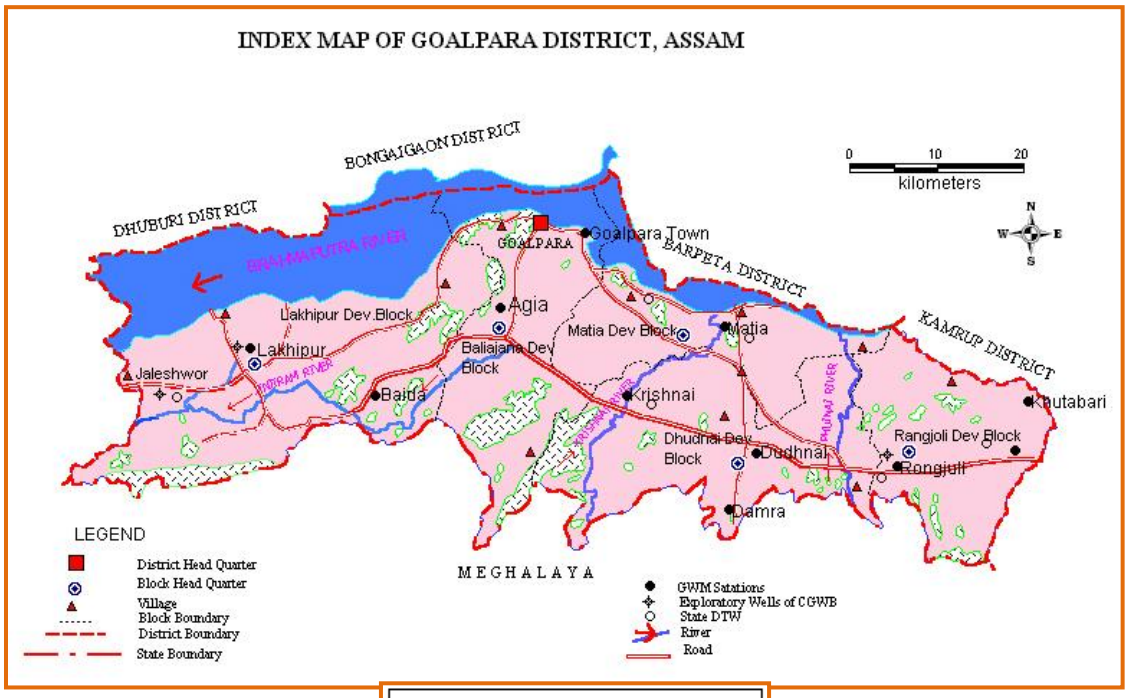
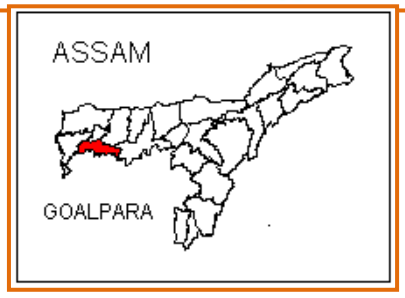
Ground Water Information Booklet
Goalpara District, Assam





Central Ground Water Board

North Eastern Region

Ministry of Water Resources

Guwahati

September 2013

GROUND WATER INFORMATION BOOKLET
GOALPARA DISTRICT, ASSAM

DISTRICT AT AGLANCE

Sl. No.	ITEMS	STATISTICS
1.	GENERAL INFORMATION i) Geographical Area (in sq.km) ii) Population iii) Average Annual Rainfall (mm)	 1,842 10,08,959 2,169
2.	GEOMORPHOLOGY i) Major Physiographic Units ii) Major Drainages	 Hills (isolated inselberg) and flat alluvial plains sloping towards Brahmaputra River Brahmaputra, Dudhnoi, Krishnai, Jinjiram, Jinari and Deosila River.
3.	LAND USE (sq.km) i) Forest area ii) Net area sown iii) Total cropped area iv) Area sown more than once	 383.44 795.60 1,060.89
4.	MAJOR SOIL TYPES	Older alluvium, and Younger alluvium
5.	AREA UNDER PRINCIPAL CROPS in sq.km. (as on 2007)	325.38
6.	IRRIGATION BY DIFFERENT SOURCES (sq.km.)	1.61
7.	NUMBERS OF GROUND WATER MONITORING STATIONS OF CGWB (as on March 2013)	21
8.	PREDOMINANT GEOLOGICAL FORMATIONS	i) Pre-Cambrian crystallines (hills) ii) Quaternary sediments (plains)
9.	HYDROGEOLOGY i) Major water Bearing Formations ii) Pre-monsoon Depth to Water Level during 2007 iii) Post-monsoon Depth to Water Level during 2007 iv) Long term Water Level Trend in 20 yrs (1988 –2007) in m/yr	 Unconsolidated and Consolidated formation 0.94 to 8.57 m bgl 1.38 to 8.67 m bgl No significant rise/fall recorded, Pre-monsoon = 60% rise, 40% falls; Post-monsoon = 60% rise, 40% falls.

10.	GROUND WATER EXPLORATION BY CGWB (as on 28.02.2013). i) No of Wells Drilled ii) Depth Range (m) iii) Discharge (lps) iv) Transmissivity (m^2/day)	 25 (15 EW, 8 OW & 2 PZ) 86-100 49-1508 169-2282
11.	GROUND WATER QUALITY i) Presence of Chemical Constituents more than Permissible Limit (e.g. EC, F, Fe, As) i) Type of Water	Except Fe and F problems in some parts of the district, other elements are within the permissible limit. Occurrence of Fe is more than permissible limit in the shallow aquifers. F content in deeper aquifers is more than permissible limit.
12.	DYANMIC GROUND WATER RESOURCES (2009) in mcm ii) Annual Replenishable Ground Water Resources iii) Net Annual Ground Water Draft iv) Projected demand for Domestic and Industrial Use upto 2025 v) Stage of Ground Water Development	 1,063.74 266.10 32.65 26%
13.	AWARENESS AND TRAINING ACTIVITY i) Mass Awareness Programmes Organised ii) Date iii) Place iv) No of Participants	 Nil
14.	EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HARVESTING i) Projects Completed by CGWB (No & amount spent) i) Projects Under technical Guidance of CGWB (Numbers)	 Nil
15.	GROUND WATER CONTROL AND REGULATION i) Number of OE Blocks ii) Number of Critical Blocks ii) Number of Blocks Notified	 Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Higher concentration of Fe & F in ground water in some parts of the district is observed (greater than permissible limits prescribed by BIS and WHO).

Ground Water Information Booklet, Goalpara District, Assam

1.0 INTRODUCTION

The district of Goalpara is situated in the South bank of River Brahmaputra. The district covers an area of 1,842 square kilometers and is bounded by West and East Garo Hills districts of Meghalaya in the South and Kamrup district in the East, Dhubri district in the West and River Brahmaputra is all along in the North. The geographical location of the district is between North Latitudes of 25^0 53′ & 26^0 15′ and East Longitudes of 90^0 07′ & 91^0 05′.

