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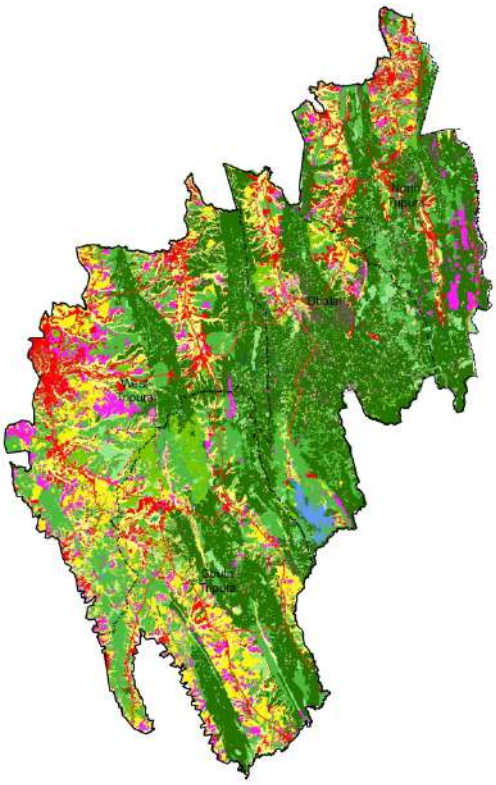
HYDROGEOLOGICAL CONDITIONS AND GROUND WATER DEVELOPMENT PROSPECTS IN TRIPURA



CENTRAL GROUND WATER BOARD
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MINISTRY OF JAL SHAKTI
जल शक्ति मंत्रालय
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March, 2023

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ABBREVIATION

AAP	Annual Action Plan
CGWB	Central Ground Water Board
NER	North Eastern Region
NAQUIM	National Aquifer Mapping and Management Plan
GL	Ground Level
LPM	Litres per minute
LPS	Litres per second
GSI	Geological Survey of India
m	Metre
mbgl	Meters below ground level
MCM	Million Cubic Meter
Mm	Milli meter
mg/l	milligram/litre
m amsl	Metre above mean sea level
Sq.Km	Square Kilometre
µS/cm	Microsiemens/centimetre
BIS	Bureau of Indian Standards
BDL	Below detectable level
BCM	Billion Cubic Metres
DTW	Depth to water table
DW	Dug Well
BW	Bore well
EC	Electrical Conductivity
EW	Exploratory Well
GEC	Ground water Estimation Commitee
Ha	Hectare
Ham	Hectare meter
Km	Kilometer
MP	Measuring Point
OW	Observation Well
°C	Degree Celsius
Ppm	Parts per million equivalents to mg/l
Pz	Piezometer
SWL	Static water level
TDS	Total dissolved solid
GWMW	Ground water monitoring well
PWD (WR)	Public Work Department (Water Resources)
PWD (DWS)	Public Work Department (Drinking Water & Sanitation)

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EXECUTIVE SUMMARY

Tripura, bounded between the geographical coordinates 22° 56' 32" and 24° 31' 51" N latitudes and 91° 09' 15" and 92° 19' 51" E longitudes, is the third smallest states of India. The erstwhile princely state of Tripura merged with the Union of India after independence on the 15th October, 1949 as Group-C category state. Then it became a Union Territory on 1st July 1963. Finally, Tripura emerged as a full-fledged state on the 21st January 1972.

The state is spread over a total geographical area of 10,491.69 Sq.km and nearly 60% area of the state is covered by forest.

Physiographically, the state is covered by hilly terrain with an immature topography. The major geographic features are tightly folded anticlinal hill ranges and broad synclinal valleys in between. The altitude of the hill ranges increases progressively from west to east attaining a maximum of 975.36 m above mean sea level (amsl) at Betling Shib in Jampui hill range. It is drained by ten major rivers, viz. Gomati, Haora, Khowai, Deo, Juri, Dhalai, Manu, Longai, Fenny and Muhuri. The drainage system of the state forms a part of the Meghna basin.

