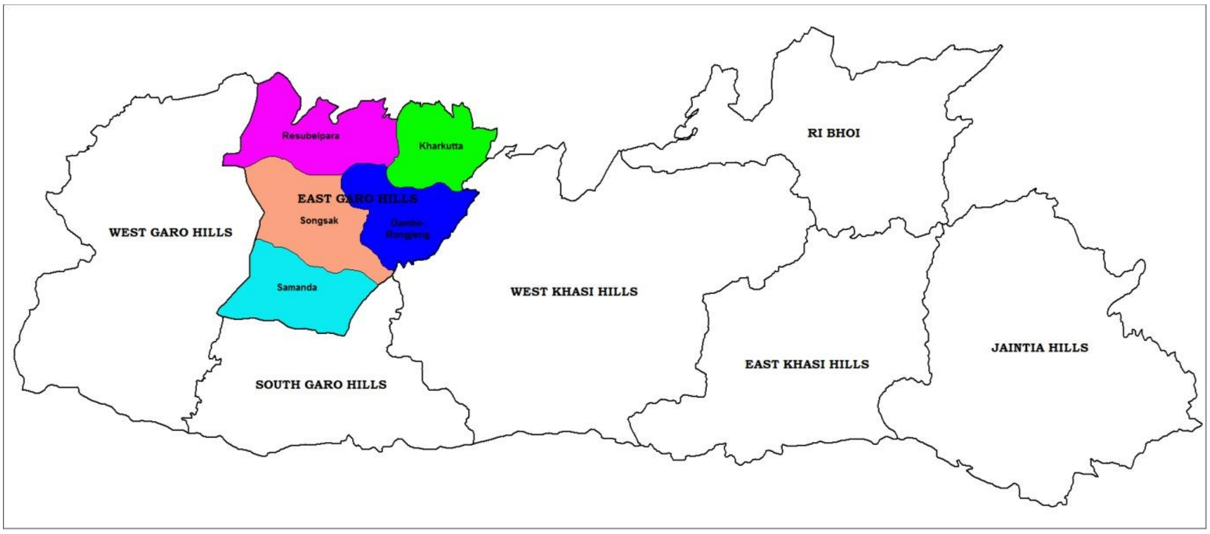
Technical Report Series: D No:

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET
EAST GARO HILLS DISTRICT, MEGHALAYA



North Eastern Region
Guwahati

GROUND WATER INFORMATION BOOKLET, EAST GARO HILLS DISTRICT, MEGHALAYA

DISTRICT AT A GLANCE

Sl. No.	ITEMS	STATISTICS
1.	**GENERAL INFORMATION**	
	i) Geographical area (Sq km) ii) Administrative set up Number of Blocks a) Resulbelpara b) Dambo-Rongjeng c) Songsak d) Samanda e) Kharkutta Number of Villages (2011 census) Town	2603 5 1110 2
	iii) Population (as per Provisional 2011 census) Total Population Rural Population Urban Population	 3,17,618 (Decadal Growth 2001-2011 25.84%) 2,72,378 (Decadal Growth 2001-2011 26.28%) 44,240 (Decadal Growth 2001-2011 23.21%)
	iv) Average annual rainfall (mm) *Source: Source: Directorate of Agriculture, Meghalaya.*	3293 mm
2.	**GEOMORPHOLOGY**	
	Major physiographic units	Denudational low hills and dissected mound
	Major Drainages	Simsang, Manda (Dudhnoi), Damring (Krishnoi)
3.	**LAND USE (Sq Km)**	**2011-12**
	a) Forest area	1245.25
	b) Net area sown	370.09
	c)Total Cropped area	423.46
4.	**MAJOR SOIL TYPES**	a) Lateritic soil b) Red and yellow soil b) Red loamy soil
5.	**AREA UNDER PRINCIPAL CROPS** (*2011-12 in ha*) *Source: Directorate of Agriculture, Meghalaya.*	Rice: 17588, Maize:1059, Wheat:45, Small Millet: 424, Pulses: 565
6.	**IRRIGATION BY DIFFERENT SOURCES** *(2011-12)* a. Surface water, command area (Ha) b. Ground water (Ha)	 4335 Nil
7.	**NUMBERS OF GROUND WATER MONITORING WELLS of CGWB** (as on 31.3.2013) No of dug wells No of Piezometers	 16 Nil
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	a. Archaean Gneissic Complex - Granitic, Gneissic and schistose rocks. b. Tertiary sedimentary rocks like sandstone and shale. c. Alluvium
9.	**HYDROGEOLOGY**	

