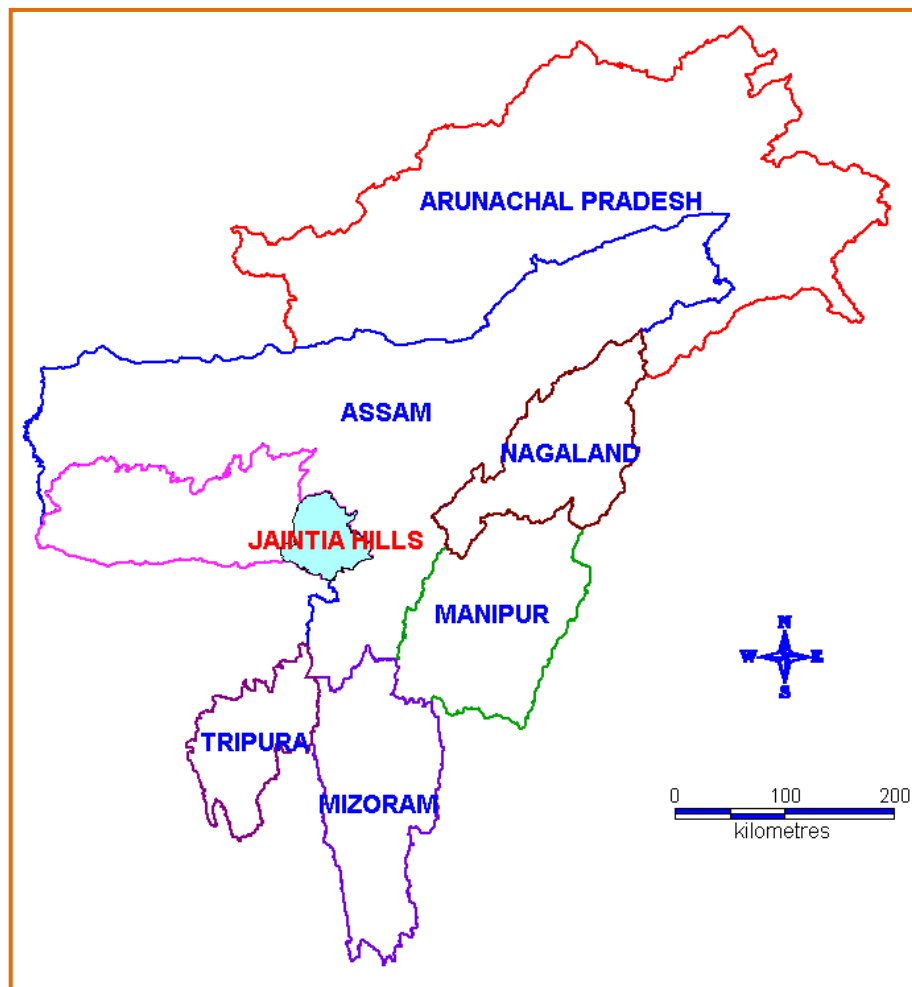




Ground Water Information Booklet Jaintia Hills District, Meghalaya



Central Ground Water Board
North Eastern Region
Ministry of Water Resources
Guwahati
June 2009

**GROUND WATER INFORMATION BOOKLET
JAINTIA HILLS DISTRICT, MEGHALAYA**

DISTRICT AT A GLANCE

Sl. No.	ITEMS	STATISTICS
1.	GENERAL INFORMATION	
	i) Geographical area (sq. km.)	3,819
	ii) Administrative Divisions (as per 5 th Economic census, 2005)	
	Number of Blocks	5
	a) Thadlaskein	
	b) Laskein	
	c) Amlarem	
	d) khliehriat	
	e) Saipung	
	Number of Villages	519
	iii) Population (as per 2001 census)	2,94,108
	iv) Average Annual Rainfall (mm) Source: Dept. of Agriculture, GOM Rain gauge station: Rymphum Seed Farm, Jowai	5,966
2.	GEOMORPHOLOGY	
	Major physiographic units	Denudational High & Low Hills, dissected plateau with deep gorges.
	Major Drainages	Myngngot, Myntdu, Wah Prang, Wah Lukha, Wah Simlieng and Kupli Rivers
3.	LAND USE (sq. km.)	
	a) Forest area	1,541.21
	b) Net area sown	319.46
	c) Total Cropped area	323.06
4.	MAJORS SOIL TYPES	a) Red loamy soil b) Lateritic soil c) Alluvial soil
5.	AREA UNDER PRINCIPAL CROPS (as on 2002-03, in sq. km.)	Kharif: 30.32 Rabi : 19.95
6.	IRRIGATION BY DIFFERENT SOURCES	
	a. Surface water (sq. km.)	45.45
	b. Ground water (sq. km.)	Nil
7.	NUMBERS OF GROUND WATER MONITORING WELLS of CGWB (as on 31.3.2009)	
	No of dug wells	02
	No of Piezometers	Nil

