

Groundwater Information Booklet  
Darjeeling District, West Bengal

**DISTRICT AT A GLANCE**

**1. GENERAL INFORMATION**

• Name of District :	DARJEELING
• Longitude :	87° 59' - 88° 53' E
• Latitude :	26° 31' - 27° 13' N
• District Hqr. :	DARJEELING
• Longitude :	88° 16' E
• Latitude :	27° 3' N
a) Geographical area :	3149 Sq. km
• No. of Sub Div. :	4 (Sadar, Kalimpong, Kurseong & Siliguri)
• No. of C.D.Blocks/MC/M/OG :	14
b) Population (2001) :	1609172
c) Average annual rainfall :	2841 mm
• Max. & Min. Temperature :	21°C & 1°C

**2. GEOMORPHOLOGY**

• Major physiographic units	Piedmont Plains, Hills,
• Major drainage system :	Mechi, Mahananda, Balason, Tista, Jaldhaka

**3. LAND USE:**

• Forest area ;	124.576 Ha
• Net area sown ;	143.862 Ha
• Cultivable area :	143.86 Ha

**4. MAJOR SOIL TYPES:**

• Hilly areas	Sandy loam, podzol
• Plains	Humus – acidic type Sandy loam to loam

## 5. AREA UNDER PRINCIPAL CROPS:

Sr.no.	Name of the crop	Area (ha) (1993 – 94)	Area ('000 ha) (2004 - 05)
1	Aus Paddy	8300	4.9
2	Aman Paddy	35200	28.9
3	Boro Paddy	400	1.2
4	Wheat	2700	2.3
5	Potato	6800	6.7
6	Maize	22400	14.5
7	Jute	2500	2.4

## 6. IRRIGATION BY DIFFERENT SOURCES:

No. of blocks	No. of mouzas having drinking water facilities	Area irrigated by various structures			
		RLI	STW	others	Total
		No. – Area	No. – Area	No. – Area	No. – Area
D'jeeiling-Pulbazar	42	-	-	1 – 15	1 – 15
Sukhiapokhri-Jurebunglow	45	-	-	-	-
Rangli-Rangliot	29	-	-	-	-
Kalimpong – I	41	-	-	1 – 12	1 – 12
Kalimpong – II	31	-	-	1 – 14	1 – 14
Gorubathan	25	-	-	-	-
Kurseong	62	-	-	-	-
Mirik	4	-	-	-	-
Matigara	66	5 - 160	-	12 – 108	17 – 268
Naxalbari	75	13 – 560	21 – 67	12 – 112	46 – 739
Kharibari	72	55 – 1640	434 – 1641	34 - 282	523 – 3563
Phansidewa	98	51 - 1740	155 - 566	-	206 – 2306

**7 NUMBER OF GWMW OF CGWB (As on 31-3-2007)**

• Number of Dug wells	15
• No. of Piezometers	Nil

**8 MAJOR GEOLOGICAL FORMATION :**

Newer &  
Older Alluvium,  
Siwalik (Tertiary),  
Gondwana (L),  
Pre-Cambrian

**9 HYDROGEOLOGY**

- Major water bearing formation:
  - 1. *Consolidated formation of Dalings and Darjeeling Gneiss –* mainly occur in fractures, joints, faults etc..
  - 2. *Piedmont Zone –* high level terraces consists of sand & gravel
  - 3. *Unconsolidated sediments* consists of sand of various grade.
- Pre – monsoon depth to water level during 2006      1.10 – 9.69 m bgl
- Post – monsoon depth to water level during 2006      1.29 – 4.66 m bgl
- Occurrence of Spring;    across NE – SW above Naxalbari area

**10 GROUND WATER EXPLORATION BY CGWB**

( As on 31.03.2007)

• No. of wells drilled ( EW, OW, PZ, SH, Total)	
1. EW:	12
2. OW:	Nil
3. PZ	Nil
4. SH	Nil
5. total 12 ( all in Boundary area	
• Depth range (m)	
Max.:	360
Min.:	73
• S.W.L.(m bgl)	0.54 – 10.35
• Discharge (Litres per seconds)	1.5 – 33.47
• Drawdown (m)	3.3 – 20.30

11	<b>GROUND WATER QUALITY</b>	
	<ul style="list-style-type: none"> <li>• Presence of chemical constituents more than permissible limit;</li> </ul>	Fe ( iron) is at higher side in some places
12	<b>DYNAMIC GROUND WATER RESOURCES (2004) – IN MCM</b>	
	<ul style="list-style-type: none"> <li>• Utilizable ground water resources : 399.49 MCM</li> <li>• Net ground water draft : 5.3158 MCM</li> <li>• Stage of ground water development : 1.33%</li> <li>• Projected demand for domestic and Industrial uses up to 2025</li> <li>• Name of block/Watersheds where slopes are less than 20% are considered for resource calculation : Naxalbari - Matigara Kharibari – Phansidewa</li> </ul>	
13	<b>AWARENESS AND TRAINING ACTIVITY</b>	
	<i>Mass awareness programme organized</i>	
	<ul style="list-style-type: none"> <li>• Date/ Year 2002-03</li> <li>• Place Darjeeling</li> <li>• No. of participants 100</li> </ul>	
14	<b>EFFORTS OF ARTIFICIAL RECHARGE &amp; RAINWATER HARVESTING</b>	
	<ul style="list-style-type: none"> <li>• Project completed by CGWB (no. &amp; amount spent) Nil</li> <li>• Project under technical guidance of CGWB (no.) two</li> </ul>	
15	<b>GROUND WATER CONTROL AND REGULATION</b>	
	<ul style="list-style-type: none"> <li>• No. of OE blocks Nil</li> <li>• No. of Critical blocks Nil</li> <li>• No. of blocks notified Nil</li> </ul>	

## 16 MAJOR GROUND WATER PROBLEMS AND ISSUES.

- a. *Consolidated formation of Dalings and Darjeeling Gneiss –* Due to high runoff and presence of hard rock water availability is very poor
- b. *Piedmont Zone –* Due to high runoff and presence of Boulder water availability is limited.
- c. *Unconsolidated sediments* Although there is every scope to develop Ground water even the development is very poor.