	Major water bearing formation • Depth to water level Pre-monsoon, 2012 Post-monsoon, 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. 2.21 mbgl to 3.92 mbgl 1.49 mbgl to 2.36 mbgl
10.	**GROUND WATER EXPLORATION BY CGWB** (as on 31.3.2013)	
	No. of wells drilled (EW,OW,PZ, SH. Total)	Eleven Exploratory Wells
	Depth Range (m)	14.25 to 202.30
	Discharge (m^3/hr)	poor to 17.60
11.	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limits	Good and potable
	Type of water	Generally good for drinking & irrigation purposes
12.	**DYNAMIC GROUND WATER RESOURCES** (2008-09) ham	
	Annual Replenishable Ground Water Resources	7316 ham
	Net Annual Ground water draft	1.76 ham
	Projected demand for domestic and industrial uses upto 2025	1042 ham
	Stage of Ground Water Development	0.02%
13.	**AWARENESS AND TRAINING ACTIVITY**	
	Mass awareness Programme Organized	Nil
	Water Management Training Programme Organized	Nil
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Project Completed by CGWB	Nil
	Project under technical guidance of CGWB (nos.)	
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**	1. Management and utilization of Groundwater. 2. Limited natural recharge in hilly areas. 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).

GROUND WATER INFORMATION BOOKLET

EAST GARO HILLS DISTRICT, MEGHALAYA

1.0 Introduction

East Garo Hills District was upgraded from a sub-division to a full fledged district on 23rd October 1976 and lies in the eastern part of the Garo Hills in the state of Meghalaya. It is bounded in the north by Goalpara district, Assam, in the east by West Khasi Hills district, in the west by West Garo Hills district and in the south by South Garo Hills District. This hilly district is having its headquarters at Williamnagar. The district is situated between $25^0$24’05” and $26^0$00’57” N latitudes and $90^0$08’42” and $91^0$02’00” E longitude and covers a total geographical area of 2603 sq. km. The district is accessible through NH-62 from Dudhnoi, Goalpara district, Assam which is 84 km from Williamnagar via Nengkra-Rongjeng and 285 km from Shillong, the State Capital. It is also approachable via Nongstoin with a distance of 246 km from Shillong.

As per 2011 census (provisional), East Garo Hills District has a total population of 317618 with male population of 161372 and female population of 156246. The rural population is 273378 and the urban population is about 44240. The total number of villages in the district as per 2011 census is 1110. The main occupation of the population in the district is agriculture.

2.0 General Features

2.1 Rainfall & Climate

The climate of the district is directly controlled by the southwest monsoon originating from the Bay of Bengal and the Arabian Sea. The climatic conditions vary substantially from place to place due to wide differences in altitude. The average annual rainfall in the district is 3293 mm as recorded by District Agriculture Office, Government of Meghalaya, Williamnagar. There are four seasons in the district namely summer, monsoon or rainy, autumn and winter. The summer season extends from the end of March to mid-May, which is characterized by relatively high temperature. Rainy season commences with the onset of southwest monsoon in April and lasts up to October. This is followed by short autumn from mid-October to November. This season indicates the slow retreating of monsoon with clear and sunny sky. Winter season extends from December to the end of March. This is the coldest season of the year with sharp decline in the temperature. The district receives a fairly high rainfall throughout the year. However, maximum of the precipitation occurs during the rainy season i.e. between April and October due to southwest monsoon.

2.2 Land Use

The land utilization statistics of the district during the year 2006-07, 2007-08, 2008-09, 2009-10, 2010-11and 2011-12 is shown in the following table 2.1

Table 2.1: Land utilization statistics of the district (area in hectares)

Sl. No.	Land classification	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Geographical area		260300	260300	260300	260300	260300	260300
A	Reporting area	259300	259300	259300	259351	259300	260115
1	Forest	124797	124492	124496	124551	124551	124525
2	Not available for cultivation						
a	Area under non agriculture uses	5689	5713	5765	5814	6232	6643
b	Barren & uncultivable land	4712	4689	4675	4678	4664	4654
Total (a +b)		10401	10402	10440	10492	10896	11297
3	Other uncultivable Lands						
a	Permanent pastures & other grazing lands	-	-	-	-	-	-
b	Lands under Misc. trees crops & groves etc	23409	23429	23432	25195	25290	25214
c	Cultivable waste land	43165	38924	38726	36952	36624	36917
Total (a+b+c)		66574	62353	62158	62147	61914	62131
4	Fallow Lands						
a	Fallow lands other than current fallows	21190	21169	21167	20267	20139	20238
b	Current fallows	4949	4932	4930	4928	4816	4915
Total (a+b)		26139	26101	26097	25195	24955	25153
5	Net area sown	31389	35952	36009	36921	36984	37009
6	Area sown more than once	5289	5299	5303	5306	5327	5337
7	Total crop Area	36678	41251	41312	42227	42311	42346