8.	PREDOMINANT GEOLOGICAL FORMATIONS	Archaean to Recent a. Archaean Gneissic Complex b. Shillong Group of rocks c. Cretaceous & Tertiary sediments
9.	HYDROGEOLOGY	
	Major water bearing formation <ul style="list-style-type: none"> • (Pre-monsoon depth to water level during 2007) • (Post-monsoon depth to water level during 2007) Long term water level trend in 10 years (April 1997 – April 2007) in m/yr	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. 2.49 to 3.99 m bgl 1.5 to 1.7 m bgl 0.16 m/yr rise in pre-monsoon at Jowai 0.022 m/yr fall in pre-monsoon at Dauki 0.16 m/yr rise in post-monsoon at Jowai 0.097 m/yr fall in post-monsoon at Dauki
10.	GROUND WATER EXPLORATION BY CGWB (as on 31.3.2007)	
	No. of wells drilled (EW, OW, PZ, SH. Total)	7 EW and 1 OW Total: 08
	Depth Range (m)	80.18 to 159.52
	Discharge (m ³ /hr)	0.30 to 6.3
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 (as on March 2004) in mcm	
	Annual Replenishable Ground Water Resources	434.69
	Net Annual Ground water draft	0.62
	Projected demand for domestic and industrial uses up to 2025	13.19
	Stage of Ground Water Development	0.16 %
13.	AWARENESS AND TRAINING ACTIVITY	
	Mass awareness Programme Organized	Nil
	Water Management Training Programme Organized	

14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	
	Project Completed by CGWB (No. & amount spent)	Nil
	Project under technical guidance of CGWB (nos.)	Nil
15.	GROUND WATER CONTROL & REGULATION	
	Number of OE Block	
	Number of Critical Block	Nil
	Number of Blocks notified	
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

JAINTIA HILLS DISTRICT, MEGHALAYA

1.0 Introduction

Jaintia Hills district is the easternmost district of Meghalaya and covers a total geographical area of 3,819 sq. km. It falls between North Latitudes $24^{\circ} 58'$ and $26^{\circ} 03'$ and East Longitudes $91^{\circ} 59'$ and $92^{\circ} 51'$ and covers about 17 percent of the total area of Meghalaya state. The population is 2,99,108 as per 2001 census. It is hilly and tribal and is bounded by Karbi Anglong district (Assam) in northern part, North Cachar Hills district (Assam) in eastern part, East Khasi hills district in the west and Cachar Hills district (Assam) and Bangladesh in the south. The area, population and number of villages in the administrative blocks are given below.

Table 1 Area, population and number of villages in the administrative blocks

Blocks	Area (sq.km.)	Population (2001 census)			No of villages as per 5 th Economic census 2005		
		Male	Female	Total	Inhabited	Uninhabited	New villages
Thadlaskein	753	51565	53055	104620	122	8	1
Laskein	553	32886	32840	65726	79	12	2
Amlarem	398	18158	17812	35970	86	1	3
Khliehriat	2115	47282	45510	92792	103	7	0
Saipung	-	-	-	-	81	3	11
Total	3819	149891	149217	299108	471	31	17

The land utilization statistics of the district during the year 2003-04 shows that the forest area is 1,54,121 ha, 30,889 ha is barren, uncultivable and non agriculture land, 27,028 ha is fallow land and 31,946 ha land is under net area sown. The total cropped area is 32,306 ha.