As per 2011 census Tripura has a population of 36,73,917 consisting of 18,74,376 male and 17,99,541 females. The density of population in Tripura is 350 persons per Sq. Km. 73.8% of the population is staying in rural areas while 28.2% of the population is urban.

The climate of the State is tropical, highly humid with average annual rainfall of 2241 mm.

The State is basically agrarian and about 42 % of the population is dependent on agriculture. The net cultivable area of the state is 2714 sq.km. This constitutes only 25% of the state's total geographical area. The state is hilly and nearly 60% area is under forest.

The state is underlain by unconsolidated Recent alluvium and Semi-consolidated sedimentary formations, comprising Tertiary Group of rocks represented by the Dupitila, Tipam and Surma formations.

Groundwater occurs under unconfined to confined conditions and autoflow condition occurs in some part of the state. At shallow depths, in shallow aquifers ground water occurs mainly under unconfined condition. In some small isolated zones ground water at shallow depths occurs under semi-confined to confined conditions and at some parts shows artesian condition. Water bearing formation occur both in shallow alluvial formation and Tertiary coarse clastics occurring in deeper horizons.

Auto flow artesian conditions have been found in a number of valleys. The artesian flowing conditions occur in patches in both shallow and deeper depths. Discharge of the auto flowing wells ranges from 100 to 6000 lph. Generally, the piezometric head rises up to 2.5 m above ground level (agl).

The semi-consolidated Tertiary Formations constitute the main hydrogeological units in the state. Other small depositions of alluvial formations of Recent age also constitute the local hydrogeological units along major river courses.

Aquifer system of the state is divided into two groups –shallow aquifer group, generally within 50 m bgl (sometimes within 30 m bgl) and deep aquifer group between 50 to 300 m bgl. In shallow aquifer group, ground water occurs under unconfined and semi-confined conditions, whereas in deeper aquifer group ground water occurs under semi-confined to confined conditions.

Shallow aquifers have been intersected within a depth of 50 m bgl and the deeper aquifers occur in the depth range of 50 to 200 m. Ground water in the near surface zones occurs under unconfined conditions with the depths to the water table for the whole year commonly range from 2 to 6 m.

Deeper aquifers consisting of semi-consolidated sandstone of Tipam formation constitute the most prolific aquifers with 2 to 4 granular zones within 300 m depth. Ground water in the deeper horizons is held under pressure.

The recharge area for the deeper aquifers, situated in the valleys of Tripura, lies on the adjacent anticlinal hills. Auto flow artesian conditions have also been found in a number of valleys. In fact, the geology as well as geomorphology of the state is favourable for such artesian conditions within synclinal valleys.

The depth to water level for shallow aquifers during pre-monsoon period generally lies between 1 and 7 m below ground level (bgl) and during post-monsoon period it lies between 1 and 6 m bgl. Generally, the fluctuation of water level varies from 0.06 to 2.98 m. There is no significant decline in trend of ground water level for the last decade in the state.

Transmissivity and Permeability of the aquifers in the state range from 4.5 to 1689 m^2/day and from 0.1 to 43.90 m/day respectively. The Storage Coefficient or Storativity ranges from 7.5 x 10^{-4} to 1.775 x 10^{-3} showing confined to slightly semi-confined nature of the deeper aquifers.

Under exploration programme of Central Ground Water Board till date (March, 2023), a total 102 Wells at 76 different locations have been drilled, that includes 65 EW, 26 OW, 9 Deposit Wells and 2 Slim holes. The valley portions of the state have proved to be ground water worthy up to the depth of 300+m.

In general, the chemical quality of ground water of the state is good and suitable for both the domestic and irrigation purposes. However, occurrence of excessive iron has been reported in some parts of the state.

Groundwater resources of the state based upon GEC-2015 methodology is assessed from time to time and last Estimation was done during 2022. The net annual groundwater availability of the state is 1.18 BCM as on March 2022. The estimation also reveals that the stage of ground water extraction in the state is insignificant and is only 9.7%.