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## **GROUND WATER INFORMATION BOOKLET DARJEELING DISTRICT, WEST BENGAL**

### **1.0 INTRODUCTION**

Administrative details

Location and area :

The district is bounded by the latitude  $26^{\circ}29'00''$  to  $27^{\circ}14'30''$  N and longitudes  $87^{\circ}59'30''$  to  $88^{\circ}53'20''$  E. The total geographical area of the district is 3149 Km<sup>2</sup>. It has 4 subdivisions consisting of 10 blocks, 77 gram -panchayat and 15 Police stations. **Darjeeling** is the district headquarter

Ground water basin :

The district is sandwiched between the lower Himalayas and the foothills parts of the eastern Himalayas.

Drainage

Mainly drained by 5 perennial rivers the Mechi, Mahananda, Balason, Tista and Jaldhaka. Each of the rivers are fed by a innumerable perennial and seasonal streams.

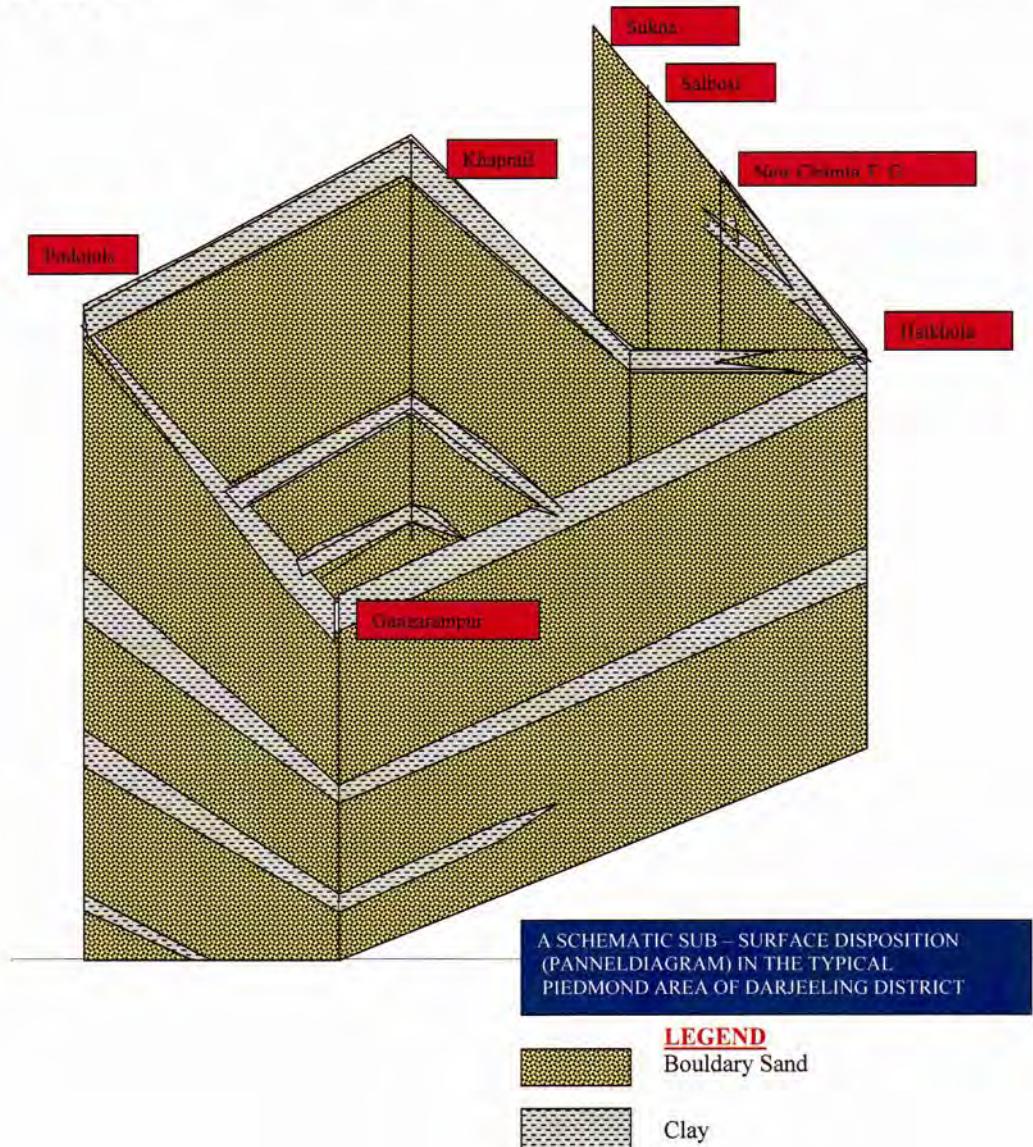
Irrigation practices

The cultivation is done both by Surface and Ground water. The sources of Surface Irrigation are Jhora( in Hilly area), river lift irrigation, canal, Tank. The ground water irrigation is done from shallow and deep tubewells.