Geomorphologically, the district represents a remnant of an ancient plateau of Pre-Cambrian Indian shield block, uplifted to its present height due to tectonic activities in the past. The southern parts form a platform on which Tertiary rocks were deposited in the post-Cretaceous period. In general, the district has a diversity of landscape such as hills, plateau and deep gorges. Topography varies from gently rolling type to highly undulating type. The highest point of 1,627 m above MSL is observed at *Maryngksin*, in eastern part and the lowest point is 76 m above MSL at *Dawki*.

The drainage system of the district is controlled by topography. Broadly, there are mainly two watersheds in the district, one river flowing in the northern direction toward the Brahmaputra River and the other in the south, towards the Surma valley in Bangladesh. The important rivers flowing to the Brahmaputra River are *Kupli*, *Myntang* and *Mynriang* and the main rivers flowing to the Surma valley are *Myngngot*, *Myntdu*, *Wah Prang*, *Wah Lukha* and *Wah Simlieng*. The drainage pattern is sub parallel to parallel. It is being controlled by joints and faults as indicated by the straight courses of the rivers and streams with deep gorges.

In the district, there are no major or medium irrigation projects; hence the agricultural development in the area is dependent on minor irrigation schemes. The existing irrigation schemes are based only on surface water and the source is mainly through non-monsoon base flow. The total command area as on 31/03/2004 is 4,545.29 ha in the district. Piped water supply schemes and spot source water schemes are the main source of water supply and play a major role for the water requirement of the people especially in the rural areas. Piped water supply schemes are categorized into (i) Gravity Feed Schemes and (ii) River Pumping Schemes. Spot source water supply scheme are classified into (i) Hand pump, (ii) Spring tapped chamber and (iii) Well (dug, ring) maintained by Public Health Engineering Department, Meghalaya (PHED).

Central Ground Water Board has carried out various water supply investigations in the district. During Annual Action Plan 2004-05, District Ground Water Management Studies was carried out in the district. Further, Ground Water exploration has been carried out during the year 2005-06.

2.0 Rainfall & Climate

The climate shows a variation from the warm, humid tropical in the plains in the eastern and southern part and temperate climate is experienced in the western part around the district Headquarters Jowai. The climatic conditions vary substantially from place to place due to wide differences in altitude. Therefore, according to the prevailing weather condition over the years, the district can be grouped into four conspicuous seasons namely winter season, pre-monsoon season, monsoon season and retreating season.

The average annual rainfall in the district is 5,966 mm recorded at Rymphum Seed Farm in Jowai. The district receives a fairly high rainfall throughout the year. Most of the precipitation occurs between April and October. The monthly maximum rainfall of 2,655.80

mm was recorded in June 1995 at the same rain gauge station. The lowest annual rainfall was recorded as 3,933 mm in 1994 and the highest annual rainfall was recorded as 7,695 mm in 1995 respectively.

3.0 Geomorphology & Soil Type

Geomorphologically, the district 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. Broadly, the district can be differentiated into four fold major geomorphic units.

- Alluvial plains.
- Area having denudo-structural hills and highly undulating topography.
- Area showing more or less flat topography with rolling mounds representing plateau
- Area containing denudational hills and less dissected topography.

The district shows different types of soils as the provenance differs widely. The loamy soil is the most prevalent one. It varies from sandy to clayey-loam in *Jowai* and *Nongbah*. Reddish lateritic soil is observed in the hill slope in *Sonapur* and alluvial soil occurs in the southern periphery of the district eg *Dawki*, *Muktapur*, *Lakroh* etc. The soil is acidic in nature, with low percentage of phosphorous and high organic carbons.

4.0 Ground Water Scenario

4.1 Hydrogeology

Hydrogeologically, the district can be divided into three units, namely consolidated, semi-consolidated and unconsolidated formations.

4.1.1 Consolidated Formation: These include the oldest rock formation occupying about 1300 km² in the northern and western parts. Gneissic complex, quartzite etc constitute this unit. The depth of weathering varies from place to place and ranges from 15 to 20 m at places. The presence of substantial weathered mantle is confined to their secondary porosities, which form excellent repository of ground water in hard rock area. The storage and movement of ground water in hard rock is controlled by physiography, zone of weathering and interconnected zones of weakness. Ground water occurs under unconfined

condition and in semi-confined condition in the interconnected secondary structural weakness/ features like joints, fractures etc of the hard rocks. The depth to water level varies from 0.13 to 1.13 m bgl.

