Board has constructed a total of 15 numbers of exploratory wells so far. The depth of the exploratory well ranges from 60 to 247.6 m below ground level, tapping aquifer thickness of 15-135 m. The bore wells tapping the deeper aquifer are encountered with two sets of fractures within a depth range of 120 m. Other set of fracture may extend deep beyond 120 m bgl. The depth to water level of the exploratory wells ranges from 1.95 to 49 m below ground level. The yield of the wells varied from 5- m^3/hr. Transmissivity (T) is in the order of 7.46 m^2 /day. The summarised details of Ground Water Exploration carried out in the district are given in Table 4.1.

Table 4.1: Summarised Details of Ground Water Exploration

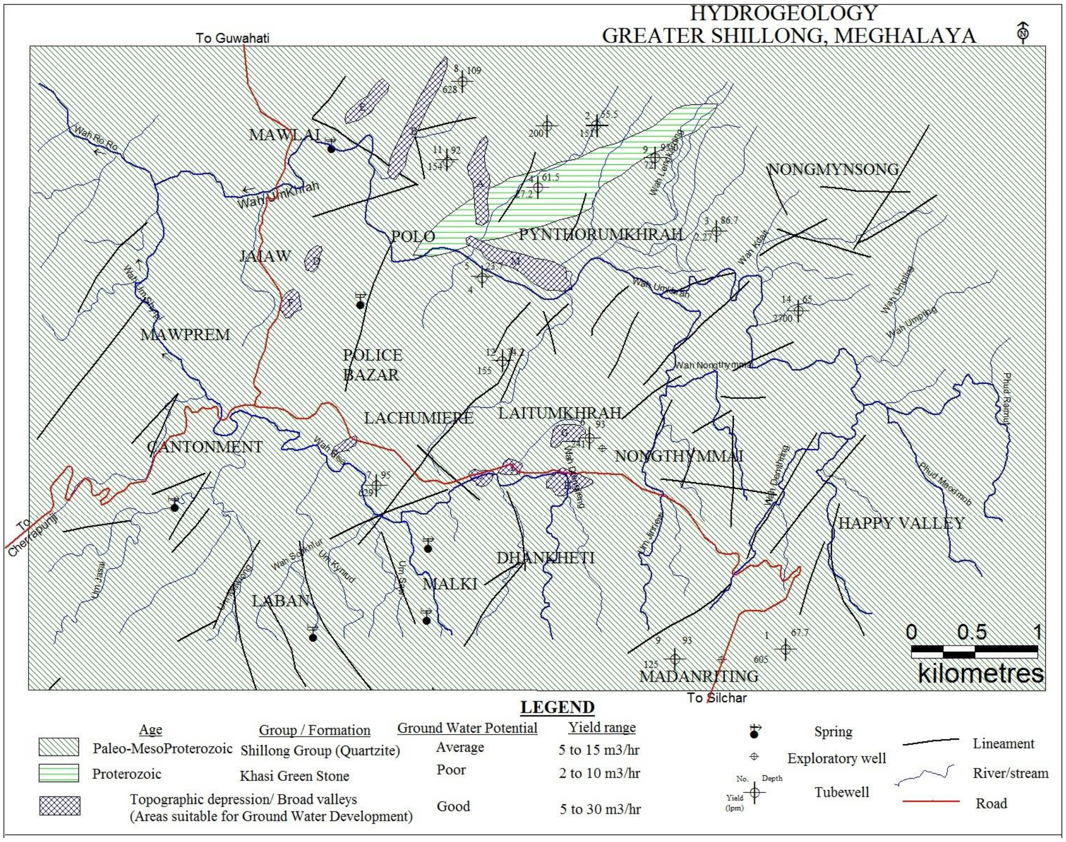
S. No	Location	Depth drilled (m)	Aquifer type	Aquifer zones tapped (m.below ground level)	SWL (m.bgl)	Discharge (m^3/hr)	DD (m)	T (m^2/day)
1	Mamluh, Sohra	201.3	Limestone	---	dry	dry	---	
2	Dymper	80	Quartzite	---	---	---	---	---
3	MES,Shillong	108.8	Quartzite with Khasi Greenstone intrusive	16.7-17.4,45-46,56-57,70-71,74-75,106.5-108.5	8.2	---	2.4	86.87
4	NEHU	100.9	Quartzite	67	---	40	---	---
5	12th Mile, Mylliem	231.95	Mylliem Granite	135	3.52	32.4	38.1	0.43
6	ASI, Mawblei	140.7	Quartzite	43.5-47,110-114	26.04	9.3	---	---
7	Kynton –U-Mon	70	Quartzite	5.7-12,15-19,20-28,30-35.5,55.2-60.0	2.05	8.45	2.5	11.4
8	Mawryngkneng	59.45	Quartzite	4.0-19.0,22.0-59.45	5.91	8.08	13.08	7.26
9	Umlyngka	80	Quartzite	13.0-20.0,56.0-60.0	3.5	5.3	40	---
10	Mawsmai, Sohra	247.6	Limestone	17	49	2.1	---	---
11	Thynroit	80	Quartzite	---	1.95	0.54	24.1	---
12	Umtyngar	200.45	Mylliem Granite	---	14.15	15	-	-
13	Mawdiangdiang	200.05	Quartzite	12-15,150-168,168-180	78.75	7	-	-
14	Mawkynrew	153.70	Quartzite	32-39,39-82,124-127, 148.6-153.7	8.3	16	-	-
15	Laitkor Lumheh	190.95	Quartzite-Khasi Greenstone	93.35-117.75.175.65-178.75	28.1	24	-	18
16	Mawlyngad	200.05	Quartzite-Khasi Greenstone	35.32-38.45,96.35-114.65, 154.35-178.75	0.52	13	-	3