Studies of C. G. W. B.

CGWB has completed Systematic Hydrogeological survey and continuing Ground Water Management studies in the foothill. Ground water exploration is being carried out in the foot-hill and plain part of the district to delineate the aquifers/granular zones and to know the aquifer characteristic particularly in the boudary areas. Technical guidance on Rainwater Conservation has been rendered in the Rajbhavan, and Jubille park in Darjeeling town.

The spring line which has been traced along NE – SW direction just above Naxalbari roughly corresponds to the boundary line between the Piedmont zone and the alluvial plain. The potential springs with high discharge are the dependable source of domestic water supply in the hilly terrain.



Because of heavy rainfall and high infiltration through highly permeable materials Bhabar and Terai Formations have developed promising ground water regime. The area can be broadly divided into three hydrogeological units viz. Consolidated formation represented by Buxa group of metamorphic rocks, Semi-consolidated formation comprising Gondwana and Siwalik sedimentaries and Unconsolidated formation consisting of piedmont and alluvial deposits. Secondary porosity like joints/fractures, bedding planes etc. give rise to the development of potential aquifers in consolidated and semi-consolidated formations, with moderate to low yield prospect. Boulder, pebble, gravels and sand of unconsolidated formation constitute highly potential aquifers under unconfined to semi-confined conditions. Piedmont zone (Bhabar) with high permeability, sloping topography and sub-surface runoff is characterized by poor to moderate yield ( $5 - 50 \text{ m}^3/\text{hr}$ ). Aquifers in alluvial plain (Terai) are highly potential, showing yield prospect of around  $50 - 150 \text{ m}^3/\text{hr}$ . The contact of Bhabar and Terai is marked by an almost E – W trending discontinuous spring line.

In the shallow aquifers (unconfined) of Bhabar zone, depth to water level is in the range of  $4 - 10 \text{ mbgl}$  for Siliguri sub-division. Water level becomes progressively deeper in the northern foot-hill areas of Bhabar. Water level in the shallow aquifers of Terai formation is shallow, resting within  $4 \text{ mbgl}$ . In the deeper aquifers (semiconfined) of both Bhabar and Terai, water level occurs within  $8 \text{ mbgl}$ , except in some foot-hill pockets. Water level fluctuation is in the order of  $2 - 6 \text{ m}$  in the northern foot-hill part of Bhabar and less than  $2 \text{ m}$  in the central and southern parts of Bahabar and in entire Terai. Deeper aquifers are very productive, with yield prospect of  $50 - 180 \text{ m}^3/\text{hr}$  and transmissivity in the range of  $20 - 2500 \text{ m}^2/\text{day}$ . As the stage of development of ground water is less than 10% the rural blocks come under '**Safe**' category

Generally the water table in the piedmont zone is deeper than that of alluvial plains. Premonsoon water level varies from 8 – 9 m bgl whereas in the post monsoon it varies from 4 – 5 m bgl.

#### A. DISTRICT-WISE STATUS OF GWMW IN DARJEELING DISTRICT

Sl.no.	Dist.	No. of GWMW as on March 07		Total	Remarks
		Dug well	Piezometer		
1	DARJEELING	15	-	15	Tapping boundary area

#### B. DISTRICT-WISE WELL FREQUENCY FOR DIFFERENT RANGES OF DTWL (Pre monsoon ) IN DARJEELING DISTRICT

No. of well analysed	Depth to water level		% of wells showing DTWL range in m bgl				
	minimum	maximum	0-2	2-5	5-10	10-20	> 20
15	1.10	9.69	1	7	7	0	0

#### C. DISTRICT-WISE WELL FREQUENCY FOR DIFFERENT RANGES OF DTWL (Post monsoon ) IN DARJEELING DISTRICT

No. of well analysed	Depth to water level		% of wells showing DTWL range in m bgl				
	minimum	maximum	0-2	2-5	5-10	10-20	> 20
15	1.29	4.66	6	9	0	0	0

In the piedmont zone ground water occurs under water table conditions. In the alluvial plains area ground water occurs under both water table as well as confined conditions. A fairly thick aquifers down to the depth of 200 m bgl in this terrain can yield 26.8 lps with a drawdown of 5 – 15 m. Overall hydraulic gradient is steep in the north and gentle in the south.

Long-term trend of water level does not show any significant change, indicating a stable ground water regime in both the sub-divisionswater table contour reveals that the ground water flows southeasterly in Siliguri – Sukna teract while in Tirhana – Ambari tract it is in southernly direction

In nutshell the hydrogeological parameters for deep tubewells in the select parts of Darjeeling dist. are:

	Padojela	Bagdogra	Kadamtala, BSF Campu	Sukna	Krishnanagar	SSB Campus, Ranidanga
Total depth drilled (m bgl)	306.62	151	211	181	73	183
Granular zone Encountered (m )	37-41, 45-51, 73-76, 79-82, 88-94, 99-105, 119- 124, 131- 134, 137- 143	52-58, 67-73, 83-92, 119- 125, 129- 135	112-120, 123-128, 132-135, 139-142, 154-172	73-79, 90-94, 103- 111, 134- 136, 138- 140, 149- 166, 173- 174	21-33, 50-68	79-82, 94- 100,136- 139, 156- 161, 165- 177
Depth of the well (m bgl)	146	138	175	177	71	180
Static water level (m bgl)	4.48	0.54	10.35	2.91	0.715	8.34
Discharge(m <sup>3</sup> /hr.)	33.47	26.80	15.58	1.5	7.3	20
Drawdown (m)	8.86	12.76	3.86	20.30	18.23	3.39
Transmissivity ( m <sup>2</sup> /day)	47.12	-	685.14	2.58	9.96	-

## 5.2 GROUND WATER RESOURCES:

The dynamic ground water resources of the non hilly blocks of Darjeeling dist. ( Kharibari – Phansidewa and Naxalbari – Siliguri blocks) has been estimated jointly by CGWB and SWID, Govt. of West Bengal, following the norms laid down by GEC 1997 methodology and projected as on 31.03.04.