Source: Directorate of Agriculture, Govt. of Meghalaya, Shillong

The land utilization statistics during the year 2011-12 shows that the forest area is 124525 ha occupying 47.84% of the district. Fallow land is 9.66%, net area sown is 14.21% and the total cropped area is 16.27%.

2.3 Geomorphology & Soil type

Geomorphologically, the district can be broadly divided into three units:-

i. Denudational Hills: These are the Archaean gneissic hills undergoing weathering and erosion. These have narrow to broad rounded crests. The elevation varies between 431 and 718m above mean sea level. The hills have diverse orientations assuming isolated hummocky nature.
ii. Foot- Hills Zones: These areas exist between the rugged mountain mass and valley areas. They actually represent talus zones comprising clayey and bouldery materials transported below by mass wasting process and gravitational forces.
iii. Valleys: These are intermontane valley existing between hills. They get widen towards the north merging into plains of Brahmaputra valley. Such valleys occur in areas of Dainadubi, Mendipathar, Resubelpara, Bajendoba, Kharkutta adjoining the Assam border in the northern part of the district. These valleys are structurally controlled by series of parallel lineaments found in the area as a result of tectonic disturbance in the past.

Soil is one of the most important components of land through which an interaction of all natural factors is possible. The district shows different types of soils as the provenance differs widely. Broadly, there are divided into following major soil sub-orders, i. Lateritic soil: It is found in the northern parts of the district. They are characterized by reddish brown colour and rich in iron. They occurs in areas around Rongmil, Karkutta, Resulbelpara, Wagensi, etc

ii. Red - Loamy soil and Red and Yellow soil: These soil is the most prevalent one covering the middle and southern part of the district. Red – loamy soil is found in parts of Rongjeng and Songsak and Red and Yellow soil is found in Samanda and Williamnagar areas. These soil are acidic in character with pH ranging from 4.9 to 5.6.

2.4 Drainage

The drainage system of the district is controlled by topography. The East West trending hills ranges passing through the area of Dilmagiri, Rongdolgiri, Narringiri, Wethesa ranging in elevation between 688 to 784 m above mean sea level serves as water divide and dissect the area into two drainage basins viz the Brahmaputra and the Meghna.

The northern basin drained the water into the mighty river Brahmaputra, Assam where as the southern ones into Meghna, Bangladesh. The southern basin is drained by the river Simsang which is the major perennial river in the southern part of the district. The northern basin is drained by the tributaries viz Manda (Dudhnoi), Damring (Krishnoi) etc into the Brahmaputra.

2.4 Agriculture, Irrigation and water supply

Agriculture is the mainstay of livelihood of the people in the district, covering about 80% of the total population. The people are dependent on traditional jhum cultivation and forests for their livelihood. Efforts to improve food production through agriculture are impeded by the limited area available for cultivation, hilly terrain, low land holdings, landlessness, and low availability of technical support. The principal crops grown are paddy, maize, pulses, oilseeds, turmeric, sugarcane etc. Paddy is the main field crop of the district during Kharif season. Cultivation of paddy is spread over 17588 hectares. Paddy cultivation in Kharif is followed by cultivation of a second crop of paddy, oilseeds and pulses. Agricultural activities are by and large confined to the valleys and hill slopes. Kharif cultivation, depending mainly on monsoon rainfall, holds sway over restricted Rabi cultivation. The district is however agriculturally backward due to shifting cultivation (jhum cultivation) and lack of assured irrigation facilities.

Irrigation has so far played only a minimal role in agriculture in the district. The topography itself makes alignment and construction of channels difficult and comparatively costly. However, even in areas where the lay of the land is more favourable, irrigation is confined to areas bordering rivers and streams. Farmers in the hills have traditionally depended upon rainfall, the months of heavy rainfall being May to September. The abundant supply of rain during the growing season reduces the dependence on artificial alternatives, except during the brief dry spell before the monsoons. Wherever irrigation is feasible, the State Government has taken up a number of small-scale irrigation schemes and more are being investigated, especially to meet the needs of farmers in areas where double cropping is in vogue.