As the incidence of rainfall is high in the state, rainwater harvesting is another viable option to augment the water supply. Harvested rainwater can be utilized to meet the domestic water demand and excess rainwater can be utilized for recharging groundwater also. Soil and water conservations on gentle hill slopes may be taken up by constructing contour bunds and trenches. Rainwater harvesting may be adopted successfully to meet the demand of the rural people residing on the hilltops, particularly during non-monsoon period, as the average non-monsoon rainfall in Tripura is generally in the tune of 800 to 1000 mm.

In many parts of the hilly areas, there are some open spaces called platforms or terraces. Platforms are raised areas and may be cemented or covered by plastic sheets spread, which will have distributors of rainwater on all the sides. These platforms should be fully protected from approaching by animals and human beings. Maintenance of platforms in hygienic way is a must. Surface runoff should not be allowed to enter into the platforms. The rainwater collected by this method can then be used by rural people residing on hills for domestic purposes.

The scope of conjunctive use of surface water and ground water may be studied in minor irrigation command areas. This will help in minimizing water logging problem and materialize the equal distribution of irrigation water in the cropped area.

There is a huge scope for further development of ground water resources for domestic and irrigational purposes in the state. Ground water development for drinking and domestic, industrial and irrigation purpose can be done through dug wells, shallow tube wells, medium depth tube wells and deep tube wells. If ground water is harnessed with proper planning and management, the agro-economic scenario of the entire state may be uplifted.

TRIPURA STATE AT A GLANCE

1	**Location**	North Eastern part of India North Latitude - 22° 56′ 32′′ to 24° 31′ 51′′ East Longitude - 91° 09′ 15′′ to 92° 19′ 51′′
2	**Geographical area**	10,491.69 sq. km.
3	**Administrative Divisions**	District: 8.; Sub-Division: 23; Block : 58, G.P : 591 Tripura Tribal Areas Autonomous District Council (area-7,132.56 sq.km) Nos. of TTAADC Constituencies: 28; ADC villages : 587
	(a) District	(i) West Tripura, (ii) Khowai, (iii) Sipahijala, (iv) Gomati (v) South Tripura, (vi) Dhalai, (vii) North Tripura, (viii) Unakoti
4	**Capital**	Agartala (altitude 12.80 m amsl)
5	**Population (Census 2011)**	Total - 36,73,917 (Male – 18,74,376, Female – 17,99,541) Population Density– 350 persons/sq. km; SC– 17.82 %, ST– 31.76 % Rural Population- 27, 12, 464; Urban Population- 9, 61, 453
	Literacy	Literates– 28, 04,783 (Male– 15, 01,369, Female– 13, 03,414 Literacy rate- 87.2 % (Male – 91.5 %, Female – 82.7 %)
	Sex Ratio	960 (F)/1000 (M)
	Decadal Growth (2001-11)	14.84 % (as per 2011 Census)
6	**Hydrometeorology**	Normal Annual Rainfall - 2262 mm Co-Efficient of Rainfall Variation - 7 to 30 % Temperature variation throughout the Year - 5.1^0 C to 35.6^0 C
7	**Rivers and Surface Water Bodies**	**Basin**: Meghna; **Sub-basin**: Barak, Gomati and Fenny
	Rivers	Manu, Dhalai, Gomati, Fenny, Haora, Khowai, Deo, Juri and Longai
	Surface Water Bodies	Gomati and Dambur Reservoirs in Dhalai District and Rudrasagar in n West Tripura District
8	**Land Use (2020-21) in Hectares**	**Area Under Forest**: 6,29,426 hectares **Total Cultivable Area:** 2,70,755 hectares(2020-21), 271052 ha (2019-20) **Net Area Sown**: 255466 hactares (2020-21), 2,55,368 hectares (2019-20) **Miscellaneous pastures, cultivable waste land, Tree Crop & Groves** (not included in Net Area Sown)- 9838 ha (2020-21) 10,037 ha(2019-20)
9	**Irrigation**	**Irrigable Land** – 1,17,000 hectares **Area brought under Irrigation** – 1,17,544 (March 2019) (WR– 81354; RDD– 30642; Agri. Deptt. – 3594; TTAADC – 1069; Forest Dept. – 885) **Total Potential Utilised** – 80,701 hectares (March 2019); **Irrigation Coverage by WR Dept. (March 2019):** 81,354 (structures 1931 Nos.) **By Surface Water –** 74,934 (1656 Nos.)**; by Ground Water –** 6416 (275 Nos.)
10	**Geology**	**Upper Tertiary Formation :** Surma, Tipam & Dupitila **Quaternary Formation :** Alluvium
11	**Hydrochemistry**	Ground water is generally **suitable for domestic, irrigation and industrial use**, however, **Iron content is in more than permissible limit** in manylocalities
12	**Ground Water Resources**	Annual Rechargible Ground Water Resource – **1.18 BCM** (As on March 2022) Annual Extractable Ground Water Resource - **1.06 BCM** Annual Extraction for Domestic and Industrial Use - **0.08 BCM** Annual Draft for Irrigation Use - **0.02 BCM** Future Allocation of Ground Water for Domestic and Industrial Use up to 2025 - **0.08 BCM** Balance Ground Water for Future Irrigational Use – **0.95 BCM** Stage of Ground Water Extraction - **9.7 %**