All the said blocks are under safe category. The reconciled figures are as under:

- Net Ground Water Availability 46957 ham
- Existing Gross Ground Water Draft for Irrigation 1700 ham
- Existing Gross Ground Water Draft for Domestic
- and Industrial Water Supply 807 ham
- Existing Gross Ground Water Draft for all Uses 2507 ham
- Allocation for Domestic and Industrial Requirement Supply upto Next 25 Years 1719 ham
- Net Ground Water Availability for Future Irrigation Development 3539 ham
- Stage of Ground Water Development 5.34 %

**ANNEXURE - I**  
**DETAILS OF EXPLORATION CONDUCTED IN DARJEELING DISTRICT OF WEST BENGAL (TILL March 2007)**

Sl. No	Location/ Block/Year of construction	Aquifer	Depth drilled/ Well constructio n depth (mbgl)	Zones Tapped (mbgl)	SWL (mbgl)	Dischar ge (lps)	Dra w Dow n (m)	T (m <sup>2</sup> /d ay)	Chemic al quality
1.	Padojela, Siliguri/ Naxalbari Block	Bouldary Formation	306.62/ 146	37-41, 45-51, 73- 76, 79-82, 88-94, 99-105, 119-124, 131-134, 137-143	4.48	33.47	8.86	47.12	Potable
2.	Salbari, Siliguri/ Naxalbari Block	Bouldary Formation	153/ 124	55-64, 70-92, 101-121	3.33	16.70	15	10.08	Potable
3.	Adalpur MES, Khaprail, Siliguri/ Naxalbari Block/ 96-97, 97-98	Bouldary Formation	156/ 154	96-110, 112-120, 126-138, 146-151	-	-	-	-	-
4.	Bagdogra, Siliguri/ Naxalbari Block/ 97-98	Bouldary Formation	151/ 138	52-58, 67-73, 83- 92, 119-125, 129- 135	0.54	26.80	12.7 6	-	Potable
5.	Kadamtala, BSF Campus, Siliguri/ Naxalbari Block/ 98-99	Bouldary Formation	211/ 175	112-120, 123- 128, 132-135, 139-142, 154-172	10.35	15.58	3.86	685.14	Fe 4.9- 5.7ppm
6.	Shiv Mandir, MES Campus, Siliguri/ Naxalbari Block/ 99-2k	Bouldary Formation	157/ 112	40-52, 62-65, 70- 82, 95-97, 106- 108.5	3.64	15.77	11.0 8	131.40	Potable
7.	Pintail Village, Siliguri/ Naxalbari Block/ 2000-01	Bouldary Formation	182/ 179	48-50, 51-55, 110-114, 120- 125, 128-130, 135-141, 148- 156, 162-164, 174-176	5.73	17.98	3.78	-	Potable

8.	Sukna/ Kurseong block/ 98-99, 99-2k	Bouldary Formation	181/ 177	73-79, 90-94, 103-111, 134-136, 138-140, 149-166, 173-174	2.91	1.5	20.3 0	2.58	Potable
9.	Krishnanagar/ Mirik block/ 2003-04, 04-05	Fractured Formation	73/ 71	21-33, 50-68	0.715 magl	7.3	18.2 3	9.96	Potable
10.	SSB Campus, Ranidanga/ Phansidewa block/ 2005-06	Bouldary Formation	183/ 180	79-82, 94-100, 136-139, 156-161, 165-177	8.34	20	3.39		
11.	Bhutabari Air Force Campus/	Bouldary Formation	135/ 134	87-93, 98-104, 107-119, 125-131					
12	Naxalbari block/ 2006-07	Bouldary Formation							
13	Khaprail, Bogra Niketan Army Complex, Matigara Block	Bouldery Formation (Bhabar)	158.5/132.4	54.8-60.9, 68.5-74.5, 79.0-88.2, 94.2-103.3, 118.5-124.5	3.5	45.5	32.5	-	Potable
14	Gungaram T. Garden, Phansidewa Block	Bouldery Formation (Terai)	97/93.3	37-56, 71-77, 83-90	17	191	4.0	-	Potable
15	Naxalbari PHE scheme, Naxalbari Block	Bouldery Formation (Terai)	85.23/84.03	63-72, 79-85	3	51.4	13	-	Potable
16	Bijoynagar T.Garden, Naxalbari Block	Bouldery Formation (Terai)	101/106	42.4-59.3, 71.2-77.0, 80.0-98.1	8.5	96	-	-	
17	Batasi PHE scheme, Khoribari Block	Bouldery Formation (Terai)	60.37/60	48-51, 54-60	1.21	23	2.12	-	Fe 2.4 mg/l