Not a single major or medium irrigation project exists in the district. There are only minor irrigation schemes and hence agricultural development is dependent on it. Majority of the projects are flow irrigation type as the district is hilly. The existing irrigation schemes are based only on surface water and the source is mainly through non-monsoon base. As on

2011-12, there are 47 irrigation projects, out of which 32 are Flow Irrigation Project, 13 are Rain Water Harvesting Structures and 2 are Lift Irrigation Project. However, this two LIP project are not working.

Table 2.2 presents the irrigation status in the district.

Command area (ha)	Cultivable Command area (ha)	Net Irrigated area (ha)	Area Irrigated in Ha			Gross irrigated area (ha)	Potential created (ha)	Potential utilised (ha)
			Kharif (ha)	Rabi (ha)	Perennial (ha)			
4335	3976	3831	3831	547	-	4378	3976	3831

(Source: Water Resource Department, East Garo Hills Division, Williamnagar, *Government of Meghalaya)*

Piped water supply schemes and spot source water schemes are the main source of water supply schemes 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 (PHED), Meghalaya.

3.0 Geological Set-up

The district has a variety of rock formations ranging in age right from the Archaean to Tertiary and also Recent Alluvium occurring as valley-fills. Major parts of the district have been covered by the Archaean Gnessic Complex intruded by acid/basic intrusive viz Granites, Pyroxenite and Amphibolites. The Oulier of tertiary formation occurs in and around Williamanagar Town. The stratigraphic succession of the district is given in table 3.1 as worked out by previous work by GSI.

Table 3.1: General Geological Succession of the district

Geological Age	Group	Formation	Rock Type
Quaternary – Pleistocene-Holocene	Alluvium	Newer and Older Alluvium	Sand, silt and clay
~~ Unconformity ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
Palaeocene-Eocene	Jaintia Group	Kopili Formation	Shale, sandstone, marls and coal
		Shella Formation	Alternation of sandstone, limestone
~~ Unconformity ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
Neo-Proterozoic - Lower Palaeozoic		Granite Plutons	Porphyritic coarse granite, pegmatite, aplite/quartz vein etc.
~~ Unconformity ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
Archaean(?)-Proterozoic	Gneissic Complex (Basement Complex)		Biotite gneiss, biotite hornblende gneiss, granite gneiss, mica schist, silliminite- quartz schist, biotite- granilite- amphibilite, pyroxene granulite, gabbro & diorite

The Gneissic complex represents the remnant of an Archaean Peninsular landmass which covers almost the entire district. These crystalline rock masses were subjected different grades of weathering which has formed the loose weathered mantle over the parent rock. The tertiaries overlying the basemant gneissic complex are represented by Jaintia Group of rocks of Eocene age. Older alluvium occurs along the bank of Simsang river near Williamnagar. Newer or recent alluvium forms superficial blanket in the river valley of Simsang, Manda, Damring, Didram etc.

4.0 Ground Water Scenario

4.1 Hydrogeology:

The hydrogeological framework of the district is essentially controlled by geological setting, distribution of rainfall and movement of ground water through inter-connect weak planes due to joints, fissures and faults, primary and secondary porosities of the Geological formation. Hydrogeologically, the district can be divided into three units, namely consolidated, semi-consolidated and unconsolidated formations.

4.1.1 Consolidated formation: The crystalline Archaean Granites and Gneissic Complex occupy about 2460 km^2. These include the oldest rock formations occupying the northern part of the district. These crystalline and gneissic rocks of the Archaean age form the basement for the deposition of later semi-consolidated and unconsolidated formations. These rock formations have been subjected to faulting and fracturing at several places giving rise to several prominent structural features. Occurrence of ground water is rather limited in theses formations and is confined to topographic lows, valleys and weathered residuum and its movement is controlled by the presence of fractures and fissures. Ground water occurs under unconfined conditions and under semi-confined conditions in the interconnected secondary structural weak zones / features like joints, fractures, etc., of the underlying hard rocks. The thickness of the overburden/ weathered zone is expected to be 20 – 30 m in topographical depression but it is less in the hilly areas. The depth to water level ranges from 1 to 5 m and the ground water potentials of these rocks depend upon topographic setup and a moderate yield prospect from 5 m^3/hr to 15 m^3/hr.

4.1.2 Semi-consolidated formation: The Jaintia Group of rocks of Eocene age constitutes the Semi-consolidated formation. These formations comprising alternate beds of shale and sandstone and found in an area of 26 km^2 .Ground water in these formations occurs under unconfined to semi-confined conditions due to primary porosities of the semi-consolidated formations as well as in the secondary porosities like fractures and joints. The depth to water level ranges from 1 to 4 m and the expected yield prospects is less than 50 m^3/hr depending on topographical settings.

