GROUND WATER INFORMATION BOOKLET
EAST SIKKIM DISTRICT, SIKKIM

DISTRICT AT A GLANCE

Sl. No.	Items	Statistics
1.	**GENERAL INFORMATION**	
	i) Location and extent	27˚08´05˝ – 27˚25´24˝ 88˚26´27˝ - 88˚55´06˝
	ii) Geographical Area (Sq.km.)	964 Sq.km
	iii) District Headquarters	Gangtok
	iv) No. of Sub-Division	2 (Gangtok & Pakyong)
	v) No. of Revenue Block	120
	vi) No. of Town	3
	vii) Population	2,44,790 (as per 2001 Census)
	viii) Population Density	281 persons/Sq.km.
	ix) Percentage	Male : 53.12% Female : 46.88%
	x) Literacy	65.13%
	xi) Climatology	
	a. Average Annual Rainfall	3,894 mm
	b. Average Maximum Temperature	27.2˚C
	c. Average Minimum Temperature	1.6˚C
	xii) Land Use Pattern	
	a. Area under Forest	104.751 sq.km.
	b. Area not available for cultivation	48.712 sq.km.
	c. Current fallows	3.133 sq.kim.
	d. Area under non-agricultural uses	7.168 sq.km.
	e. Barren and unculturable land	41.522 sq.km
	f. Permanent pastures & other grazings lands	9,236 sq.km.

Sl. No.	Items	Statistics
	g. Land under miscellaneous tree, crops and groves not included in net shown area	15,069 sq.km.
	h. Cultivable waste land	5.874 sq.km
	i. Net area shown	181.216 sq.km
	j. Total croppsed area	187.290 sq.km.
	k. Area sown more than once	6.075 sq.km
	l. Total cultivable area	355.77 sq.km.
	m. Area irrigated	61.012 sq.km
	n. Cropping intensity	103.35%
2.	**GEOMORPHOLOGY**	
	Major physiographic units	Hill. Valley, slope.
	Major Drainage System	Tista, Rangpo Chhu and Dik Chhu
3.	**Major soil types**	Mountain meadow, brown-red & yellow soil and lateritic soil.
4.	**Irrigation by Different Sources (Number of structures)**	
	• Dugwells	Nil
	• Tubewells/Borewells	Nil
	• Tanks/Pond	Nil
	• Canals	Nil
	• Other sources	Spring
5.	**No. of GW Monitoring Wells of CGWB (as on 31.03.2008)**	
	No. of Dug wells	Nil
	No. of Piezometers	Nil

Sl. No.	Items	Statistics
6.	**Predominant Geological Formations**	Recent Alluvium, Reyang and Gorubathan in Daling Group, Migmatitic gneisses, Augen gneiss and Amphibolites in Darjeeling and Kachenjunga group.
7.	**Hydrogeology**	
	Major water bearing formations	Fractured zones in various lithological units, weathered zones in phyllite, schist, gneisses and quartzite. Ground water is available from some perennial springs.
8.	**G.W. Exploration by CGWB (As on 31.03.2008)**	
	1. Exploratory Well	2
	2. Observation well	Nil
	3. Piezometer	Nil
9.	**Dynamic Ground Water Resources (2004) in MCM**	The Ground Water Resources are not considered as per GEC 1997 - Methodology as hill sopes of East Sikkim are having more than 20%.
10.	**Awareness and Training Programme**	
	Mass awareness Programme	Nil
	Water Management Training Programme	Nil
11.	**Effort of Artificial Recharge & Rainwater Harvesting**	
	Project completed by CGWB	1

Sl. No.	Items	Statistics
12.	**Ground Water Control and Regulation**	
	No. of over exploited Block	Nil
	No. of Critical Blocks	Nil
	No. of semi-critical Blocks	Nil
13.	**Major Ground Water Problems & Issues**	Except perennial springs occurring in the district, limited ground water resources is available in secondary porosities in hard rocks. Construction of Rainwater Harvesting Structures in the suitable locations may solve the problems in water scarce villages

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EAST SIKKIM DISTRICT, SIKKIM