1. INTRODUCTION

The state of Tripura is situated in the north-eastern part of India and it is the third smallest state of the country. The erstwhile princely state of Tripura merged with the Union of India after independence on the 15th October, 1949 as Group-C category state. Then it became a Union Territory on 1st July 1963. Finally, Tripura emerged as a full-fledged state on the 21st January 1972.

The state is endowed with considerable natural resources such as fertile soil, well-distributed rainfall, rich flora and fauna, natural gas and abundant water resources. Moreover, the state has vast human resources with present literacy rate of 87.22 % (Male – 91.53 % & Female – 82.73 %) which is significantly higher than the all India rate of literacy (74.04 %). Most significant is that a thumping 85.58 % of the rural population of the state is literate (Rural Male – 90.86 % & Rural Female – 80.06%), which is much higher than the all India rural literacy rate (67.8%) and 5th highest in India after Kerala (94 %), Lakshadweep (91.80%), Mizoram (91.30 %), and Goa (88.70). In terms of area, it is the smallest state in the north-eastern region and third smallest state in the country after Goa and Sikkim. The Census 2011 data reveals that Tripura is the second most populated state in the north-east after Assam with density of 350 persons per sq. km.

1.1 PURPOSE AND SCOPE

Tripura is one of the economically backward states of the country. 74% of the state's total population is rural and depend largely on agriculture for their livelihood.

The state is having huge ground water resource as reserve and the present stage of ground water extraction is only 9.7%. There is ample scope for expansion of irrigation facilities through further ground water development, which will help to grow multiple crops. Keeping this in view, an attempt has been made in this report to depict the hydrogeological conditions and ground water development by synthesizing all available data in pursuance of AAP 2022-23 of CGWB, NER.

1.2 LOCATION AND EXTENT

Tripura, a lush green picturesque state, is situated in the northeastern part of India, which covers a geographical area of 10,491.69 sq. km. It is situated between North Latitudes 22° 56′32″and 24° 31′ 51″ and East Longitudes 91° 09′15″ and 92°19′51″and falls in survey of India Degree Sheet No. 79 M and parts of 78 P, 84 A and 83 D. The Tropic of Cancer passes through the southern part of the state. It is a land-locked state and bounded by Bangladesh on three sides i.e. the west, south- southeast and north. Its north-eastern and eastern boundary is demarcated by the border with Assam and Mizoram respectively. The state shares 856 Km (84 %) of international border with Bangladesh, while it shares 109 km state border with Mizoram and 53 km state border with Assam.

1.3 COMMUNICATIONS

The state is connected to other parts of the country by road, rail and air. The road distance from Agartala to Kolkata was less than 350 km before the partition of the country and now it is 1700 km via Shillong in Meghalaya, Guwahati in Assam and Sliliguri in West Bengal. National Highway 8 (earlier 44), known as Agartala - Assam road, is the only road link with the rest of India through the state of Assam and Meghalaya. Agartala, the State Capital is connected with district towns, sub-divisional headquarters and block headquarters by State Highways and other prominent metalled roads.Sabroom - Agartala – Silchar – Lumding -Guwahati railway line passes through the state, which connects Agartala with Guwahati and the rest of the country. However, Agartala is very well connected with other cities of the country by air through a number of daily flights.