4.1.2 Semi-consolidated Formation: These constitute the major part of the district covering *Amlarem* and *Khliehriat* blocks and covers two thirds of the entire area. It ranges in age from late Cretaceous to Plio-Pleistocene. The Shella formation of the Jaintia group is the most conspicuous. Ground water occurs under unconfined to semi-confined conditions due to primary porosities of the semi-consolidated formations as well as in the secondary porosities like caverns, open fractures and joints. The formations show both isolated hummocky topography to highly undulating topography with steeply rising hills and deep gorges. The karst topography is observed in areas of *Letein*, *Latyrk*, *Litang* etc. occupied by the cavernous limestone. The depth to water level ranges from 0.30 and 1.13 m bgl.

4.1.3 Unconsolidated formation: The unconsolidated formation is mainly represented by recent alluvium occurring near the southern fringe of the district and is the continuation of the alluvial plain of Bangladesh. It constitutes about 67 km² representing about 2% of the total area.

4.2 Ground Water Resources

The dynamic ground water 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 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 2004) in ham is as follows.

Table 2 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			
30,568	352	12,413	136	43,469	4,347	39,122

Table 3 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				
39,122	NIL	62	62	1,319	37,803	0.16	Safe

As per the ground water resource and the stage of development computed, it can be seen that, ground water development is yet to be picked up in the area. The stage of development during the last decade is negligible and the district can be developed further by utilizing the abundant ground water resources available in the district.

4.3 Ground water quality

In order to study the chemical quality of ground water representative water samples from select bore wells, dug wells and springs were collected during the course of field work and the parameter analysed are pH, EC, TDS, CO₃, Cl, SO₄, F, Ca, Mg, TH and Fe. It was observed that spring water is by and large slightly alkaline rather than acidic. Overall, the chemical constituent present in the ground water is within permissible limit set by BIS and WHO except the concentration of Iron in few pockets in deeper aquifer, which is higher than permissible limit. Removal of the Iron is done by aeration process followed by sedimentation and filtration. Potassium permanganate or chlorine/chloride may be employed to oxidize the

iron, which is then filtered from the waters. The process is applicable very much when bacteria is present in the water. Iron can also be removed by the addition of a mixture of sodium carbonate and sodium phosphate to precipitate iron as insoluble, followed by settling and filtration

4.4 Status of Ground Water development

The ground water development is yet to be picked up in the district. As part of ground water exploration programme, CGWB had constructed seven exploratory wells and one observatory well in the district. The depth of the exploratory well ranges from 80.18 m to 159.52 m below ground level. The depth to water level of the wells ranges from 5.15 to 14.18 m below ground level. The ground water discharge varies from 0.30 m³/hr at *Tyrsang* E/W to 6.3 m³/hr at *Thadlaskein*, DIET, O/W and the Transmissivity varies from 0.02 m²/day to 3.65 m²/day respectively.

5.0 Ground Water Management Strategy

5.1 Ground Water Development

Development of ground water in the district is practically negligible. As the district is characterized by undulatory terrain, the scope for development of ground water exists in low lying depression, and valley fills which hold good prospects for ground water development. Moreover, in the district, all the minor irrigation scheme are executed by the surface water only and as per ground water resources estimation, the stage of ground water development is only 0.16% which leaves a greater scope for ground water development.

Ground water development is being done through dug well and bore well in the intermontane valley and linear ridges. The development of spring is seen mainly along the foothills. The ground water is mainly used for domestic purposes such as washing and drinking. Therefore, there is an ample scope for future development of ground water in the area.

The peneplanied surfaces, buried pediments and the valley fills are the most favorable locations for the development of ground water. The fractured and lineament too hold prospect for the development of ground water. Structures like ring wells, shallow as well as deep tube wells are the feasible ground water structures. The fractured, fissured rocks and the intersection of faults /lineaments hold good prospects for ground water. As ground water is poorly developed/ exploited, dugwells are the preferred structures as of now in low-lying

areas and valleys. The shallow water level conditions give scope to maintain sufficient water column in the dug wells.