1.0 INTRODUCTION

Administrative Details Location & Area:	East Sikkim is one of the four administrative districts of the Indian State of Sikkim. Geographically, East Sikkim occupies the south-east corner of the State. The capital of East Sikkim is Gangtok, which is also the state capital. The district occupies an area of 964 sq.km., with a population of 2,44,790 (2001 Census). The district has two Administrative sub-divisions and 220 Panchayet and 3 Towns. Tista is the major river of the district.
Drainage:	The district is mainly drained by the perennial Tista river with tributaries Dik Chhu, Rate Chhu and Rangpo Chhu.
Irrigation practices:	The cultivation is done mainly by springs and surface water from Kholas.
Studies by CGWB:	CGWB has completed systematic Hydrogeological survey and Ground Water Management Studies. Ground water exploration programme in the district was undertaken by CGWB in early nineties. At two places exploration was done.

2.0 Rainfall & Climate

Rainfall	The normal annual rainfall is of the tune of 3800 mm
Climate	The district is characterized by cool and humid climate. It receives adequate rainfall from south-west monsoon, which sets in the later half of June and continues up to the middle of October. Pre-monsoon rains are

	received during March-April. Maximum and minimum temperature as recorded are 27.5˚ and 1.5˚C

3.0 Geomorphology & Soil Types

Geomorphology	The district is divided into three (3) geomorphic units such as, steep hill, valley, slope.
Drainage	The main rivers are Tista, Dik Chhu and Rangpo Chhu.
Soil	Soil in the area are mostly derived from parent rocks such as schist, gneiss and colluvial materials. The characteristics of soil varies from place to place due to topographical variations. The texture of the soil is loamy sand to silty clay loam. Soils are generally acidic in nature having the pH value of 5.0 to 6.0. Brown red and yellow soils is found in a small area around Rangpo town.

4. GEOLOGY

The district is a part of the Eastern Himalayas and exhibits identical geological features as in other parts of Eastern Himalayas. Five Geological units encountered in the district are Kanchenjunga gneiss, Darjeeloing gneiss, Chunthang Schists and gneiss, Lingtse granite gneiss and Daling group of rocks consisting of Phyllite, slates, quartzites and schist of Pre-Cambrian age. Quaternary deposits of alluvium are sporadically developed along the streams and rivers.

Due to different sets of structural disturbance numerous fractures, faults, joints, folds etc., have developed in the rocks occurring in the district. Prominent lineaments as displayed by geological formation in the area trend along N-S, E-W, NE-SW, ENE-WSW and NW-SE directions.

5.0 GROUND WATER SCENERIO

5.1 HYDROGEOLOGY

Ground water occurs in largely disconnected localized bodies under favourable geological structures, such as joints, fractured zones in various lithological units, weathered zones in the phyllite, schist, gneisses and quartzite. The ground water is available from source perennial springs from nallas present in all geological formations in the area.

Due to higher relief and steep gradient of the area, the subsurface flow of ground water is intercepted with manifest as seepages and springs. The area is characterized by high rainfall which is primary source of ground water. The springs are not deep seated. Direct infiltration and rainfall through joints, fracture, weathered zones of the rocks and through soil covers is the principal mode of recharge of the springs. Due to steep slope most of the precipitation in the area is lost as surface run off through streams, kholas and intermittent springs which are tapped through pipe lines and distributed by gravity method for domestic use. Precipitation is the main source of recharge of ground water but glacier melt water is also recharging the ground water considerably.

Discharge of the springs occurring in different types of rock formations in the area varies from 0.25 to 1.8 lps though the discharge decreases generally from December-January to May and maximum discharge is recorded during post monsoon period i.e., September to November.

Central Ground Water Board has constructed 2 boreholes only at Central Pendam and Rumtek in the district. The borehole at Central Pendam was drilled down to a depth of 37.0 m bgl encountering Darjeeling gneiss was abandoned due to technical reasons as there was no discharge upto the drilled depth. The second borehole at Rumtek was drilled down to a depth of 47.0 m bgl and five

potential fractured zones were encountered from 7.0 m bgl to …… m bgl and discharge was observed as 15 lps.