4.3 Hydrogeology of Greater Shillong Urban Area

Groundwater resources in Shillong area are highly variable, it being mountainous terrain and are mainly dependent on topography, zone of weathering, fracturing and interstices present in country rocks. The availability of ground water in hilly region is manifested in the form of springs, seepages, wells and bore well of limited/ nominal yield.

Ground water occurs in the area under water table conditions in the top weathered and fractured zone of quartzite. Further below, semi-confined to confined condition exist in the interconnected joints, fractures etc of the underlying hard quartzite. The weathered quartzites have poor to moderate yields. The depth of this weathered zone varies up to about 30 m below ground level. The underlying second zone is fissured and jointed which is the zone of saturation. The distribution and disposition of these joints and fractures are of complex nature due to the various tectonic and structural disturbances to which country rocks are subjected to. Groundwater occurs under semi-confined condition in this zone. Such zones saturated with water are likely to extend down to 60 to 180 m below ground level.

Quartzite and recent valley fills (in Polo area) constitute the major aquifer system in the area. Ground water occurs under unconfined condition in the weathered rock and residuum. Ground water development in the urban agglomeration is both by dug wells generally confining to the weathered zone & bore wells, which mainly tap, fractured zone in the hard rocks. These fractures sometime extend very deep occurring even beyond 60mbgl, but otherwise generally close before 60m depth. From the well inventory data, it has been found during the dry period that in dug wells depth to water level varies from 0.50mbgl (at Polo) to 5.56mbgl (at Pynther). In post monsoon period it is from 0.15mbgl to 5.10 mbgl at the same locations respectively. The average seasonal water level fluctuation is 1.19m with minimum fluctuation of 0.35 m at Polo and maximum 2.95m at Mawlai- Mawroh. The hydrogeological map of Greater Shillong is given below**.**



As the topography is uneven and the thickness of the weathered horizon varies considerably, open wells are restricted to the Umkhrah valley in polo ground and Pynthorumkhrah area. Inventory of these wells have indicated the following-

(a) Depth to water level is shallow in topographic depressions than in the upland areas or slope, it varies from about 10 m to 5.0 m in the depressions while it is about 10.0 m in the highs.
(b) Water level values are independent of the differences in lithology.
(c) Wells in weathered metabasic rocks hold water throughout the year, whereas wells in weathered quartzites dry up during the dry season, indicating thereby better inflow of ground water in metabasic rocks.
(d) The quantum of seasonal water level fluctuation is at a maximum of about 3.0 m in topographic depressions and about 8.0 m in higher areas.

Yield capacity test in the near surface aquifers in the Shillong area establishes that weathered matabasic rocks have a moderately high yield potential. Study of lithological and hydrological data collected from shallow borewells drilled in Shillong area have shown that the most productive area is the Pynthorumkhrah area. The wells were drilled within quartzites and metabasic rocks with depths ranging from 30.00 m to 110.00 m. The yield of the boreholes ranged from 5.0 m^3/hr to 40.0 m^3/ hr.

4.4 Ground Water Resources:

The dynamic groundwater resource has 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 on 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 is 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 shown in table 4.1 and 4.2 respectively.