Goalpara is located in western part of Assam. The district is well connected by NH-37, NH-51, NH-31B, road and Railway Network. The Headquarters of Goalpara district i.e. Goalpara Town is situated on the south bank of the River Brahmaputra and it may be approached mainly by roads from both the sides. After construction of the Naranarayan Setu (Bridge) over the mighty River Brahmaputra, road communication from the north bank has become easy and convenient.

As per 2001 census, the total population of the district is 10,08,959. The density of population is 547 persons per sq. km. Different communities' stay in the district.

The district experiences moderate climate during winter and hot in summer. Irregular rain starts in the month of April with occasional and irregular light showers and continues up to the end of May. This rain occurs due to the influence of Northeastern wind. Normal monsoon begins from the early part of June and heavy rains occur in the district till the month of October. About 80% rainfall is received from South-West monsoon. The maximum temperature is 33^0C during July to August and the minimum dips down to 7^0C in the month of January.

The district is primarily an agrarian as 90% of the population depend for their livelihood on agriculture. The principal agriculture produce are paddy, Jute, green and black gram and potato etc. A big market of banana has come up at Darangiri in the district. There is a bumper production of paddy due to large-scale distribution of STWs along with diesel water-pump sets by the Agriculture department in the district.

Physiographically, the area is occupied both by hills and plains. The alluvial land is flat with a gentle regional slope towards Brahmaputra River. The hills mostly occur as isolated inselberg with heights ranging between 60 to 300 m above MSL. The hills are veneered by lateritic mantle and are deeply forested with evergreen mixed open jungles. Tongue like projections of the main Shillong Plateau is also seen in the area around Agia, Krishnai, and southeast part of Rangjuli.

The drainage of the entire area is controlled by two different systems of rivers. Towards the east, a northerly flowing river system drains the area, which consists of tributaries of the mighty Brahmaputra River. In the west of Agia, the drainage is

controlled by Jinrana River, which flows in a westerly direction parallel to Brahmaputra River.

The main tributaries of the Brahmaputra River in the district are Dudhnoi, Krishnai, Jinjiram, jinari and Deosila. The Rivers are all perennial in nature. Natural lake such as Urpad Beel, Hasila Beel, Kumuri Beel and Dhamar Risan Beel exist in the district and several other artificial ponds are also seen.

Geologically, the district may be divided into two broad groups, viz (i) Pre-Cambrian crystallines occupying in the hills and the Inselbergs and (ii) Quaternary sediments constituting the river valleys and the plain areas in between the Inselbergs.

Hydrogeologically the entire district has been grouped into two main units, viz. (i) Unconsolidated formation, and (ii) Consolidated formation. Further subdivisions like Older and Younger alluvium have been made on the basis of (a) geomorphology including land use, (b) lithology and soil characteristics, (c) hydrogeological properties like yield characteristics etc.

Ground water occurs under water table conditions in the near surface aquifers in Older alluvium within fine sand and sandy clay at a maximum depth of about 20 mbgl. It also occurs under semi-confined to confined conditions in the deeper aquifer tapped by medium/heavy duty deep tube wells. In Younger alluvium, ground water occurs under unconfined conditions and it is extracted by means of open wells and small diameter tube wells for both domestic and irrigation purposes.

Goalpara district experiences floods of moderate to severe intensity during the monsoon.

Other than high concentration of Fluoride (F) and Iron (Fe) in ground water, most of the chemical constituents are within the permissible limit for both the drinking and irrigation uses.

The estimated net ground water resource availability is 1,036.15 mcm. The stage of ground water development is 16%.

The present ground water utilization for domestic and to some extent for agriculture purpose as there is no major industry in the district. A total of 95,864 households are getting their water supply through tube wells (2236 households), tap water (1916 households), hand pump (21,236 households), dug well (20,200 households) and other sources (2,344 households) in the district.

2.0 RAINFALL AND CLIMATE

The climate in the district is moderate during the winter and in summer, it is hot. Rain makes its first appearance in the month of April with occasional and irregular light showers and at times, heavy down pour is followed by cyclonic storm. This irregular rainfall continues up to the end of May It occurs due to the influence of Northeaster wind.

Monsoon rain normally begins from the early part of the month of June and heavy rain occurs in the district till the month of September. The maximum temperature is 33 degree Celsius during July and August, a minimum temperature falls up to 7 degree Celsius in the month of January. During 2002, rainfall in the district is 2,424.01 mm. About 80% of rainfall is from South-West monsoon.

Table.1 Annual Rainfall Month wise for last 10 Years from 1994 to 2003

Year	Months (Rainfall in mm)												Total Rainfall	Total Rainy days
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1994	23	23	12	172	509	749	279	405	70	229	-	-	2470	93
1995	9	7	89	73	217	545	711	397	537	19	6	7	2617	97
1996	10	Nil	6	33	532	265	279	241	110	183	-	-	1659	88
1997	8	24	22	167	99	604	318	212	132	12	3	22	1623	87
1998	Nil	10	13	117	209	434	506	483	256	244	-	-	2372	144
1999	Nil	Nil	8	210	423	375	366	202	35	144	-	-	1763	74
2000	2	8	10	283	380	490	294	271	171	70	-	-	1979	82
2001	-	2	-	302	445	297	271	169	168	213	2	-	1877	111
2002	21	-	70	167	159	832	169	109	342	-	60	-	2424	102
2003	-	2	33	256	303	639	109	1222	106	106	2	-	2905	101
2004	3.1	5.6	31.5	527.0	91.8	1304.4	2284	223	200.6	482.9	9.6	4.5	5168.0	-------
2005	Nil	Nil	50.8	326.4	275.8									

10 Years Average Annual Rainfall: 2,169 mm
10 Years Average annual Rainy days: 98 Days

3.0 GEOMORPHOLOGY AND SOIL TYPES

3.1 Geomorphic Features and Landforms

The topography of Goalpara district is generally characterized by an almost flat plain except for few low-forested hills that break the monotony of the terrain. The main hills are Pancharatna, Sri Surjya, Tukreswari, Nalanga & Paglartek with elevations ranging from 100 to 500 m. A significance of the district is the existence of a large number of Char (Riverine tracts and sandy river island) in the River Brahmaputra. The mighty River Brahmaputra flows East to West on the Northern boundary of district and the main tributaries are River Dudhnoi, Krishnai, Jinjiram and Jinary. Dudhnoi and Krishnai Rivers originate from hills of Meghalaya, then join each other in the Western part of Matia and flows as River Mornoi up to its confluence with the Brahmaputra. The Jinjiram originates from Urpad Beel flows parallel to the Brahmaputra and ultimately joins near South Salmara of Dhubri District .The Rivers are all perennial in nature. There are a few other minor streams in the District.

A number of Beels (natural reserve forests, lakes) such as Urapd Beel, Hashila Beel, Kumri Beel and Dhamar Risan Beel exist in the district and several other artificial ponds are also seen.