4.1.3 Un-consolidated formation: This formation consists of gravels sand, silt and clay deposits in the northern fringe of the district in river valley of Didak, Manda, Damring, Didram, Rongtak, Kharkutta etc. These spread over an area of 118 km^2 in the district. The ground water in valleys occurs under phreatic conditions. Thickness of this formation varies widely depending upon the basement topography. The ground water potentials of this formation depend upon topographic setup and a yield prospect is above 50 m^3/hr.

4.2 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 2011) 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			
6525	Nil	1604	Nil	8129	813	7316

Table 4.2: Categorization of Ground Water resources (ham)

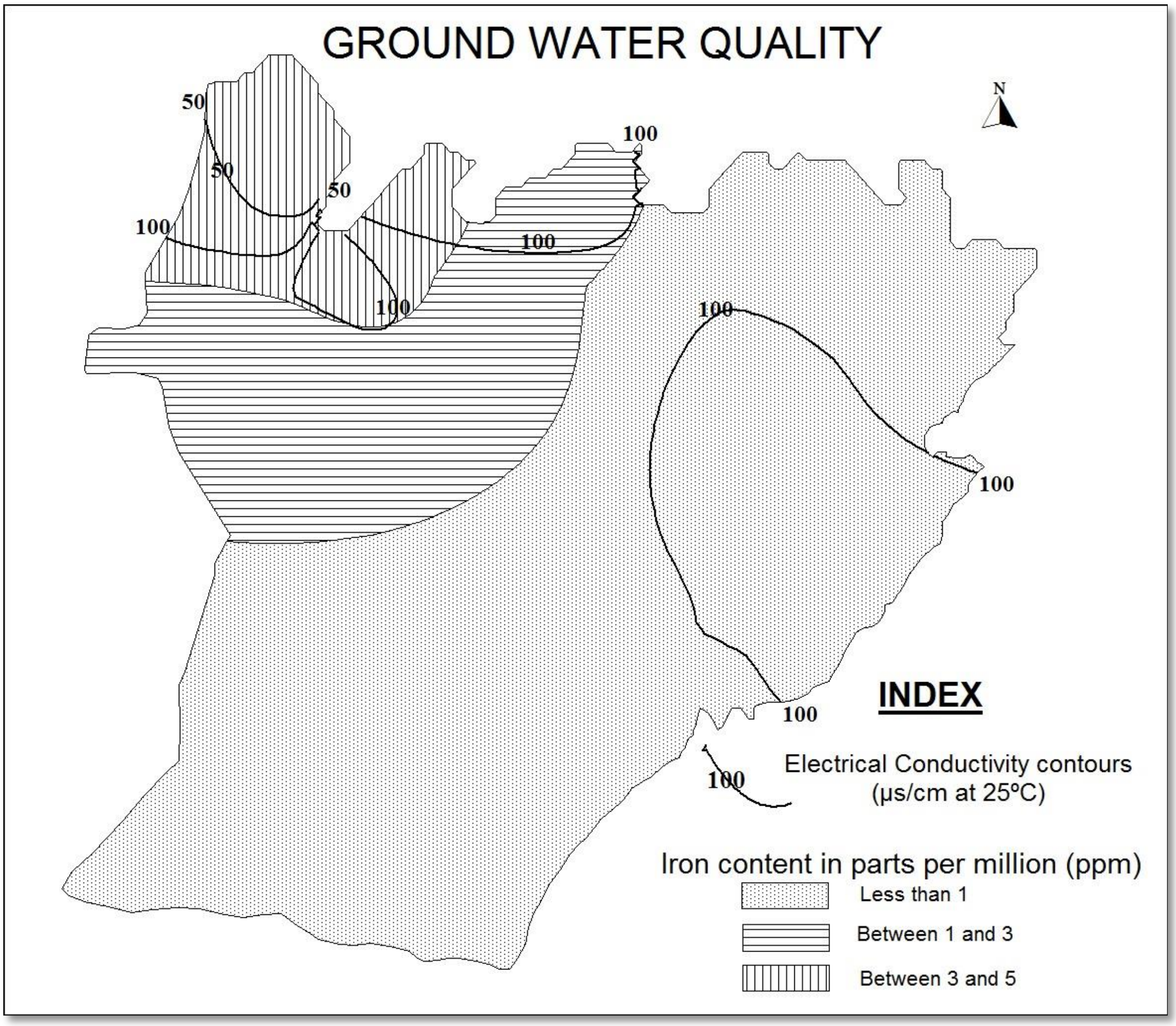
Net Ground Water availability	Annual GW draft			Domestic and industrial uses upto 2025	Ground Water availability for future irrigation	Stage of Ground Water development (%)	Categorization
	Irrigation	Domestic and industrial uses	Total				
7316	Nil	1.76	1.76	1042	6274	0.02	**Safe**

The stage of ground water development in the district is 0.005%. 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.