Table 4.1: 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			
34098	Nil	6170	Nil	40268	4026	36242

Table 4.2: 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				
36242	Nil	6	6	2382	33860	0.02	**Safe**

The total annual ground water recharge in the East Khasi Hills District is 40268 Hactare metre. The Net annual Ground Water Availability of the East Khasi Hills District works out to be 36242 Hactare metre after deducting the natural discharge during non-monsoon season. At present there is negligible Ground Water draft on account of irrigation and the annual domestic draft is 6 Hactare metre, the Gross Ground Water draft for all uses is 6 Hactare metre. The annual allocation for Domestic and Industrial uses has been made as 2382 Hactare metre based upon the population data projected upto year 2025. Thus the Net Ground Water Availability for Future Irrigation use works out to 33860 Hactare metre. The over-all stage of ground water development of the East Khasi Hills District is a meager 0.02%.

As the ground water development in the area is negligible there is sufficient scope for development of ground water. Hence a special thrust to ground water development for irrigation and future utilization.

4.5 Ground Water Quality

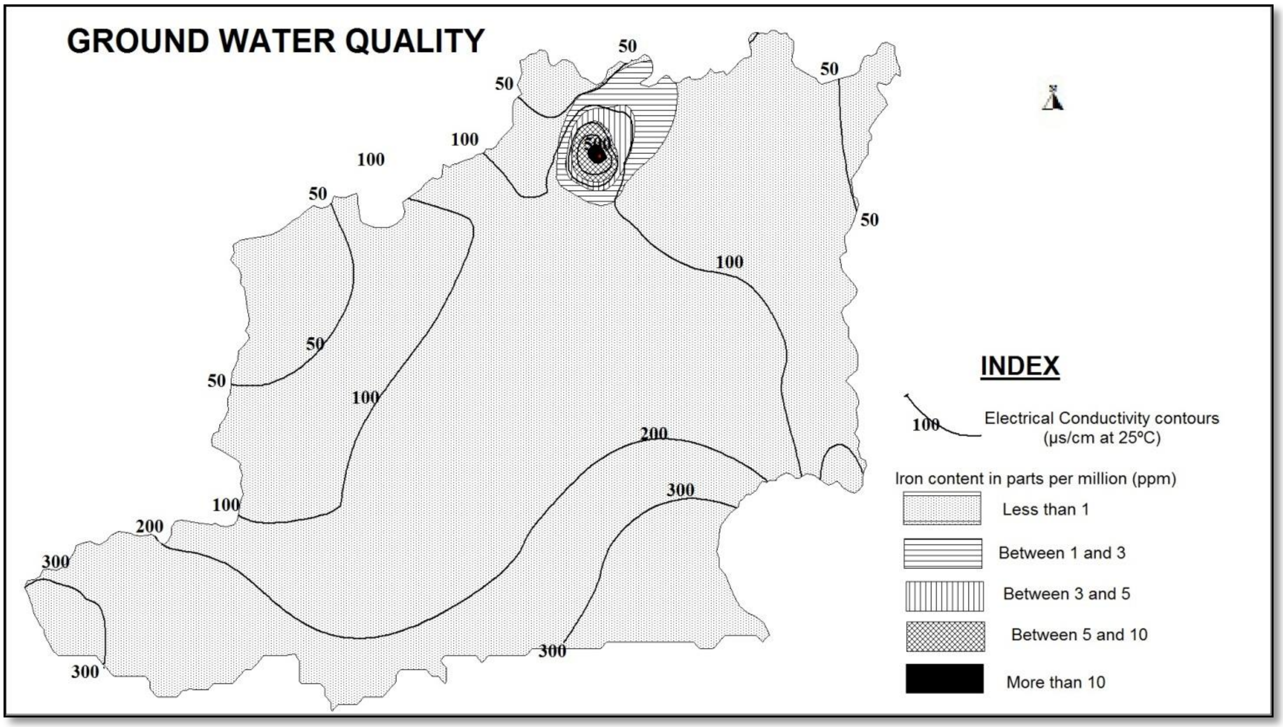
A summarized table (Table 4.3) is presented below from the available chemical analysis of water samples from various dug wells, springs, bore and tube wells in the East Khasi Hills district.