Physiographically, the area is occupied by both the hills and plains. The alluvial land is flat with a gentle regional slope of less than 1 m/km towards Brahmaputra River. The hills mostly occur as isolated inselberg whose areas vary from less than 1 sq km to almost 15 sq km (e.g. inselberg west of Goalpara town) with heights ranging between 60 to 300 m above MSL. The hills are veneered by lateritic mantle and are deeply forested with evergreen mixed open jungles. Tongue like projections of the main Shillong Plateau are also seen in the area around Agia (26^o 05′ / 90^o 33′), Krishnai (26^o02′ / 90^o 39′), and southeast of Rangjuli ($25^0$58′ / $90^0$04′). The height of the hills varies between 60 and 550 m above MSL.

3.2 Drainage and Morphometric Features

The drainage of the entire area is controlled by two different systems of rivers. Towards the east, a northerly flowing river system drains the area, which consists of tributaries of the mighty Brahmaputra River. To the west of Agia, the drainage is controlled by Jinrana River, which flows in a westerly direction parallel to Brahmaputra River.

3.3 Soil

The plain areas bordering Brahmaputra River and in between the inselbergs are occupied by alluvial sediments belonging to Quaternary ages. Based on such criteria such as sedimentation, soil characteristics and geomorphic features, the Quaternary sediments can be grouped into two subdivisions, viz.

(i) Older Alluvium, and
(ii) Younger alluvium.

The Older alluvium by virtue of its relative maturity is composed of somewhat oxidized sediments comprising yellow and the reddish brown colour sand, silt and clay in contrast to the light colour, less compact Younger alluvial sediment. The Older alluvium always occupies the higher grounds than the adjacent Younger alluvium but takes the proper stratigraphical position underlying the Younger alluvium sediments in the plain areas. A scarp as seen in the Krishnai River valley sometimes separates these two groups**.**

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

Hydrogeologically, the entire district has been grouped into two main units, viz. (i) Unconsolidated formation, and (ii) Consolidated formation. Further subdivisions like Older and Younger alluvium have been made on the basis of (a) geomorphology including land use (b) lithology and soil characteristics (c) hydrogeological properties like yield characteristics etc.

The aerial distributions of the unconsolidated formations are rather discontinuous occurring in between the inselbergs**,** but are broadly bordering the Brahmaputra River. The Older alluvium has a major development in the northern part of the area around Dudhnai-Dhupdhara (25^o 57′ and 91^o 04′) and Krishnai –Dalgoma (26^o 07′ and 90^o 48′) tracts. However, the continuity of this unit is again broken by isolated inliers of Precambrian rocks.

A continuous stretch of Younger alluvium of about 100 sq. km. has developed near Ambari (26^o 06′ and 90^o 24′) in the northwestern part adjacent to Brahmaputra River. Isolated but broad patches have developed all along the Brahmaputra River particularly near south east of Goalpara and east of Dalgoma. It has also developed in patches as low-level terraces along the small river valleys in this tract. Consolidated formations including the isolated inselbergs cover approximately 250 sq. km, which are mainly occupied by forest and barren lands.

Aquifers

The thickness of Older alluvium in the area is more than 90 m which is revealed by some deep tube wells constructed by PHED. There is one main aquifer in the area, which consists of medium and coarse-grained sand, some times mixed with gravel at a depth of about 90 m (maximum depth of probing) with intervening clay lenses. The main aquifer is overlain by reddish brown or brown colour sandy clay or fine sand mixed with clay and is widely tapped by open wells for drinking water purposes. This top sandy clay overlying the main aquifer constitutes the shallow or near surface aquifer in the area.

In the Younger alluvium, a shallow aquifer consisting of fine to coarse sand with occasional clay lense exists almost from near surface down to a depth of about 40 mbgl as tapped by shallow tube wells.

Occurrence

Ground water occurs under water table conditions in the near surface aquifers in Older alluvium within fine sand and sandy clay at a maximum depth of about 20 mbgl. It also occurs under semi-confined to confined conditions in the deeper aquifer tapped by medium/heavy duty deep tube wells. In Younger alluvium, ground water occurs under unconfined conditions and is extracted by means of open wells and small diameter tube wells for both domestic and irrigation purposes.

Yield Potential of Aquifers

In the deeper aquifer of Older alluvium, medium/heavy duty tube wells range in depth from 82 to 93 m and tap 18–36 m of granular zone yielding 55 – 110 m^3 per hour for draw down ranging up to 9 m. In the Younger alluvial areas, there is no deep tube well. However, the low duty small diameter (8 cm) shallow tube wells constructed in the similar younger alluvium in adjacent to Meaulkandi and Phulbari areas of Meghalaya, range in depth from 25 to 30 m tapping 8 – 10 m granular zones and yield about 25 – 40 m^3 per hour for a draw down up to 8 m.

Table 2: Summarised Hydrogeological data of EW of CGWB

Well Location	Depth of construction (m)	Aquifer Zone Tapped(m)	SWL (mbgl)	Discharge (LPM)	Draw Down (m)	Transmissivity (m^2/day)	Permeability (m/day)	Specific capacity lpm/m
Rongjuli	100	31-34 43-46 75-81 92-98	2.70	573	9.36	169	9.38	54.80
Kuruabasa	81.5	32-38 46-58 68-68	5.22	1507.5	2.11	2281.68	32.5	715
Jaleswor	85.50	44-57 57-66 66-76 76-84	3.53	48.45	3.30	510	5.86	1488.18
Darangiri	194.53	130 - 131 150 - 150.60 153.8 -154.2 165 - 165.5 169 - 171.5	2.51	250	25.56	-	-	-

4.2 Ground Water Regime and Depth to Water Analysis

Goalpara district has 11 Ground Water Monitoring Stations (GWMS). Monitoring of water level is being carried out periodically to observe any change in water level, in both space and time i.e. four times a year. First set of measurement is taken during pre-monsoon period (April 20th to 30th), second set is being taken during peak monsoon (August 20th to 30th), third measurement is taken during post-monsoon (November 1st to 10th) and last set is taken during January 1st to 10th.

Table 3: Depth to Water level and Water table data for the GWM Stations in Goalpara district, Assam

Location	**Well Type**	**M.P. magl**	**R.L of G.L. Metre a.M.S.L**	**DTW Apr' 07 (mbgl)**	**Water table Arr'07 (mbgl)**	**DTW Nov' 07 (mbgl)**	**Water table Nov'07 (mbgl)**	**Geology**	**Basin**
Agia	Dug Well	0.95	50.6	2.73	47.87	2.91	47.69	Alluvium	Brahmaputra river
Baida	Dug Well	0.9	38.221	1.91	36.311	3.59	34.631	Gneiss	
Damra	Dug Well	0.9	50.11	3.7	46.41	4.35	45.76	Alluvium	
Dhupdhara	Dug Well	0.57	46.95	0.94	46.01	2.78	44.17	Alluvium	
Dudhnai	Dug Well	0.95	49.196	1.43	47.776	1.63	47.566	Alluvium	
Goalpara Town	Dug Well	0.86	50.32	8.57	41.75	8.67	41.65	Alluvium	
Jaleswar	Tube Well	0.83	28.525	-	-	-	-	Alluvium	
Khutabari	Dug Well	1	43.405	1.09	42.315	1.6	41.805	Alluvium	
Krishnai	Dug Well	1.1	45.28	2.81	42.47	3.5	41.78	Alluvium	
Lakhipur	Dug Well	0.95	32.16	0.96	31.2	2.43	29.73	Alluvium	
Matia	Dug Well	0.6	37.896	1.29	36.636	1.38	36.516	Alluvium	
Narangbari	Tube Well	0.58	32.408	-	-	-	-	Alluvium	
Rongjuli	Dug Well	0.04	45.51	2.01	43.5	1.7	43.81	Alluvium	