4.3 Ground Water quality:

The natural quality of ground water depends largely upon the geological characteristics and climate conditions. Broadly, the chemical constituents present in the ground water are within the permissible limits set by BIS and WHO. However, sporadic occurrence of higher concentration of Iron is detected /reported from some localities in the district. Therefore a micro level survey of the district for iron content needs to be carried out to quantify extent of iron hazard in ground water.

Removal of the Iron is best effected 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 very much useful when bacteria are 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:

Ground water development is yet to be picked up in the district. Central Ground Water Board has drilled eleven exploratory wells in the district down to depth ranging from 14 to 202 m bgl, out of which 2 wells were abandoned. Aquifer zones encountered in wells ranges from 26 to 196 m with yield from poor to 17.60 m^3/hr. The depth to water level varies from 3.18 m bgl to 18 m bgl and the transmissivity lies between 2 m^2/day and 115 m^2/day. The salient features of these exploratory wells drilled by the CGWB in the district are given in table 4.3.

Table 4.3: Hydrogeological Data of Exploratory Wells, East Garo Hills District, Meghalaya

Sl. No	Location	AAP	Depth Drilled (mbgl)	Aquifer zone tapped/ Fractures encountered (mbgl)	Depth to water level (m bgl)	Discharge (m^3/hr)	Draw Down (m)	T (m^2/d)	Specific Capacity (lpm/m)	Formation/ Aquifer material
1	2	3	4	5	6	7	8	9	10	11
1	Mendipathar 25° 54′ 30″	1997-98	43.0	Well abandoned						

	90° 38′ 29″									
2	Bajengdoba 25° 53′ 34″ 90° 30′ 32″	1997-98	14.25	Well abandoned						
3	Kharkutta 25° 55′ 30″ 90° 54′ 30″	2006-07	214.7		9.5	Poor	-	-	-	Granite Gneiss
4	Songsak 90^{0}36’37.92’’ 25^{0}39’04.86’	2012-13	196.20	48 to 56 190 to 196	11.38	10.8	11.02	10	16.34	Granite Gneiss
5	Chidimit 90^{0}37’51.8’ 25^{0}44’27.7’	2012-13	170.85	93 to 102 161 to 170	8.11	12.6	10.88	115	19.31	Granite Gneiss
6	Naringirri 90^{0}44’18.4’’ 25^{0}36’38.8’’	2012-13	113.80	33 to 35 65 to 71 111 to 113.8	4.53	17.60	4.19	45	70.03	Granite Gneiss
7	Dobu-Rimding 90^{0}42’57.1’’ 25^{0}33’38.6’’	2012-13	202.30	62 m to 65 93 m to 95	15.20	3.6	33.42	2	1.79	Granite Gneiss
8	Nengkhra 90^{0}41’29.4’’ 25^{0}30’02.4’’	2012-13	141.30	26 to 27 132 to 141	5.70	7.92	22.80	5	5.89	Dolerite/ Pegmatite
9	Nokilawe 90^{0}46’38.2’’ 25^{0}30’38’’	2012-13	119.9	25 to 26 (Sealed) 106 to 119	3.18	8.40	13.15	25	10.68	Dolerite
10	Somgong 90^{0}36’55’’ 25^{0}30’28.8’’	2012-13	75.35	61 to 68	18	Poor	-	-	-	Sandstone
11	JNV: Williamnagar 90036’60’’E 25030’25’’N	2012-13	104.7	56-59	9.60m	10.8	7.51	55	24.84	Sandstone

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 lies in low lying depressions and the 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 0.005% which leaves a greater scope for ground water development.

Ground water development is being done through dug wells and bore wells in the intermontane valleys and linear ridges. The development of springs is seen mainly along the foothills. The ground water is mainly used for domestic purposes such as washing and drinking. Therefore, there is 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 fractures and lineaments 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, dug wells 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 can play an important role in rural water supply schemes in the district. A proper and scientific approach is required to augment the existing water supply scenario in the district.