Note: sr.no. 13 – 17 , Other than the CGWB Tube well

		favorable geomorphic situation some of the tube well may give artesian condition.	
Naxalbari - Siliguri	Mainly Bhabar zone area, Potential aquifer occurs within 143 m bgl. Aquifer in this block can yield between 15.58 – 33.47 lps with drawdown varies from 15 to 3.86 m	Tube wells tapping granular zone upto 150 m bgl can yield upto 33.47 lps. Due to boudary area during pumping more draw down can be contemplated. In this terrain length of housing must be kept at least above 40 m bgl.	Net GW Availability: 19647 ham Irrigation draft : 248 ham Domestic draft : 394 ham No. of Irrigation well (as per Census 2001): STW - 21 DTW - nil others - 12
Kharibari - Phansidewa	Mainly Bhabar zone area, Potential aquifer occurs within 180 m bgl. Aquifer in this block can yield upto 8.34 lps with drawdown varies from 3 – 18 m	Tube wells tapping granular zone upto 180 m bgl can yield upto 8.34 lps. Due to boudary area during pumping more draw down can be contemplated. In this terrain length of housing must be kept at least above 40 m bgl.	Net GW Availability: 26221 ham Irrigation draft : 1452 ham Domestic draft : 414 ham No. of Irrigation well (as per Census 2001): STW - 434+ 155 Others - 34

**ANNEXURE - 2**

**STATUS OF GROUND WATER DEVELOPMENT (BLOCKWISE)**

<b>Block</b>	<b>Occurrence of aquifers &amp; its potentiality (as per data available with CGWB)</b>	<b>Feasibility of GW abstraction structures</b>	<b>GW resources available &amp; status of GW Development (as on March '04)</b>
Darjeeling - Pulbazar	Hilly area,	limited ground water available in fractures and joints. and can be extracted from numerous springs and Jhoras.	Not assessed ,
Sukhiapokhori Jorebunglow	Hilly area,	limited ground water available in fractures and joints. and can be extracted from numerous springs and Jhoras.	Not assessed
Rangli - Rangliot	Hilly area,	limited ground water available in fractures and joints. and can be extracted from numerous springs and Jhoras.	Not assessed
Kalingpong I & II	Hilly area,	limited ground water available in fractures and joints. and can be extracted from numerous springs and Jhoras.	Not assessed
Gorubathan	Hilly area,	limited ground water available in fractures and joints. and can be extracted from numerous springs and Jhoras.	Not assessed
Kurseong	Hilly area, number of potential fracture zone encountered down to 170 m bgl. Tube tapping the weathered mantle and the fractures can yield 2.91 lps with 20 m drawdown	limited ground water available in fractures and joints. and can be extracted from numerous springs and Jhoras. In general low duty tube wells are feasible with expected yield to the tune of 2.91 lps.	Not assessed
Mirik	Hilly area, potential granular zones encountered between 21-33 m and 50-68	limited ground water available in fractures and joints. and can be extracted from numerous springs and Jhoras. In general low duty tube wells are feasible with expected yield to the tune of 0.715 lps. In	Not assessed

**ANNEXURE - 3**

**No. of Mouzas in the block and Municipality wise status of water supply in Darjeeling District:2**

Sl. No	Municipality	No. of mouzas havin drinking water faciliti	Status of water supply
1	Darjeeling - Pulbazar	42	Hilly area
2	Sukhiapokhori - Jorebunglow	45	Hilly area
3	Rangli - - Rangliot	29	Hilly area
4	Kalingpong I & II	41 + 31	Hilly area
5	Gorubathan	25	Hilly area
6	Kurseong	62	Hilly area
7	Mirik	4	Hilly area
8	Naxalbari	75	PHED water supply schemes are mostly confined to semi-urban areas whereas the domestic water supply in rural areas is done through dug wells and hand pumps sunk by the local Panchayats and PHED. Besides, the habitants in both rural and semi-urban areas have their own dug wells and shallow tube wells to meet their domestic need. The PHED water supply schemes mostly comprise India Mark-II, 100/80mm dia deep tube wells with average rate of supply of 20 lpcd (litre per capita per day). In Naxalbari and Khoribari blocks of Siliguri sub-division, number of piped water supply schemes (deep tube wells fitted with pump) is 7 and 4 in the first quarter of year 2005. The yield of the deep tube wells ranges from 26 to 40 m <sup>3</sup> /hr, having capacity of average supply @40 lpcd, benefiting 12 mouzas of Khoribari and 14 mouzas of Naxalbari blocks. About 600 Mark-II tube wells in Naxalbari and 250 in Khoribari Blocks are available for domestic water supply. 593 ordinary hand pumps (40mm dia) are scattered across Khoribari. Because of being non-tube well zone the northern part of Naxalbari block is almost devoid of ordinary had pumps.
9	Kharibari	72	
10	Phansidewa	98	
11	Matigara	66	
12	Siliguri(M)		