Table 4: Water Level Fluctuation Data in GWM Stations in Goalpara District, Assam

Location	Water Level (mbgl) Nov-07	Apr-07	Nov-06	10 Yrs Mean [1997-2006] mbgl	Yrs	Water Level Fluctuation Nov-07 With respect to Apr-07	Nov-07	Mean
	4	5	6	7	8	(5-4)	(6-4)	(7-4)
Agia	2.91	2.73	3.32	2.939	10	-0.18	0.41	0.029
Baida	3.59	1.91	3.66	2.871	10	-1.68	0.07	-0.719
Damra	4.35	3.7	4.22	4.085	6	-0.65	-0.13	-0.265
Dhupdhara	2.78	0.94	-	2.822	9	-1.84	-	0.042
Dudhnai	1.63	1.43	2.02	1.921	10	-0.2	0.39	0.291
Goalpara Town	8.67	8.57	8.34	-	-	-	-0.33	-
Khutabari	1.6	1.09	-	-	-	-0.51	-	-
Krishnai	3.5	2.81	-	-	-	-0.69	-	-
Lakhipur	2.43	0.96	-	1.852	9	-1.47	-	-0.578
Matia	1.38	1.29	1.21	1.097	10	-0.09	-0.17	-0.283
Rongjuli	1.7	2.01	1.99	1.897	10	0.31	0.29	0.197

Depth to water level during pre-monsoon (2007) ranges from 0.94 to 8.57 m bgl and it varies from 1.38 to 8.67 m bgl during post-monsoon (2007) period in the area. It is observed that water level fluctuation in November 2007 with respect to April 2007 ranges from 1.840 to 0.310 m, whereas that of November 2007 is from 0.330 to 0.410 m during pre and post-monsoon period. The mean fluctuation for pre and post–monsoon periods varies from 0.719 to 0.219 m. Long term fluctuation analysis has been attempted with the water level data of the permanent hydrograph stations for the period of 10 years from 1997 to 2006 which shows that no major change is observed in the water level over the period.

Table 5: Categorisation of Water Level Fluctuation for the ground water regime monitoring in Goalpara district, Assam

(Apr-07 to Aug-07)

Number of Station Analysed	Fall						Rise					
	0-2	(m%)	2-4	(m%)	>4	(m%)	0-2	(m%)	2-4	(m)%	4	(m%)
8	2	25.0	0	0.0	0	0.0	6	75.0	0	0.0	0	0.0

(Apr-07 to Nov-07)

Number of Station Analysed	Fall						Rise					
	0-2	(m%)	2-4	(m%)	>4	(m%)	0-2	(m%)	2-4	(m %)	4	(m%)

10	9	90.0	0	0.0	0	0.0	1	10.0	0	0.0	0	0.0

4.3 Water Level trend analysis:

The GWMS monitored data in the year 1998 is compared with the year 2007 data in respect of pre-monsoon and post monsoon periods respectively. The change in ground water regime and trend is compiled as per record in Table 6a and 6 b.

Table 6a: Ground Water Regime Analysis showing Trend of Ground Water Level for Pre-monsoon period (April 1998 to April 2007) in Goalpara district, Assam

Period 01-Apr-88 to 01-Apr-07

Location	Well No	No of Data	Ris	Fal	Intercept
			(meter/yr.)	(meter/yr.)	*01-Apr-88*
Agia	78J4C3	69	0.027	-	3.451
Baida	78J4B3	75	-	0.030	1.996
Damra	78K1D8	25	-	0.105	2.383
Dhupdhara	78O1A2	74	0.002	-	2.697
Dudhnai	78K1D1	85	0.016	-	2.301
Goalpara Town	78J4C4	21	0.104	-	10.590
Jaleswar	78J4A3	25	-	0.111	2.278
Khutabari	78N4A1	45	0.004	-	1.913
Krishnai	78J4C1	56	0.016	-	3.262
Lakhipur	78J4B1	70	0.071	-	3.310
Matia	78J4D1	73	0.081	-	2.651
Narangbari	78J4B2	21	-	0.036	2.723
Rongjuli	78K1D2	74	-	0.007	1.658

Table 6b: Ground Water Regime Analysis showing Trend of Ground Water Level for Pre-monsoon period (Nov 1998 to Nov 2007) in Goalpara district, Assam

Period 01-Nov-88 to 01-Nov-07

Location	Well No	No of Data	Ris	Fall	Intercept
			(meter/yr.)	(meter/yr.)	*01-Nov-88*
Agia	78J4C3	71	0.030	-	3.458
Baida	78J4B3	75	-	0.030	2.018
Damra	78K1D8	27	-	0.089	2.671
Dhupdhara	78O1A2	74	0.013	-	2.827
Dudhnai	78K1D1	85	0.024	-	2.384
Goalpara Town	78J4C4	23	0.135	-	10.974
Jaleswar	78J4A3	24	-	0.138	2.177
Khutabari	78N4A1	44	0.010	-	1.967
Krishnai	78J4C1	56	0.025	-	3.372
Lakhipur	78J4B1	70	0.074	-	3.278
Matia	78J4D1	72	0.077	-	2.563
Narangbari	78J4B2	20	-	0.049	2.664
Rongjuli	78K1D2	74	-	0.006	1.689

4.4 Ground Water Resources

Methodology adopted for ground water resource estimation of Goalpara District of Assam is as per GEC 1997 Report, i.e. Ground Water Level Fluctuation and Rainfall infiltration factor Method.

The net ground water availability estimated in the year 2009 is 1010.55 mcm. The existing gross ground water draft 266.10 mcm and the stages of development are 26% only. Future provision for domestic and Industrial use is 32.65 mcm and for Irrigation use is 733.66 mcm.

Assessment unit can be categorized into 4 categories as SAFE, SEMI-CRITICAL, CRITICAL, and OVER-EXPLOITED. In Goalpara district stage of ground water development is 26%, which shows under the SAFE category. As long-term water level trend does not show any major change so the whole district may be considered as SAFE.

CHART OF GROUND WATER RESOURCE ESTIMATION

Net Ground Water Availability	= 1010.55 mcm
Gross Ground Water Draft	= 266.10 mcm
Stage of Ground Water Development	= 26%
Future provision for Domestic & Industrial Use	= 32.65 mcm
Future Provision for Irrigation Use	= 733.66 mcm

4.5 Ground Water Quality

The quality of water is measure of its chemical, physical, microbiological and radiological properties with respect to its purposed use. Chemical quality of ground water in the district is being monitored every year for temporal and spatial change. Water samples are being collected in the month of April (pre-monsoon) every year.