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.

6.0: Ground Water Related Issues and Problems

In few pockets of the district, higher concentration of Iron in deeper aquifer is found which is beyond permissible limit set by BIS and WHO. In area where iron content is beyond permissible limit, iron removal plant or other suitable devices should be installed.

The district is well known for large production of coal in *Khliehriat* sub division as its main coal belt area. It can be seen that unscientific method of coal mining coupled with limestone quarry undertaken by cement factories has affected the environment particularly the water bodies in various parts of the district. Hence scientific mining is suggested as preventive measures. Government of Meghalaya can take up right steps in this direction.

7.0: Recommendation

Development of ground water in the district is still in nascent stage. Ground water development is being done through dug well and bore well in the intermontane valley and linear ridges. The development of spring is seen mainly along the foothills. The ground water is mainly used for domestic purposes such as washing and drinking. Therefore, there is an ample scope for future development of ground water in the district.

The peneplained surfaces, buried pediments and the valley fills are the most favourable places for ground water development. The narrow, linear valleys and intermontane valley offers scope for development of ground water. Structures like ring/dug well, shallow and deep bore well are the feasible ground water abstraction structures. As ground water is poorly developed, dug wells are the preferred abstraction structures as of now in low-lying areas and valleys. The shallow water level conditions give scope to maintain sufficient water column in the dug wells. Hydrogeological studies indicate that lineament, joints, fractures and fault are

the main controlling factors for the occurrence and distribution of ground water. These structures can be tapped for ground water development. However, the potential fractures zones must be confirmed by electrical resistivity survey before deploying suitable drilling rigs.

Spring plays a major role in fulfilling water requirement for the people in rural areas. It is found that the location of the spring is mainly restricted to foothills and intermontane valleys. The spring water is of excellent quality and is suitable for drinking purposes as per BIS standard. As the people in rural areas are totally dependent on spring, there is an urgent need for scientific approach for proper development and management of this precious resource. It may be recommended that the development of springs having high discharge will help in mitigating the water requirement of the people to a great extent.

The chemical quality of ground water indicates that groundwater in the area is good for domestic, irrigation and industrial uses. However, Iron content in deeper aquifer in some bore/tube wells are beyond permissible limit, which warrant proper treatment before use. Moreover, mining should be carried out scientifically and preventive measures have to be taken by the state Government in this regard so as to keep the water bodies free from pollution.

Although the district receives heavy rainfall, in the hilly portion, people face acute scarcity of water in lean period. In these areas, roof top rainwater harvesting should be adopted effectively to meet the demand of the people residing on hilltops. Rainwater can be collected from the rooftops through PVC pipe or through bamboo. Filters can be used at the time of collection for filtration of impurities. This water can be used for domestic uses and drinking purposes after treating with bleaching powder to remove bacteriological contamination.

In the foothills where most of the precipitation gets wasted as surface runoff, the area can be effectively utilized for augmentation of ground water by constructing structures such as check dams, gabions and check weirs. Doing so, the water level on the upstream can be raised to a considerable extent, saturating the dry zone of the aquifer. Gully plugging and contour bunding will be effective means of augmentation of ground water.