Table 4.3 : Summarized Chemical Analysis Results of Ground Water Samples

Constituents	Springs	Shallow aquifer	Deeper aquifer
pH	4.8-7.2	5.2-7.1	5.7-6.4
Specific conductance	20-170	51-260	51-214
Carbonate	Nil	Nil	Nil
Bi-carbonate	6.1-24	6.1-134	18-104
Chloride	3.5-35	7.1-35	7.1-11
Fluoride	*BDL-0.21	0.07-0.35	0.08-0.47
Calcium	2-30	4-40	2-22
Magnesium	1.2-4.9	2.4-4.7	1.2-8.5
Total Hardness	10-80	15-115	10-90
Iron	BDL-0.24	BDL-1.52	BDL-8.4

BDL- below detectable limit; concentration is in mg/l except specific conductance is micro mhos/cm at 25°c)

According to Bureau of Indian Standards (BIS:IS:10500, 1991), the chemical constituents present in the ground water of the district is all within the desirable limit set for drinking and irrigation water standards except for Fe for drinking purpose. Thus the water of the district is generally good and fit for drinking as well as irrigation point of view. In pockets where high concentration of Fe is detected, the water can be treated by adopting iron removal procedures for domestic use.



5.0 Ground Water Management Strategy

5.1 Ground Water Development:

As the district is characterized by undulatory terrain, the scope for development of ground water lies in low lying depression, and valley fills which hold good prospects for ground water development. In these areas, ring wells, shallow tube wells, deep tube wells are feasible.

Ground water manifests itself at the surface as springs. This plays an important role in rural water supply scheme in the district and a proper and scientific approach is required to augment the existing water supply scenario in the district. The discharge of the spring increases in the month of May and June, which is generally after the heavy rainfall that the district receives. Efforts should also be taken to safeguard the water of the spring from any sort of contamination.

5.2 Water Conservation & Artificial Recharge:

An amount of Rs 20.32 lakhs was expended under Central Sector Scheme to construct 6 structures in Shillong, the district headquarter of East Khasi Hills for implementing the roof top rain water harvesting. The implementing agency was WAPCOS who constructed 3 roof top rain water harvesting structures in schools and 3 in State Government Departments. The details of the rooftop rainwater harvesting structures is as shown below

Table 5.1 : Details of roof-top rainwater harvesting in Shillong

Sl. No.	Location	Roof-top area (sq.m)	Gutter Length (m)	Drop Pipe (m)	Conveyance Pipe (m)	Carrying Pipe (m)	Water harvested (cu.m)
1	State Guest House Barik	186.2	53.4	12.0	85.0	40.0	357.5
2	Circuit House Laban	137.6	42.4	10.0	60.0	60.0	264.19
3	State Central Library , IGP	1103.2	162.6	42.0	90.0	45.0	2118.4
4	Auxilium Convent, Nongthymmai	520.5	123.0	15.0	60.0	45.0	999.36
5	Pine Mount School in Barik	973.3	176.1	24.0	140.0	40.0	1868.73
6	All Saints School, IGP	613.4	106.0	15.0	120.0	48.0	1177.73

All the beneficiaries were using the rainwater for gardening, washing, cleaning etc except for drinking. These structures are of great help to them for meeting their water requirement during rainy season.

The construction of rain water harvesting tank of capacity of 40,000 liters and two low cost toilets in each Govt rural school have been completed in collaboration of local Non Government Organization namely Bethany Society, Shillong in the district of East Khasi Hills, coordinated by Global Rainwater Harvesting Collective, Tilonia, Rajasthan. Central Ground Water Board also prepared Roof Top Rain Water Harvesting Scheme for Raj Bhawan, Shillong.

As the East Khasi Hills district is basically a hilly one, most of the rainfall flows away as surface runoff due to undulating topography. Due to limited ground water recharge, the springs and wells do not yield sufficient water in summer months. Hence, roof top rainwater harvesting technique is a viable option. These structures can be implemented in areas where human settlement exist and in areas with steep gradient (say more than 20%) which are usually not worthy of ground water recharge.

6.0 Ground Water Related Issues & Problems:

While development of ground water in the district is still in nascent stage with over-all stage of ground water development of the East Khasi Hills District at a meager 0.02%, development by way of construction of deep tubewells in Shillong urban area is being done in a very unplanned and erratic fashion with concentration of tubewells in commercial areas and plush colonies and stage of ground water development in Shillong urban area is exceeding 50%.

Management and utilization of groundwater is also difficult as the hilly physiography and rugged terrain restricts development of groundwater, and natural recharge to ground water is limited in hilly areas. It has created some water deficient areas in the district. The approach and accessibility to the hamlets and villages is a difficult task and a major impediment in development of ground water resources.

In a few pockets of the district, high concentration of Fe (value ranging from 1.52 to 8.4 ppm) is found giving a bitter astringent taste.