In general, the quality of ground water in the district is suitable for both the drinking and irrigation purposes except the high concentration of fluoride (F) in the aquifers of hard rock fracture zones. Almost all the constituents are within the

permissible limits of drinking water standards, except Iron (Fe), which exceeds the permissible limit at a few places. The analysis of samples collected from the districts during the year 2007 shows that the concentration of fluoride is within the permissible limits.

General chemical quality analysis of ground water samples were carried out by Standard Quantitative Methods and Advanced Instrumental Analysis Techniques. Physical parameters, such as pH, EC, TDS and temperature were determined at the time of sample collection in the field itself. The general hydrochemical behavior of contaminants and water quality standards were properly followed in the determination of chemical quality data of ground water sample in the area. It is not possible to consider all of them at a time. Some of the more important contaminants of ground water, which have direct bearing on human health and environment, are highlighted for the purpose of study.

In order to study the quality of ground water suitable for domestic, irrigation and industrial purpose, ground water samples were collected from dug wells, deep tube wells and hand pumps. The water samples are analysed in the Chemical Laboratory of CGWB, NER, Guwahati. Detailed analysis report is discussed separately for shallow and deeper aquifers for the water samples collected during the said period in order to compare the changes in the chemical quality.

4.5.1 Water Quality of Shallow Aquifer

The pH value in ground water ranges from 6.96 to 7.10, while the EC value and TDS concentration are varying from 112 to 412 µ mhos/cm at 25^{o} C and 73 to 268 mg/l respectively. The concentration of Cl is from 11 to 85 mg/l and that of SO_4 is 2.0 to 9.0 mg/l showing concentrations within the permissible limits. Ca and Mg concentration ranges from 12 to 20 mg/l and 1.2 to 3.6 mg/l respectively with a total hardness of 35 to 65 mg/l concentration in the district. The chemical quality of ground water in Goalpara district shows high concentration of some chemical elements such as iron (Fe) occurring up to 1.29 mg/l.

4.5.2 Water Quality for Deeper Aquifers

Fluoride content in deeper aquifer in the district is observed high which is greater than permissible limit of BIS and WHO. Ground water samples collected from the exploratory wells of CGWB at Darangiri exploratory wells site of Rangjoli Development Block show high concentration of fluoride. The concentration of F in aquifer is found to be 7.6 mg/l.

4.5.3 Comparison of Ground Water Quality w.r.t. Previous Study

Comparison of ground water quality with respect to previous study reveals that there is no major change in the chemical quality of water in the last ten years. But recently, fluoride has been reported from the exploratory well in the Rongjuli block of the

district. Presence of fluoride content in the fracture zone at Darangiri is 7.6 mg/l, which is more than the permissible limit of Indian water Standard for drinking purposes. It urges the need of improvement of water supply and sanitation system.

Keeping in view this updated picture of chemical quality scenario of ground water in the district, it is advisable to test the potability of ground water before using it for drinking and cooking purpose.

4.6 Status of Ground Water Development

4.6.1 Present Ground Water Development

Ground water is used for drinking and irrigation purposes only in the district. As there is no major industry in this district, ground water utilization for the same may be considered as negligible. Development of ground water in Goalpara district is discussed below.

i) Urban and Rural Water Supply Schemes

In Goalpara district, out of 8,22,306 populations, 95,864 households are getting their sources of drinking water supply through tube wells (2,236 households), tap water (1,916 households), hand pump (21,236 households), dug wells (20,200 households) and other sources (2,344 households) in their premises and nearby sources. The detail water supply for drinking is shown below in Table 7 & 8.

Table 7: Household water Supply System in the District as per Census Operation 2001

Source of drinking water & Total Household supplied	Total/Rural/Urban	Total number of households
Tube well =2236	Total	1118
	Rural	1052
	Urban	66
Tap =1916	Total	958
	Rural	720
	Urban	119
Hand Pump =21236	Total	10618
	Rural	7874
	Urban	2744
Well =20200	Total	10100
	Rural	9200

	Urban	900
All Sources =47932	Total	23966
	Rural	19858
	Urban	2054
All Others =2344	Total	1172
	Rural	1072
	Urban	160
Total number of household in the district benefited		**95,864**

Table 8: Block wise PWSS of DTW covered under PHE, Goalpara District

Name of PWSS	Name of Block	Gram Panchayat	Depth of Construction (mbgl)	SWL (mbgl)	Draw Down (m)	Discharge (lpm)
Kadamtola	Matia	Dalgoma	85.00	8.18	4.50	412.00
Gumaijhan	Jaleswor	Gaurnagar	157.23	3.30	6.00	392.69
Chataimari	Jaleswor	Gauranagar	40.30	2.40	5.70	411.43
Tinkonia	Matia	Srisunjagiri	61.50	7.20	4.10	283.00
Sarapara	Matia	Karipara	88.00	6.60	4.45	272.20
Kamaraputa	Rangjuli	Simlitola	90.00	6.60	4.40	265.00

Source: PHE, Goalpara Division, Govt.of Assam

4.6.2 Ground Water for Irrigation

The district is primarily an agrarian as 90% of the population depend their livelihood on agriculture. The principal agriculture produce are paddy, Jute, green and black gram and potato etc. However, the district is also known for its production of areca nut and banana. There is a bumper production of paddy. This is perhaps due to large-scale distribution of STWs along with diesel water pump sets by the Agriculture Department in the district.

Table 9: Irrigation Potential Created and Actual Area Utilized under Goalpara District

Sl No	Name of Irrigation Project	Targeted Area (Ha)	Actual Area utilized (Ha)
1	Bapuara D.T.W. Agia	40	40
2	Kuruabhasa D.T.W.	40	40
3	Garoimari D.T.W.	20	20
4	Sijukona L.I.S.	200	150
6	Supervita L.I.S.	-	20
7	Ghagua F.I.S	-	10
8	Nolonga D.T.W.	400	200
9	Ambari D.T.W.	-	40

10	Garobhatkhowa D.T.W., Baguan	-	30
11	Mulaligarh D.T.W.	-	40
12	Katlitari D.T.W.	-	35
13	Sidli L.I.S. Matia	-	35
14	Dalgoma Kadamtola D.T.W.	-	80
15	Bohoti L.I.S	-	40
16	Dandalama F.I.S Damra	-	150
17	Kharubhaj F.I.S.	-	15
18	Thekasu F.I.S.	-	15
19	Deosila F.I.S. Dhanubhanga.	-	10
20	Old private S.T.W. & C.I.P. – 1578	5367	3070
21	Pasmaphaf C.I.P. –796	1194	796
22	LLP-GKY, MLA Fund and P.M.'s programme etc. 692	1038	692
23	ARIASP – 3202	6741	4804
24	NABARD – 4500	9000	6750
	TOTAL		17142

District Agriculture Department, Goalpara district creates irrigation potential of 17,142 ha by 24 irrigation schemes (LIS, STWS and DTWS). But most of the schemes are inoperative due to lack of fund and constant flood damage. Thus, it is observed that production assured irrigation from ground water source is required to be developed for which there is an ample scope from the resource point of view.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

In view of ground water development, ground water resource potential is good enough in the district. Older alluvium comprises fine sand and sandy clay. Ground water occurs in semi-confined to confined conditions in the deeper aquifer and it may be extracted by construction of medium/heavy duty deep tube wells. In Younger alluvium, ground water can be extracted by means of open wells and small diameter tube wells for both domestic and irrigation purposes.