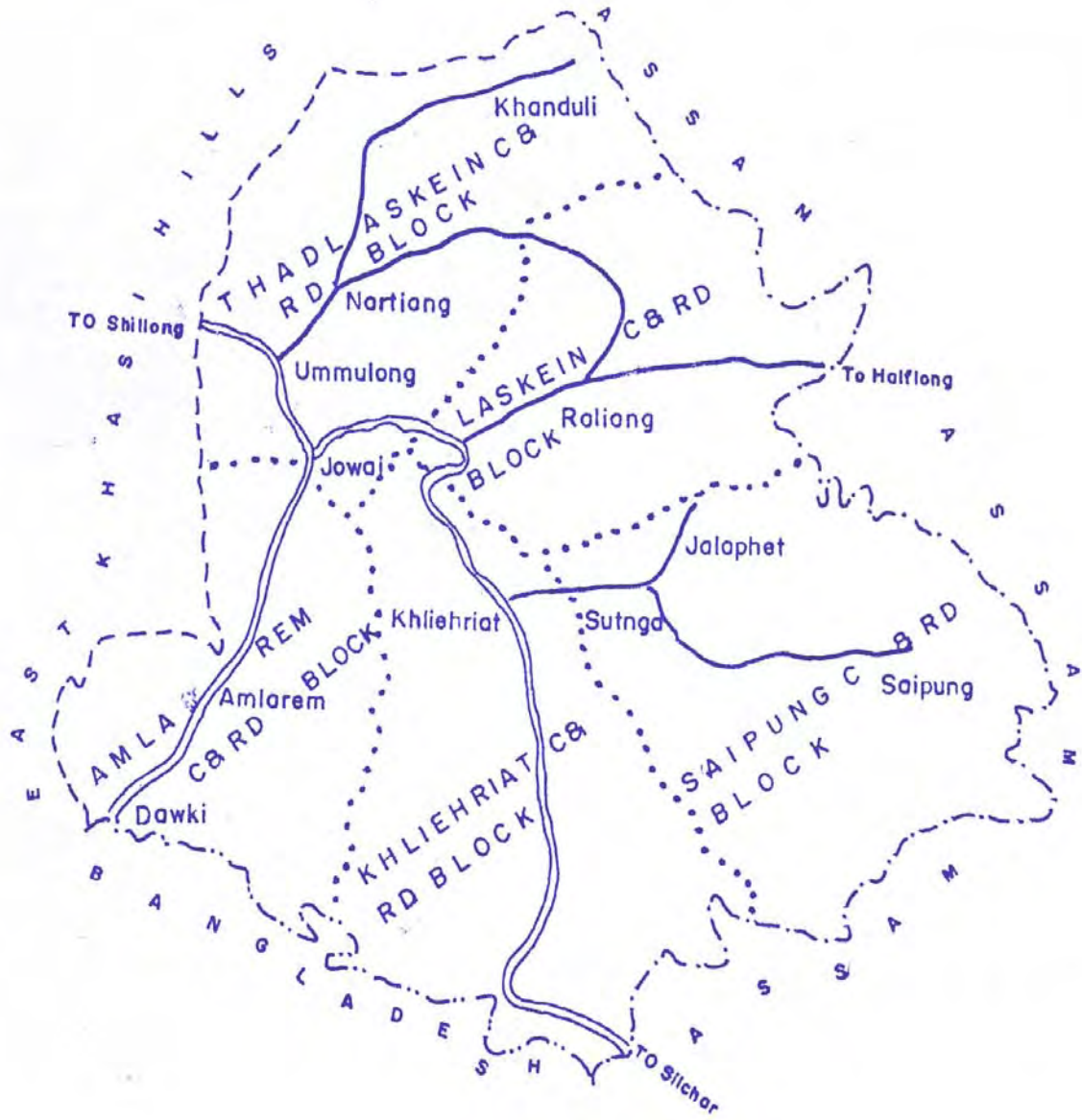
As already mentioned above, the stage of ground water development in Jaintia district is only 0.16%, hence, there is sufficient scope for development of ground water resources in the district. A special thrust to ground water development for irrigation and future utilization is recommended.