ANNEXURE - 4

**GROUND WATER LEVEL VARIATION IN PARTS OF DARJEEILING DIST.**

No.	Location of wells	Block	Water level (m bgl)		Fluctuation (m) (Premonsoon WL – Postmonsoon WL)
			Premonsoon	Postmonsoon	
<b>Siliguri Sub-Division, Darjeeling District</b>					
1	Siliguri (Coolie Para) GWMW	Siliguri Municipality	1.01	2.22	-1.21
2	Siliguri (Police Station) GWMW	Do	10.39	6.77	+3.62
3	Salbari	Matigara	4.66	4.20	+0.46
4	Champasari	Do	2.22	1.06	+1.16
5	Babupara	Do	4.44	2.78	+1.66
6	Matigara GWMW	Do	6.89	5.63	+1.26
7	Khaprail	Do	2.25	2.06	+0.19
8	Tumbajote GWMW	Do	1.87	1.70	+0.17
9	Sukna GWMW	Kurseong	8.70	5.07	+3.63
10	Simulbari	Kurseong	8.48	6.99	+1.49
11	Kamalpur	Naxalbari	3.28	2.55	+0.73
12	Tirhana GWMW	Do	7.03	5.76	+1.27
13	Jhabra More	Do	9.14	4.44	+4.70
14	Naxalbari GWMW	Do	2.97	2.69	+0.28
15	Bagdogra GWMW	Do	6.71	4.75	+1.96
16	Atal Bazar	Do	4.87	3.41	+1.46
17	Gaursingh Jote	Khoribari	4.31	3.57	+0.74
18	Batasi GWMW	Do	6.23	4.87	+1.36
19	Adhikari	Do	4.24	2.87	+1.37
20	Galgalia (Bhajanpur) GWMW	Do	3.44	2.05	+1.39
21	Khoribari GWMW	Do	4.04	2.20	+1.84
22	Hathiduba	Do	2.57	1.15	+1.42
23	Bijoynagar	Do	3.87	3.08	+0.79
24	Ranidanga	Phansidewa	3.89	3.37	+0.52

### ANNEXURE - 5

**Available Ground Water Resource, Irrigation Potential, Ground Water Draft and Stage of Development and no. of ground water abstraction structures feasible in parts of Darjeeling dist.**

Sl. No.	Sub-division	Block	Irrigation potential created (ha)	Actual area irrigated (ha)	Net ground water resource available (ham)	Ground water draft for irrigation (ham)	Ground water draft for domestic and industrial purposes @60 LPCD (ham)	Gross draft for all uses (ham)	Stage of development (%)	Category of Block	Net ground water resource available for future irrigation (ham)
1	Siliguri (part) (Darjeeling district)	Matigara	2224.81	1405.38	9041	101	352	453	5.0	Safe	8291
2		Naxalbari	6546.25	4322.08	11696	150	378	528	4.5	Safe	10642
3		Khoribari	6586.83	1797.83	7866	910	226	1136	2.9	Safe	6461
		Total	15357.89	7525.29	28603	1161	956	2117	4.1 (avg.)		25394

Sl. No.	Sub-division	Block	Additional irrigation potential that can be created (ha)	Area to be irrigated by shallow TW (ha) (70% of Col. 4)	Area to be irrigated by deep TW (ha) (30% of Col. 4)	Potential command area of shallow TW (ha)	Potential command area of deep TW (ha)	No. of shallow TW (Col.5 / Col.7)	No. of deep TW (Col.6 / Col.8)
1	Siliguri (part) (Darjeeling Dist.)	3	4	5	6	7*	8*	9	10
1		Matigara	4225	2958	1267	7	33	370	38
2		Naxalbari	1147	803	344	8	31	100	11
3		Khoribari	1216	851	365	8	40	106	9
		Total	6588			8		576 (say, 500)	58 (say, 50)

## 6.0 GROUND WATER QUALITY:

- 6.1 The chemical quality of ground water has an important role for supplying water for drinking, irrigational and industrial uses in the society. Ground water quality in this area is suitable for domestic, agriculture and industrial uses barring a few places particularly in the southern part ( in and around Bagdogra area )where concentration of iron ('Fe') is much above than permissible limit. Ground water in this tract is very low chloride content and also low E.C. Ground water is slightly alkaline ( pH varies from 7.3 to 7.80 ).

**Range of ground water quality parameters in Darjeeling district**

Parameter	Range	BIS Std.
pH	7.5-7.8	6.5-8.5
E.C.	157-647	
TDS (mg/L)	94-356	500-2000
T.H. (mg/L)	15-175	300-600
Calcium (mg/L)	4-52	75-200
Magnesium (mg/L)	1.2-13	30-100
Sodium (mg/L)	9.7-85	
Potassium (mg/L)	0.4-9.7	
Bicarbonate (mg/L)	49-207	
Chloride (mg/L)	11-107	250-1000
Sulphate (mg/L)	3.2-45	200-400
Nitrate (mg/L)	0.4-20	45
Fluoride (mg/L)	0.16-0.43	1.0-1.5
Iron (mg/L)	0.01-2.3	0.3-1.0

**ANNEXURE - 6**

**Chemical Quality of Ground Water in parts of Darjeeling district.**

(Concentration in mg/l)

Sl. No.	Sub-division	Location	Date of sampling	pH	EC ( $\mu$ S/cm at 25°C)	Na	K	Ca	Mg	Fe	CO <sub>3</sub>	HCO <sub>3</sub>	Cl	F	SO <sub>4</sub>	TDS
1	Siliguri (Darjeeling Dist.)	Bagdogra Air Force, DW in 273SU	07.05.03	7.8	86	9	<1	8	1	0.35	Nil	43	7	0.05	<1	47
2		Bagdogra Air Force, DW near GE office	07.05.03	7.6	193	16	5	16	2	0.55	Nil	67	11	0.13	18	106
3		Bagdogra Air Force, Deep TW near PH- 3 (138mbgl)	07.05.03	7.6	150	14	1	12	2	0.15	Nil	79	7	0.13	<1	83
4		Bhutabaru Air Force Stn., DW	08.03.06	8.2	88	4.8	1.1	6	3	ND	Nil	24	14	0.05	2	-
5*		Batasi PHED deep TW scheme (60m bgl)	07.10.97	6.5	-	-	-	-	-	2.4	-	-	3.0	-	-	203
6*		Naxalbari PHED Deep TW scheme (85m bgl)	23.07.96	7.0	-	-	-	-	-	0.96	-	-	10	-	-	315
7		Ranidanga SSB Camp deep TW (180mbgl)	10.12.05	8.2	143	13	2.3	14	3.6	0.7	-	61	18	0.26	2	-