The estimated gross annual dynamic groundwater resource is 1319.85 mcm while a net ground water resource is 1187.87 mcm. The stage of development is 20%. Natural discharge during non-monsoon season is 131.99 mcm. Future provision for domestic and Industrial use is 32.65 mcm and for future irrigation use, it is 933.17 mcm.

Thus, there is much scope for the development of ground water by way of constructing ground water abstraction structures in a planned way for profitable ground water development.

5.2 Water Conservation and Artificial Recharge

Method of making ground water abstraction structure, type, design, depth of wells, number and spacing between two wells depends on size of aquifer material, depth range & hydraulic parameters of aquifer zones, which differ from place to place. As per earlier reports and present study, following design criteria is recommended.

5.2.1 Shallow Domestic Wells

Open wells and filter point wells are feasible in all area of the district. In unconsolidated sediments, ring well may be constructed by excavating down to the saturated horizon. Cement or earthen rings of 0.80 to 1.20 dia may be placed one above another with weep holes in the bottom rings and these are likely to hold sufficient quantity of water. Depth may range from 9 to 22 m depending upon the topographic elevation. Expected discharge will be 4 to 6 cubic meters per day.

In the iron contaminated areas of the district, it is important to construct Filter Point Wells with a total depth of 10 to 25 m bgl by providing galvanized iron or mild steel pipe and at bottom slotted pipe against aquifer zone either made from bamboo or MS pipe or P.V.C pipe which is suitable. Bamboo as pipe and screen are very much within the reach of small and marginal farmers, as bamboo is locally available in the district. This type of well will be low cost and long lasting. Expected discharge will be 10 to 20 cubic meters per day.

5.2.2 Deep Tube Well for Irrigation Purpose

Goalpara area is feasible for construction of the deep tube wells for irrigation purposes by tapping the granular zones occurring beyond 35-50 m bgl. Housing pipe should be large enough to accommodate the pump. Based on the static water level, maximum draw down and seasonal fluctuation, length of housing pipe may range from 30 to 40 m bgl. Along foothill region of inselbergs and towards southeastern part bordering Meghalaya State, it may range from 20 to 30 m bgl. For avoiding corrosion and clogging of well screen, the entrance velocity should be less than 2 cm/sec.

6.0 Recommendations

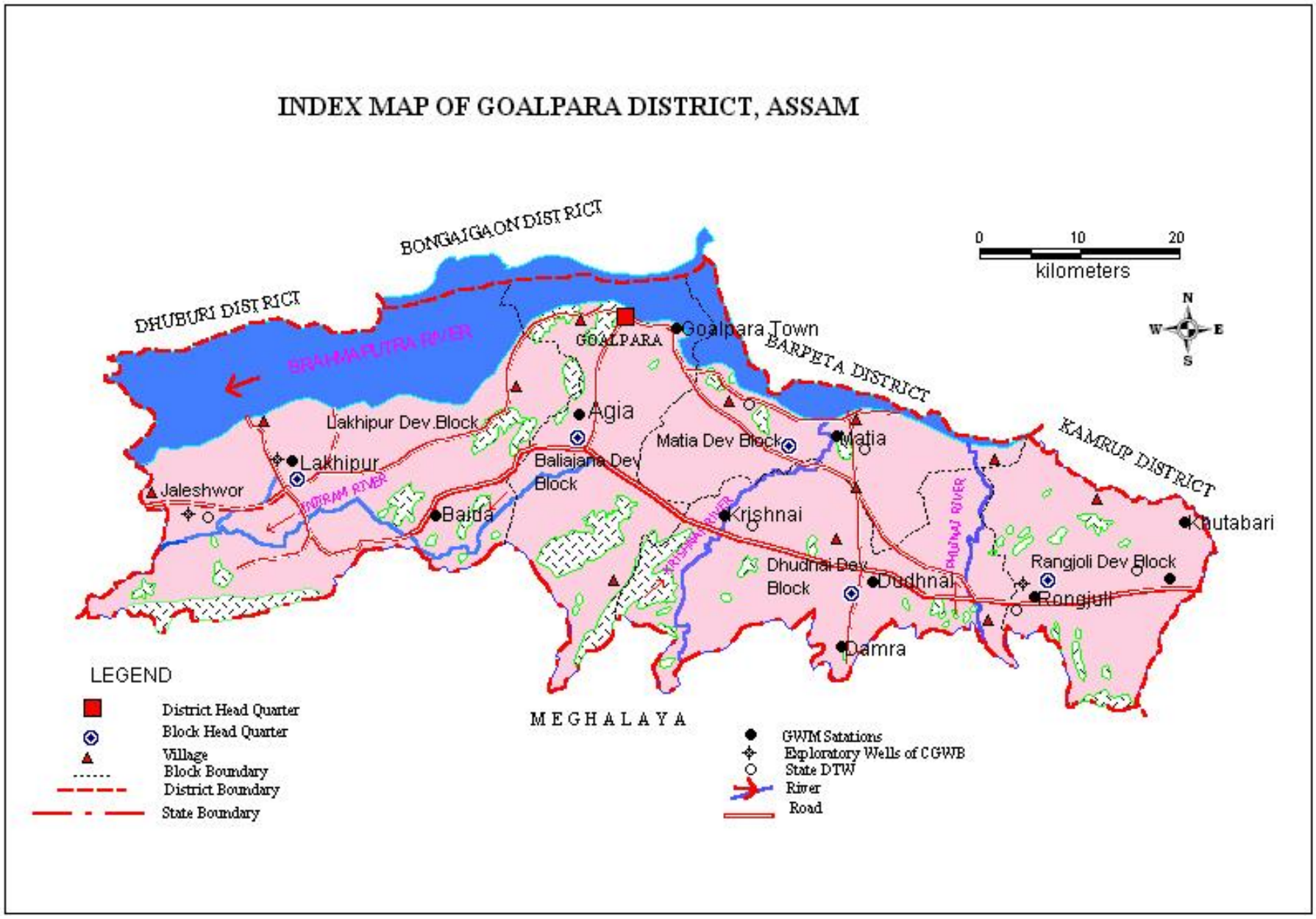
The hydrogeological condition and ground water resource in the district indicates the scope for the development of ground water by constructing ground water abstraction structures in a planned way for profitable development stage.