1.4 ADMINISTRATIVE DIVISIONS

Administratively, the state of Tripura is divided into eight districts, which are West Tripura, Khowai, Dhalai, North Tripura, Unakoti, Sipahijala, Gomati and South Tripura with their

headquarters at Agartala, Khowai, Ambassa, Dharmanagar, Kailashahar, Bishramganj, Udaipur and Belonia respectively. Agartala is the state capital. The eight districts are further sub-divided into 23 sub- divisions and 58 blocks. Tripura has one Autonomous Tribal District Council, the Tripura Tribal Areas Autonomous District Council (TTAADC), which has its head-quarter at Khumulwng, 23 kms away from Agartala city. The TTAADC covers about two third of the state's area (7132.56 sq. km.). The 3 tier Panchayat Raj System is prevalent in the state. There are 8 Zilla Parishads and 23 Panchayat Samitis. The total number of Gram Panchayats/ADC Village Councils is 1178, which includes 587 Autonomous District Council (ADC) and 591 elected Gram Panchayats functioning outside the Autonomous District Council areas. The details of administrative divisions have been given in Table 1.1, whereas the Administrative Map of Tripura has been presented in Figure 1.1.

Table 1.1: Administrative Divisions of the State of Tripura

New District	Area (km^2)	Sub-Division	Block	GP	ADC	Revenue Village	Old District
1. North Tripura district (H.Q : Dharmanagar	1444.5 (km^2)	a) Dharmanagar b) Kanchanpur, c) Panisagar	1. Kadamtala, 2. Panisagar, 3. Damcherra 4. Jubaraj nagar, 5. Dasda, 6. Jampui Hills 7. Laljuri, 8. Kalacherra	70	60	89	North Tripura
2. Unakoti district (HQ : Kailashahar)	591.93	a) Kumarghat, b) Kailashahar	1. Gaurnagar, 2. Kumarghat 3. Pecharthal, 4. Chandipur	59	32	78	
3. Dhalai district (H.Q : Ambassa)	2405.3	a) Ambassa, b) Kamalpur c) Gandacherra d) Longtarai Valley	1. Salema, 2. Manu, 3. Ambassa 4. Chhamanu, 5. Dumburnagar 6. Raisabari, 7. Ganganagar 8. Durga-Chowmuhani	41	110	154	Dhalai
4. Khowai district (H.Q : Khowai)	1005.7	a) Khowai b) Teliamura	1. Khowai, 2. Tulashikhar, 3. Padmabil4. Teliamura, 5.Kalyanpur, 6. Mungiakami	54	69	79	West Tripura
5. West Tripura district (H.Q : Agartala)	942.55	a) Sadar b) Mohanpur c) Jirania	1. Dukli, 2. Mohanpur, 3.Lefunga 4. Hezamara, 5. Jirania, 6. Mandai 7. Old Agartala, 8. Belbari, 9. Bamutia	87	85	98	
6. Sepahijala district (HQ: Bishramganj)	1044.8	a) Bishalgarh b) Sonamura c) Jampuijala	1. Jampuijala, 2. Bishalgarh, 3. Boxnagar 4. Melaghar, 5. Kathalia, 6. Charilam 7. Nalchar	111	58	119	
7. Gomati district (H.Q : Udaipur)	1522.8	a) Udaipur, b) Amarpur c) Karbook	1. Matabari, 2. Tepaniya, 3. Kakraban, 4. Killa, 5. Amarpur, 6. Ompi, 7. Karbook 8. Silachari	70	103	132	South Tripura
8. South Tripura district (H.Q : Bilonia)	1534.2	a) Santirbazar b) Belonia c) Sabroom	1. Bogafa, 2. Jolaibari, 3. Hrishyamukh 4. Rajnagar, 5. Bharatchandra Nagar 6. Satchand, 7. Poyangbari, 8. Rupaichari	99	70	138	
Total Districts = 8	**10492**	**Sub-Divisions = 23**	**Blocks = 58**	**591**	**587**	**887**	