## **6.2 Chemical Characteristics of ground water in Darjeeling District**

- Water is mostly fresh.
- Generally very soft.
- Mostly Ca- HCO<sub>3</sub> type of water.
- Fluoride and Nitrate is not a problem.
- In few cases high Iron has been observed specially in southern part of the district and also in the deeper aquifer in the Tarai zone particularly in and around Bagdogra area.
- The irrigation class of water is generally C1 S1 and C2 S1.

## **7.0 GROUND WATER MANAGEMENT & STRATEGY & RECOMMENDATION**

### **7.1 Ground Water Development:**

Ground water development in Darjeeling dist. is very low and it is restricted to the plain areas of Siliguri sub div. Substantial development of ground water could not be done in spite of easy availability of institutional finance due to drilling hazards in boundary area. In the hilly area the rain water is available in abundance which goes waste as a rejected recharge. Urban water supply is through deep tube wells in Siliguri town, in and around Bagdogra, Naxalbari and Kharibari area.

#### **Present Ground Water Development**

The level of ground water development in Siliguri sub-divisions is meager (mostly <6%), thereby characterizing the area 'safe' for further utilization of ground water resource. As such, the major unutilized portion of ground water can be developed in large scale for domestic and irrigational purposes. Dug wells and shallow tube wells are the major ground water abstraction structures in this area. Some deep tube wells have been in use in domestic and irrigation sectors. Dug wells are common in the Bhabar and Terai zones, whereas number of shallow and deep tube wells is more in Terai than Bhabar.

#### ***Ground water for irrigation***

Ground water is withdrawn by dug wells shallow tube wells and low, medium as well as heavy duty tube wells in the study area. Based on the 3<sup>rd</sup> Minor Irrigation Census of West Bengal it has been estimated that about 464 ham ground water was drafted through 663 STWs (both govt. and non govt.) in Matigara, Naxalbari and Khoribari blocks of Siliguri sub-division in 2000-2001. The resource of 435 ham and 38 ham were utilized by 25 DTWs (both govt. and non govt.) 192 dug wells, respectively. Therefore, a total of about 937 ham ground water was utilized by abstraction structures for irrigational purpose.

#### ***Future Ground Water Development and Management Aspects***

There is a lot of scope for safe development of ground water in the study area as plenty of water resource has not been harnessed for domestic, irrigational and industrial uses. As has been discussed earlier that an estimate of about 25394 ham resource in three blocks of Siliguri sub-division is at present available for future irrigational use. A portion of this unutilized resource can be safely harnessed by 576 STWs and 58 DTWs in Siliguri sub-division.

### **8.0 Water Conservation & Artificial Recharge:**

#### *Scope for artificial recharge in Darjeeling dist.*

- Depth to ground water level is in general shallow in both pre and post monsoon periods except for a few places.
- Long term trend of ground water level is in general rising in both pre and post monsoon periods.
- Hydrogeological condition is in general not in favour of artificial recharge.
- Conservation of rainwater is the best option.

- Rainwater harvesting scheme is very much site specific and hence people in need should get top priority. Any scheme of rainwater harvesting if found viable in all respect should therefore be taken in the area of need.

#### *Artificial Recharge in Hilly Terrain*

- In hilly terrain artificial recharge to ground water by rain water is to be avoided because the injected rain water before recharging the ground water might find its way to a stream or it may come out through cracks, fractures etc. causing damages like land slide, collapsing of buildings etc.
- In hilly terrain conservation of rainwater is a better option and should be conserved in structures above the ground.
- Technical guidance of Rainwater harvesting through conservation in Darjeeling dist. has been given in two place namely, at Raj Bhawan Main Building, Darjeeling and Jubilee park , Darjeeling

#### *Availability of Rainwater in an area*

Net Rainwater available (mcm) = Area (Sq.km) of catchment surface X

Normal annual rainfall X Run off coefficient.