5.2 GROUND WATER RESORUCES:

Most of the hill slopes are having more than 20% slope. Geologically the rock types are comprised mostly of Phyllite, Slates, Quartzite and granite gneiss and most of the rain water flows out as surface run off. In this type of terrain the scope for ground water storage is limited to mostly in secondary porosity and structurally controlled at higher altitude aquifers. These aquifers are the main source of springs. Groundwater stored in the hill slopes emanates in the form of springs, which are being used as a source for water supply.

5.3 GROUND WATER QUALITY:

The chemical quality of ground water in the area indicates that ground water is fresh and fit for both drinking and irrigation purposes as concentration of chemical constituents are within the permissible limit as per BIS standard. The Specific Conductance varies from 36-85 µs/cm at 25˚C. In general the ground water is of bi-carbonate type; i.e., bi-carbonate content varying from 12-110 mg/lit., the chloride contents varying from 7-14 mg/lit and that of calcium varying from 4034 mg/lit. Bacterial contamination is very common in the spring water especially in the hilly terrains and proper safeguards have to be taken before it put to use for human consumption.

6.0 GROUND WATER MANAGEMENT STRATEGY :

6.1 GROUND WATER DEVELOPMENT:

The entire East Sikkim district is hilly with steep slope due to which the major part of rainfall is lost as surface run-off. In spite of good rainfall of more than 3,800 mm, in the district there is acute shortage of water especially during the summer. Considering the physiography, rainfall, some suitable structures like check dams, nallah, bandhs, etc., can be constructed for harvesting the

surface run-off. Water resources of East Sikkim can be augmented through development of springs and by constructing rain water harvesting structures.

a) Development of springs: The ground water is out flowing through numbers of springs wide spread in the district. These springs can be developed scientifically for providing safe drinking water to the rural people. Presently rural people have to walk a long distance in rugged terrain to fetch drinking water. In such area spring can be developed to supply water.
b) Rain water harvesting: Roof top rain water harvesting is one of the appropriate options for storing of water for direct use especially in hilly terrains like East Sikkim district, for both domestic and irrigation. Roof top rain water harvesting can supplement the domestic requirements in both urban and rural areas during lean period.

6.2 WATER CONSERVATION & ARTIFICIAL RECHARGE:

Only one structure of rain water harvesting has been constructed by CGWB at the Governor's house in Gangtok in East Sikkim under Central Sector Scheme.

7.0 AWARENESS AND TRAINING ACTIVITY, MASS AWARENES PROGRAMME (MAP) AND WATER MANAGEMENT TRAINING PROGRAMME (WMIP) BY CGWB.

Nil

7.1 PARTICIPATION IN EXHIBITION, MELA, FAIR ETC.

Nil

8.0 AREA NOTIFIED BY CGWB/SGWA:

No area of East Sikkim District has been notified by CGWB/SGWA.

9.0 RECOMMENDATION:

In the hilly area a separate planning and management is to be made for the withdrawal of ground water and for water conservation.

i) In the hilly terrain, springs are the main source of water supply supplemented by rain water harvesting technique. The discharge of springs can be increased by modification of collector wells and deforestation around the spring sources should be totally stopped. In the villages where springs are giving poor discharge, cleaning of springs channel and increasing dimension of collector wells or tanks is advisable for better yield.

ii) Some open wells were constructed in the weathered residuum. Water seepages from bedding planes, joints, fracture etc., have been collected in the conservation tank. The existing capacity of the tanks should be increased for supply of sufficient amount of water to the consumers depending on the discharge of the springs. At some places this water which is being used for drinking purpose is polluted, so proper preventive measures are required so that the water shall not be easily contaminated.

iii) Rain water harvesting in the technique for collection and storage of rain water. This should be encouraged more and more to meet ever increasing demand for water in urban areas and augments groundwater storage. This is an ideal solution in the hilly terrain.

iv) The perennial springs which are not yet tapped, may be properly developed for sustainable water supply in the respective areas.

v) Social awareness has to be created at all levels to educate and bring awareness of the people about the adverse impact of wastage of ground water and the benefit of conservation of water.