In view of Ground water quality, there is no major change in the chemical quality of water for the last ten years except the recent report of high content of fluoride in ground water in a few exploratory wells of the district. Presence of fluoride content in the

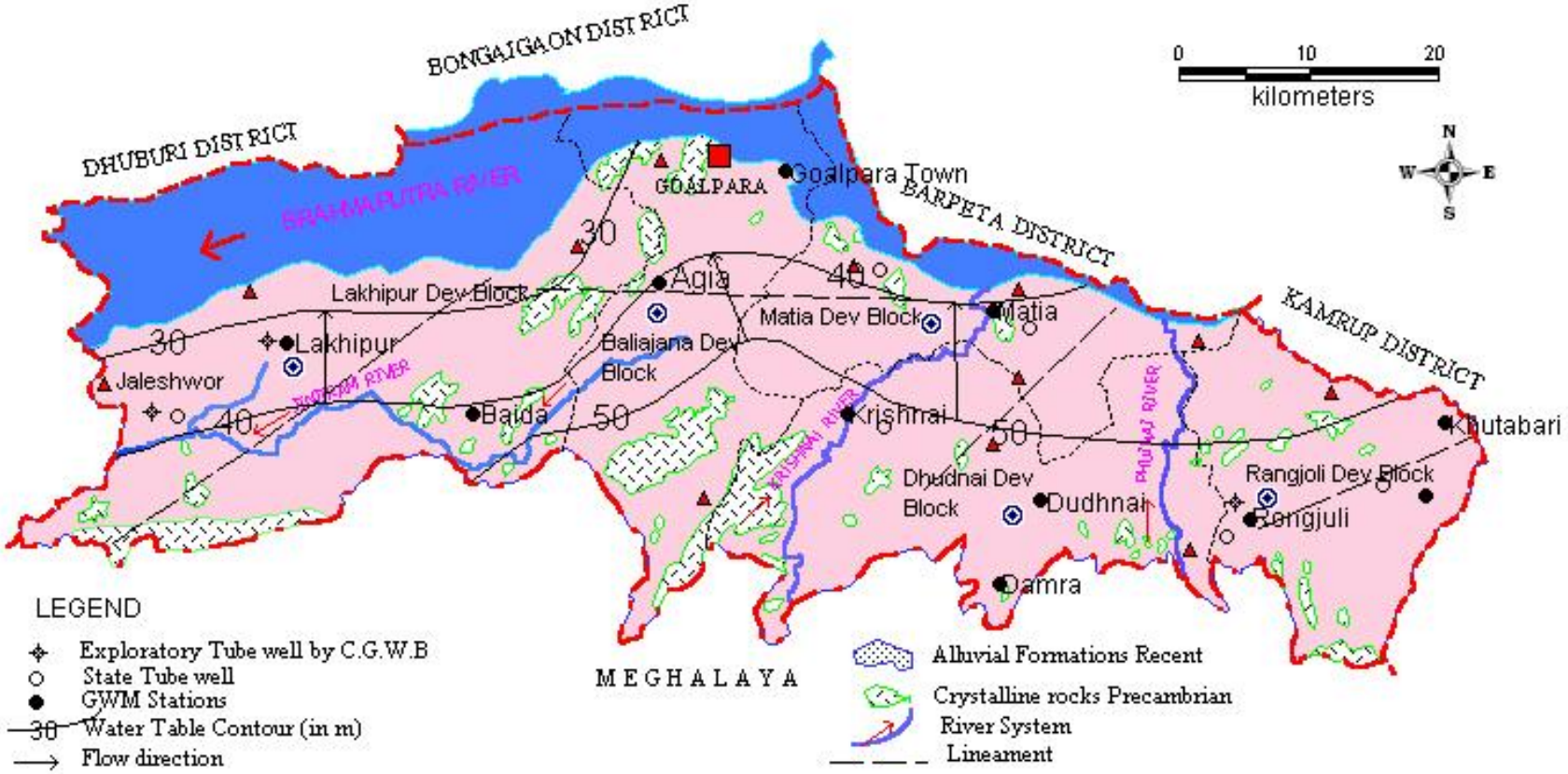
fracture zone at the exploratory well of Darangiri is 7.6 mg/l, which is more than the permissible limit of Indian water Standard for drinking purposes.

Keeping in view this updated picture of chemical quality scenario of ground water in the district, it is advisable to test the potability of ground water before using it for drinking and cooking purpose. A long term environmental planning is also essential to blunt the danger from such pollution problems. The status of chemical quality of ground water regime and its utilized formulation for future ground water development programme and drinking water management strategy must assume a greater significance.

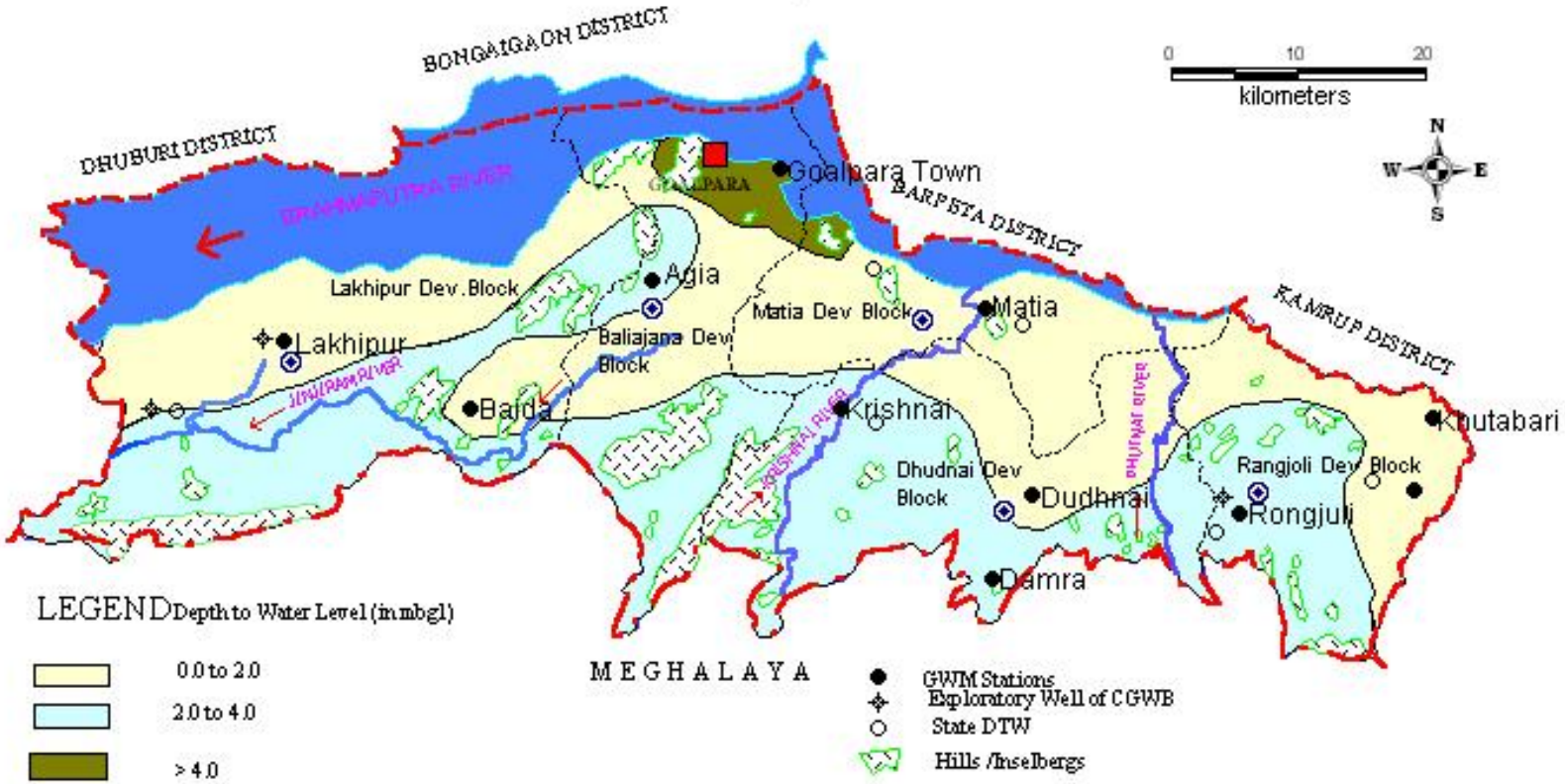
Iron treatment plants need to be installed with PHED water supply station under the regular monitoring of the ground water of the existing water supply stations. Proper rehabilitation of sick wells in the district is to be carried out so as to mitigate water scarcity as reported from different village.