5.2 Rain Water Harvesting and Watershed Management

The District with its undulating topography and high intensity of rainfall, suffers acute erosion problem and ecosystem degradation. The problem is further compounded by unscientific agricultural practices such as jhum /shifting cultivation on steep slopes, rampant deforestation, burning etc, which has resulted in degradation of land and water resources. To combat the harmful effects of jhumming, hill-slope terracing, contour bunding, stream-bank erosion control, land reclamation, water harvesting, conservation & distribution, irrigation & check dams, gully plugging, afforestation etc, are to be implemented by the State authorities. Roof-top Rain Water Harvesting should be made mandatory in urban areas like Williamnagar and in smaller towns as well.

5.2 Ground Water Related Issues and Problems

East Garo Hills district is basically a hilly one with steep slopes and rugged terrain offers limited scope for recharge and development of ground water. Moreover, approachability is a big constraint for an assured water supply in the hamlets/ villages situated on hilltops or steep slopes. The major ground water related problem of the district is its management and non-utilization of run off in the steep slopes resulting in limited natural recharge areas. This has created some water deficient areas in the district. The approach and accessibility to the hamlets and villages is a difficult task, which are the major impediments in developing the ground water resources. As some pockets are affected with higher concentration of Iron in water (higher than permissible limit prescribed by BIS, WHO), so the water supply agencies should take precautionary measures to provide Iron free water for domestic and industrial.

6.0: Recommendations

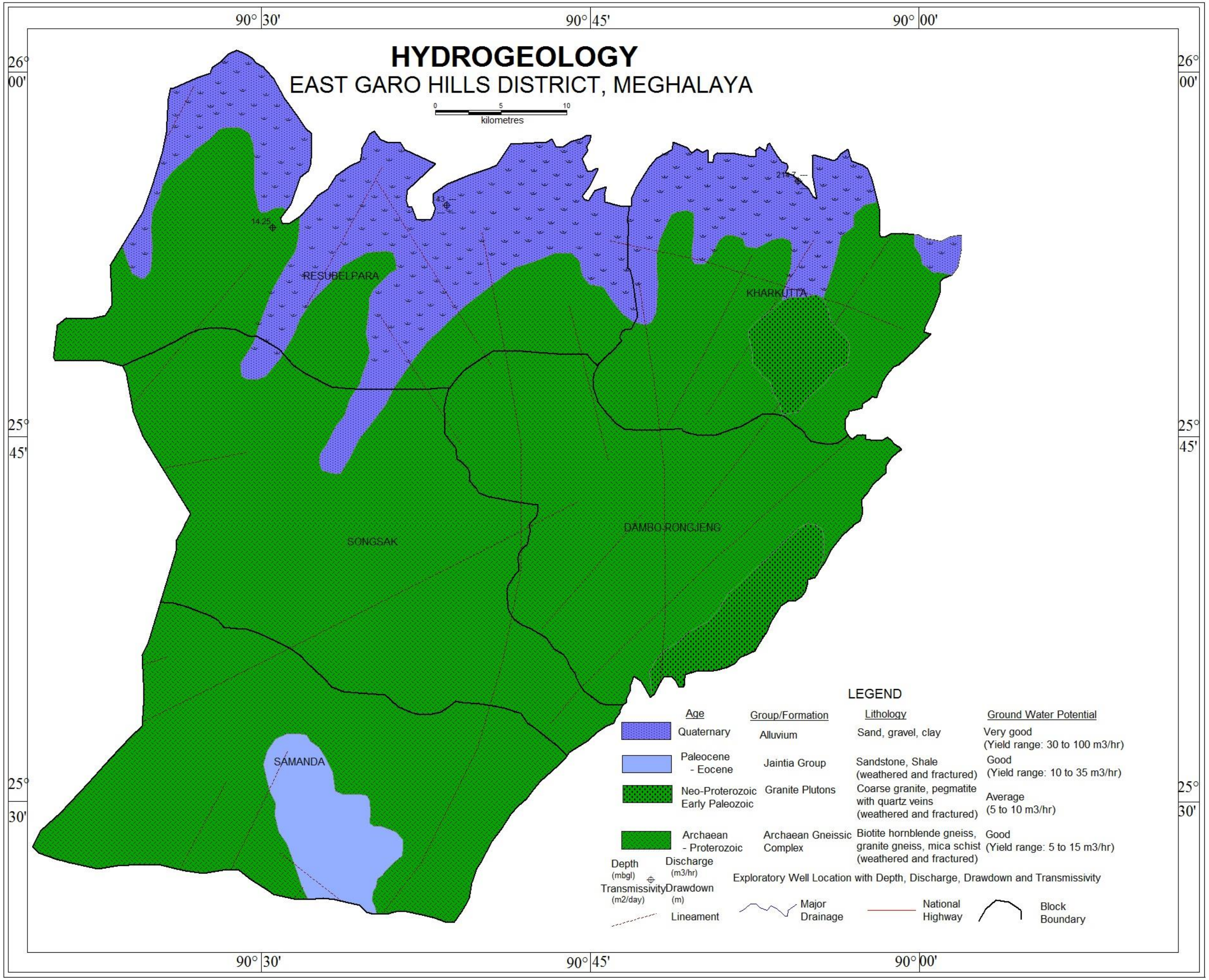
Development of ground water in the district is still in nascent stage. Thus, there is ample scope for future development of ground water in the district. It is being done through dug and bore wells in the valley areas and linear ridges. The intermontane valleys are the most favourable places for ground water development. Structures like ring/dug wells, shallow and deep bore wells are the feasible ground water structures. However prioritization should be for the construction of dug wells having depth in the range of 10 m to 15 m and diameter in the range of 2 m to 5 m depending upon their requirement. The well has to be properly lined to avoid collapse of weathered zone. Bore wells can be drilled in such formation down to a depth of about 100-150m tapping about 2 to 4 fractured zones with a diameter of 152.4 mm. As ground water is poorly developed/ exploited, dug wells are the preferred structures as of now in low-lying areas and valleys. 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. Thus, the potential fractured zones must be confirmed by Geophysical Survey and lineaments studies by Remote Sensing Studies.