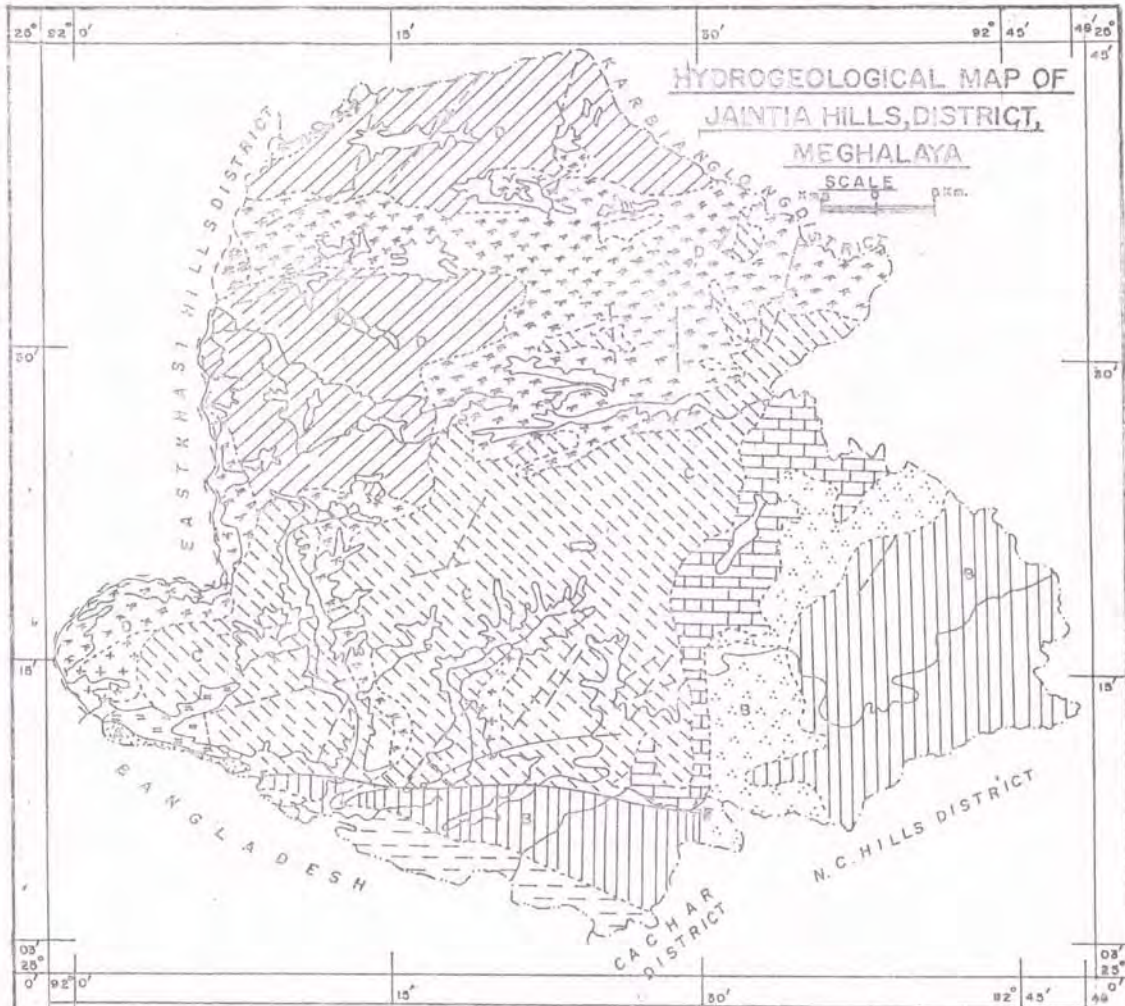
Creating public awareness for effective use of water resources is essential for proper management of ground water resources. Hence, the co-operation of public is as important as the technical or administrative considerations.

ADMINISTRATIVE MAP OF JAINTIA HILLS DISTRICT,

MEGHALAYA

NOT TO SCALE





GEOLOGICAL UNITS			
---	Lineament	[Symbol]	Alluvium
— —	Fault	[Symbol]	Dupitila
[Symbol]		[Symbol]	Surma
[Symbol]		[Symbol]	Barail
[Symbol]		[Symbol]	Kopili
[Symbol]		[Symbol]	Shella Formation. (Limestone)
[Symbol]		[Symbol]	Shella Formation. (Sandstone, shale)
[Symbol]		[Symbol]	Intrusives, (Dolerite, Amphibolite, Pyroxenite)
[Symbol]		[Symbol]	Quartzites, phyllites
[Symbol]		[Symbol]	Granites
[Symbol]		[Symbol]	Gneiss

GEOGRAPHIC DIVISIONS		GROUNDWATER POTENTIAL IN DEPRESSION	
[A]	Alluvial plain	Areas with yield prospect above 20m ³ /hr.	[A]
[B]	Area having denudostructural Hills highly undulating Topography.	Areas with yield prospect upto 20m ³ /hr.	[B]
[C]	Area showing more or less flat Topography representing plateau.	Areas with yield prospect upto 10m ³ /hr.	[C]
[D]	Area with denudational hills and less dissected Topography.	Areas with yield prospect below 5m ³ /hr.	[D]