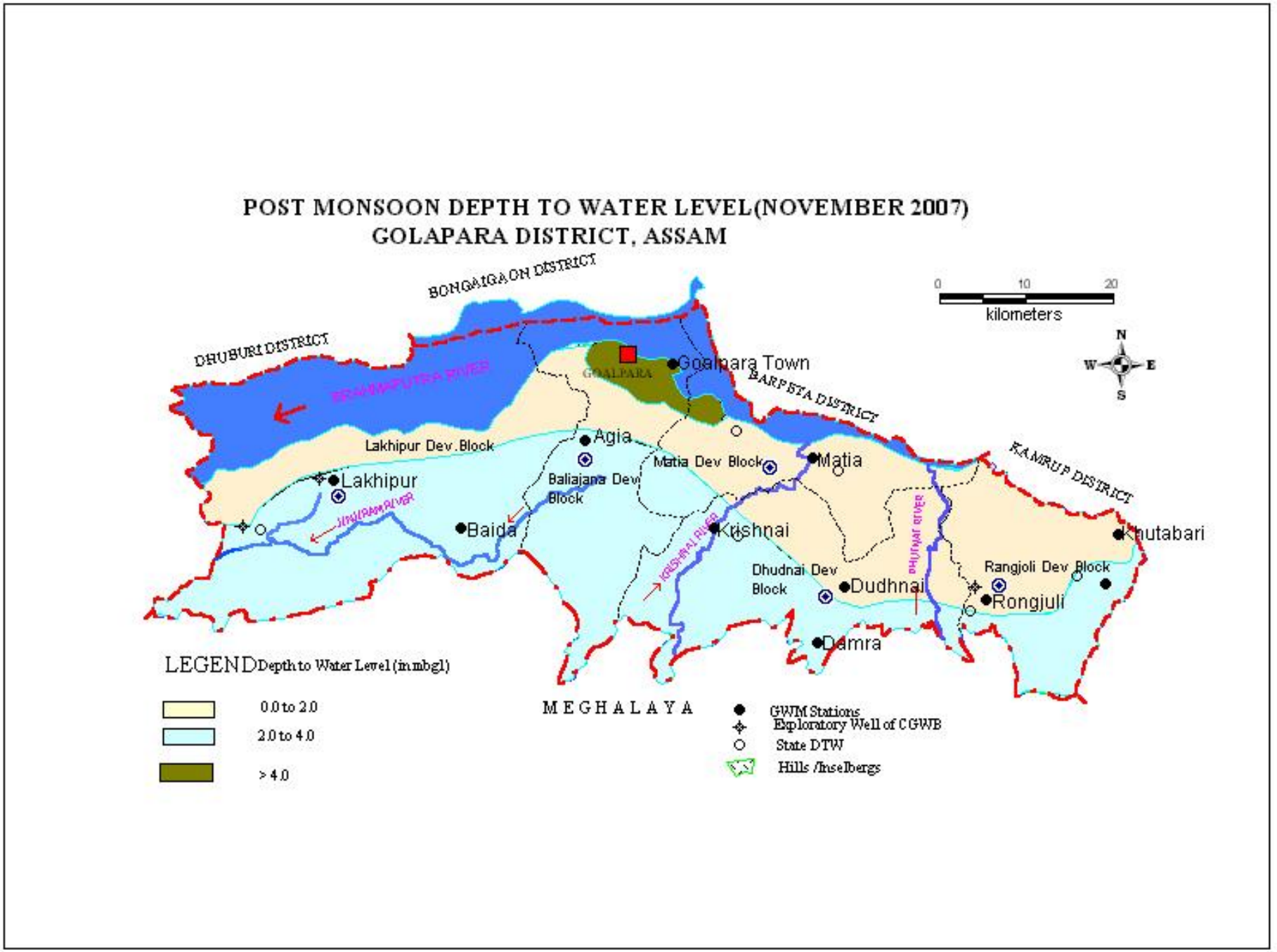

INDEX MAP OF GOALPARA DISTRICT, ASSAM
BONGAIGAON DISTRICT
DHUBURI DISTRICT
BRAHMAPUTRA RIVER
GOALPARA
Goalpara Town
BARPETA DISTRICT
KAMRUP DISTRICT
0
10
20
kilometers
N
W
E
S
Agia
Lakhipur Dev.Block
Lakhipur
Jaleshwor
Baida
Baliajana Dev Block
Matia Dev Block
Matia
Krishnai
Dhudnai Dev Block
Dudhnai
Rangjoli Dev Block
Rongjuli
Khutabari
Damra
MEGHALAYA
LEGEND
District Head Quarter
Block Head Quarter
Village
Block Boundary
District Boundary
State Boundary
GWM Satations
Exploratory Wells of CGWB
State DTW
River
Road

MAP SHOWING HYDROGEOLOGICAL SETUP OF GOALPARA DISTRICT, ASSAM



PRE-MONSOON (APRIL2007) DEPTH TO WATER LEVEL MAP, GOALPARA DISTRICT, ASSAM




POST MONSOON DEPTH TO WATER LEVEL(NOVEMBER 2007)
GOLAPARA DISTRICT, ASSAM
BONGAIGAON DISTRICT
DHUBURI DISTRICT
BRAHMAPUTRA RIVER
GOALPARA
Goalpara Town
BARPETA DISTRICT
KAMRUP DISTRICT
Lakhipur Dev. Block
Agia
Matia Dev Block
Matia
Lakhipur
Baliajana Dev Block
JINJIRAM RIVER
Baida
Krishnai
KRISHNAI RIVER
DHUMAI RIVER
Khutabari
Dhudnai Dev Block
Dudhnai
Rangjoli Dev Block
Rongjuli
Damra
0 10 20
kilometers
N
W E
S
LEGEND Depth to Water Level (in mbgl)
0.0 to 2.0
2.0 to 4.0
> 4.0
MEGHALAYA
GWM Stations
Exploratory Well of CGWB
State DTW
Hills /Inselbergs

IRON CONCENTRATION RANGE IN GOALPARA DISTRICT, ASSAM

FLUORIDE CONCENTRATION RANGE IN GOLAPARA DISTRICT, ASSAM