Construction of groundwater abstraction structures should be promoted in needy areas, especially areas which face scarcity of water during summer. The intermontane valley areas, occupied by alluvium and areas with low gradients and valley areas are the most potential and productive aquifers and are suitable for ground water development. Bestowed with high rainfall and fairly good recharge conditions, ground water gets replenished every year. However the physiography of the rugged terrain restricts development of groundwater.

As the rainfall is quite high in the area, rainwater harvesting is another viable option to augment the water supply. People face acute scarcity of water in the steep and hilly portion. This is because of higher gradient resulting in surface run off. In these areas, roof top rainwater harvesting may be adopted effectively to meet the demand of the people residing on hilltops. Rainwater can be collected from the rooftops made of PVC or concrete through bamboo or pipe. This water can be used for domestic uses including drinking purposes after treatment. In the foothills where most of the precipitations get wasted as surface runoff, the area can be effectively utilized for rain water harvesting and ground water recharge by constructing structures such as gully plugging, check weirs and check dams. In doing so, the water level on the upstream can be raised to a considerable extent.

As the people in the rural areas are totally dependent on springs, there is an urgent need for scientific approach for proper development and management of it. It may be recommended that the development of springs will help in catering the water requirements of the people to a large extent. Unutilized springs should be developed scientifically for providing safe drinking water. Moreover, conjunctive use of surface and ground water, as well as rain water harvesting should be encouraged as this entails the planned and coordinated harnessing of ground and surface water resources to achieve optimal utilization of total resources. There is also an inherent need to educate the general public as a whole for management of this precious resource and to accept the benefits of many developmental schemes of the government for utilization of ground water resources.

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, few sporadic occurrences of high concentration of Iron in ground water have been reported in some pockets of the district. Therefore, the water supply agencies should take precautionary measures to provide Iron free water for potable purpose.


HYDROGEOLOGY
EAST GARO HILLS DISTRICT, MEGHALAYA
0
5
10
kilometres
90° 30'
90° 45'
90° 00'
26° 00'
25° 45'
25° 30'
RESUBELPARA
KHARKUTTA
SONGSAK
DAMBO RONGJENG
SAMANDA
LEGEND
Age
Group/Formation
Lithology
Ground Water Potential
Quaternary
Alluvium
Sand, gravel, clay
Very good
(Yield range: 30 to 100 m3/hr)
Paleocene - Eocene
Jaintia Group
Sandstone, Shale (weathered and fractured)
Good
(Yield range: 10 to 35 m3/hr)
Neo-Proterozoic Early Paleozoic
Granite Plutons
Coarse granite, pegmatite with quartz veins (weathered and fractured)
Average
(5 to 10 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)
Depth (mbgl)
Discharge (m3/hr)
Transmissivity (m2/day)
Drawdown (m)
Exploratory Well Location with Depth, Discharge, Drawdown and Transmissivity
Lineament
Major Drainage
National Highway
Block Boundary