Groundwater, especially springs play an important role in rural water supply schemes. Due to lack of proper and effective water treatment plants in East Khasi Hills, contaminated & polluted water is a major concern. In the absence of solid waste disposal management system in the district, surface and ground water are being polluted due to common practice of dumping municipal waste along the streams and untreated sewage is also flowing into the streams. The matter has been pointed out to the district authorities.

7.0 Awareness & Training Activity:

- A Mass Awareness Programme was conducted on Ground Water Management & Rain Water Harvesting on 26th march 2004 at Auxillium Convent School. Shillong. About 200 people from different walks of life participated making the programme a huge success.
- A Mass Awareness Programme was conducted on 30th March 2005 at Shillong Club, Shillong on Ground Water Management & Rainwater Harvesting.
- Two days long Water Management Training Programme was organized on 24th & 25th March 2004 at PHED conference hall, Shillong. A total of 13 Trainees participated from different State, Central and Non-Governmental Organizations.
- During 2004-05, two days long Water Management Training Programme was conducted on 28th & 29th March '05 at PHED conference hall, Shillong. A total of 16 Trainees participated in the training programme.
- During 2010-11, a one-day Training Programme on Ground Water Development and Management was conducted on 24th January 2011 in the the conference hall, Hotel Pegasus Crown, Shillong. A total of 16 Trainees from different State Government Departments and NGOs participated in the training programme.
- Presentation & lectures Delivered in Public Forum/Institution of Repute, etc:and electronic media. Fresh Water Year was celebrated in the district in the year 2003 in collaboration with Central Water Commission. Central Ground Water Board has participated during the workshop on "The impact of Air and water pollution as the quality of life and solution thereof' organized by the State Development Reforms Commission, Government of Meghalaya. A technical topic on "Ground Water Pollution" was presented by the Board and was associated in the celebration of World Water Day at Shillong (during 2005 & 2007). Government of Meghalaya has prepared a draft Model Bill to regulate and control the development and management of ground water in Meghalaya during March, 2007, and a representative from CGWB is a member of the committee on the Model Bill. Government of Meghalaya has proposed to constitute Water Harvesting Authority /Mission in the state to look after various activities in connection with implementation of rainwater harvesting schemes in the state.

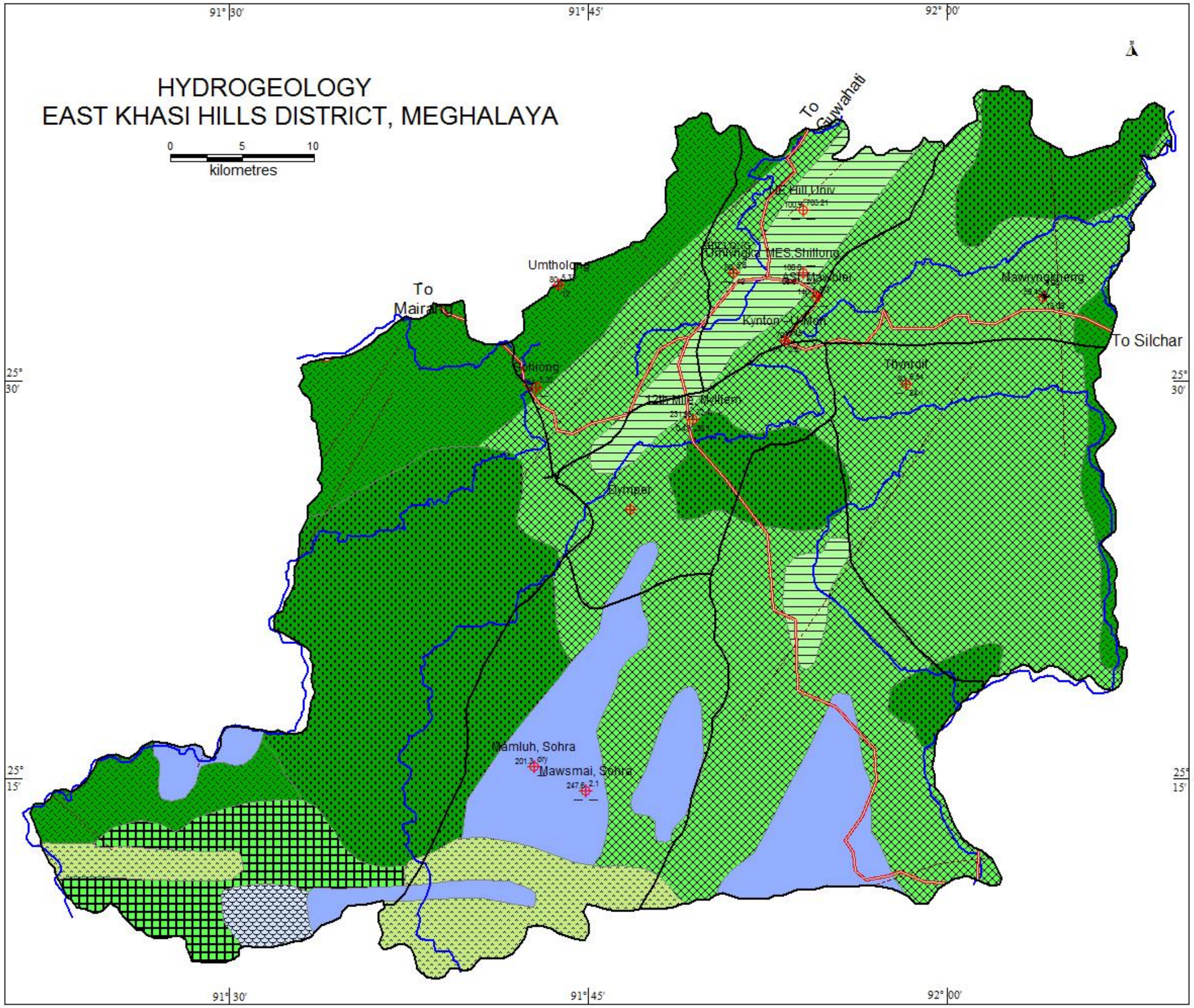
All MAP and WMTP organized by CGWB were covered by local News Papers