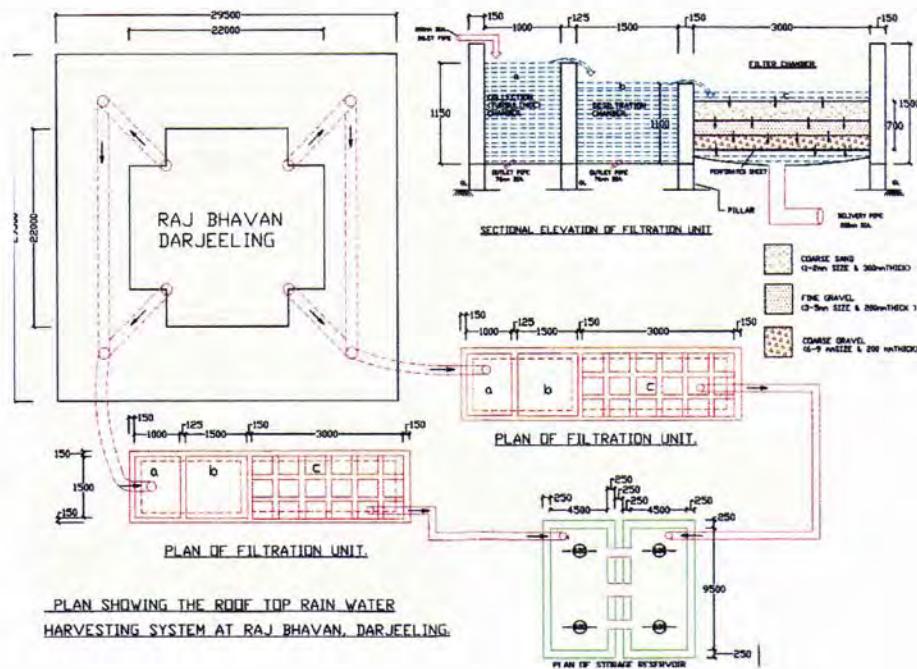
- Area of Darjeeling town : 10.57 sq.km.
- Normal annual rainfall : 2973mm.
- Net annual rainwater available : 19MCM (Considering 60% as run off coefficient).

#### **A bird's eye view of the Roof Top Rainwater Harvesting at Raj Bhawan Main Building, Darjeeling**

- Total area of the roof : 823.69m<sup>2</sup>.
- Normal Annual Rainfall : 2973mm
- Net rainwater available annually from the roof : 1959.06 m<sup>3</sup>.
- Normal Monsoon Rainfall
- (May to September) : 2614mm
- Net Monsoon rainwater : 1722.5 m<sup>3</sup>.

- Normal Non-monsoon Rainfall : 359mm
- Net Non-monsoon rainwater : 236.56 m<sup>3</sup>.

**Schematic diagram of the structure**



## 9. GROUND WATER RELATED ISSUES & PROBLEMS

The occurrence of iron (Fe) in the Bhabar and Alluvial area than permissible limit (1.00 mg/l) in ground water has been observed in the blocks of Bagdogra, Naxalbari, Siliguri etc.

## **10.0 AWARENESS & TRAINING ACTIVITY**

### **10.1 Mass Awareness Programme (MAP) & Water Management Training Programme (WMTP) by CGWB:**

Programme	Place	Date/year	No. of Participants	Theme
MAP	Darjeeling town, Darjeeling dist.	2002 -03	100	Rain Water Harvesting

**10.2 Participation in Exhibition, Mela, Fair etc. :** Nil

**10.3 Presentation & Lectures delivered in public forum/  
Radio/T.V/Institution of repute/ Grassroots associations /  
NGO/Academic intuitions etc.: Nil**

### **11.0 AREAS NOTIFIED BY CGWA/SGWA:**

No area of Darjeeling district has been notified by CGWA/SGWA

### **12.0 RECOMMENDATIONS:**

- A) In the hilly area a separate planning for the withdrawal of ground water may be chalked out
  - Ground water occurs in the hilly area in fractures and joints.
  - These conduits have to be demarcated precisely with help of remote sensing and geophysical studies followed by deploying a suitable drilling machine (DTH Rig) for construction of tube wells..
  - High hill area like Darjeeling, Kalingpong, Kursiong etc.. where no ground water structure is feasible, perennial spring can be developed. By conserving battery of perennial spring in an Artificial tanks in the topographical low area may be the best solution in solving domestic water requirements.
- B) In the piedmont zone Ground water development can be done through construction of tube wells.

- In the Bhabar areas special attention may be given in proper construction of a tube well
- Underlying bouldery formation together with rugged topography in Bhabar zone causes a lot of difficulty for construction of tube wells. It is relatively easy in Terai which is almost flat and composed of coarse sand, clay and gravels. Therefore, detailed hydrogeological studies, geophysical investigation and remote sensing studies are to be carried out for locating favorable site prior to the drilling operation.
- In the Bhabar zones (piedmont) where yield of the deep tube wells is high, the discharge of such tube wells quite often decreases in the long run due to gradual choking of iron strainers by formation of iron encrustation from iron rich ground water. Use of fiber glass strainers or PVC well assembly is a suitable measure to overcome the problem.
- It is mandatory to keep a more housing Pipe length because high water level and expected drawdown.
- Construction of Jack well in the vicinity of the river may be encouraged.

C) In the alluvial plains :

- In the alluvial plains of Terai, small diameter shallow irrigation tube wells of 50-80m depth, and tapping 10-15m thick sediments can yield around 5 ham water. Irrigation through shallow tube wells is quite suitable as operation and maintenance is easily maneuvered by the co-operatives.. The withdrawal of ground water in large scale in the lean period will be also conducive in raising the crop production in post-Kharif season, thereby improving the agro-economic condition of the area/community.
- Small dia. Irrigation well (40 – 60 m depth) tapping 10 – 15 m aquifer materials can yield 15 – 20 m<sup>3</sup> /hr.
- Irrigation through shallow wells has been found to be quite suitable due to its low cost nature.

- Large scale development in the vicinity of river banks can be introduced for lowering of water level to a great extent in the lean period so that the thickness of unsaturated zone within the aquifer is increased.
- Construction of Jack well in the vicinity of the river may be encouraged. Rooftop rain water harvesting and conservation of rain water by different conservation structures particularly in southern part of the district should be encouraged.