8.0 Recommendations:

Judicious planning for Ground Water Resource Development should be preceded by intensive hydrogeological and geophysical survey aided by remote sensing studies. Though ground water has the possibility to further augment the drinking water supply of the city, conjunctive use of surface and ground water sources is highly recommended to ensure optimal utilization of the ground water resources creating additional irrigational potential. Areas with low gradients and valley areas are favourable areas for groundwater development. Construction of groundwater abstraction structures should be promoted in needy areas, especially areas which face scarcity of water during summer. Unutilised springs should be developed scientifically for providing safe drinking water. Also, conjunctive use of surface and ground water, as well as rain water harvesting should be encouraged in the District as this entails the planned and coordinated harnessing of ground and surface water resources to achieve optimal utilization of total resources of the District. Roof top rain water harvesting technique may be encouraged to augment ground water resource potential wherein water table is deeper/ ground water development is higher, particularly in Shillong Urban Area.

The farmers should be educated through agricultural extension services, Mass Awareness and Water Management Training Programme to adopt suitable cropping pattern, irrigation method, conservation of water and optimal utilization of available ground water resources.

Municipal solid and liquid (sewage) waste disposal management system should be developed to avoid the surface and ground water contamination due to adoption of most common practice of dumping municipal waste along the streams/here & there.



LEGEND

Age	Group/Formation	Lithology	Ground Water Potenti (Yield range)
Mio- Pliocene	Chengapara Formation	Coarse sandstone, siltstone, clay and marl	Good (15 to 50 m3/hr)
Paleocene - Eocene	Jaintia Group	Sandstone, Shale (weathered and fractured)	Good (10 to 30 m3/hr
Upper Cretaceous	Khasi Group	Conglomerate /sandstone	Good (10 to 25 m3/hr
Cretaceous	Sylhet Trap	Basaltic flows	Unexplored
Paleo-Meso Proterozoic	Shillong Group	Quarzite, phyllite (weathered and fractured)	Average (5 to 15 m3/hr)
Neo-Proterozoic Early Paleozoic	Granite Plutons	Coarse granite, pegmatite with quartz veins (weathered and fractured)	Average (5 to 10 m3/hr)
Proterozoic	Khasi Greenstone	Dolerite and ultrabasic dykes and sills	Poor (2 to 10 m3/hr)
Archaean - Proterozoic	Archaean Gneissic Complex	Biotite hornblende gneiss, granite gneiss, mica schist (weathered and fractured)	Poor (2 to 5 m3/hr)

Depth (mbgl) Transmissivity (m2/day) Discharge (m3/hr) Drawdown (m) — Exploratory Well Location with Depth, Discharge, Drawdown and Transmissivity

Lineament

Major Drainage

National Highway

Block Boundary