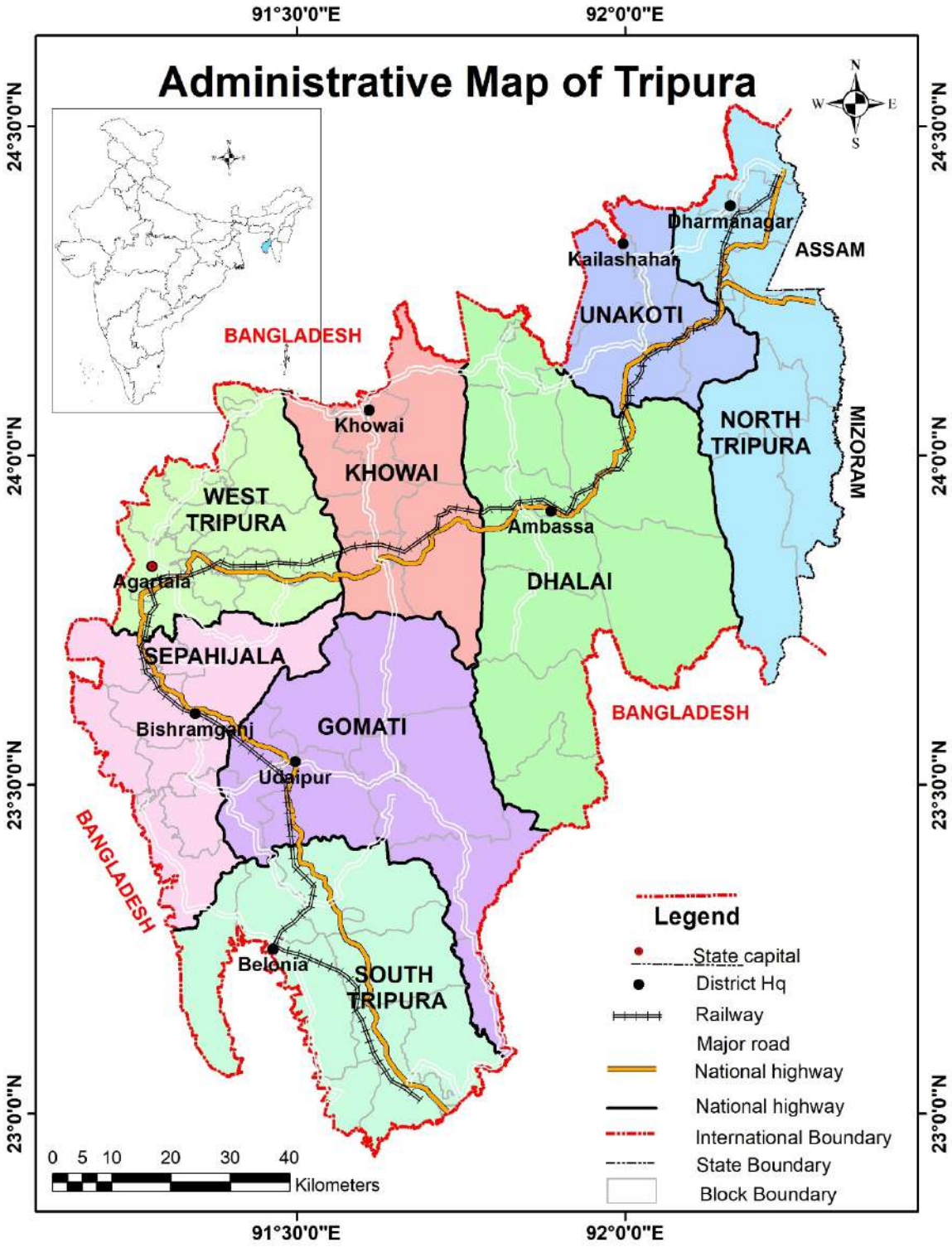

Figure 1.1: Administrative Map of Tripura

1.5 DEMOGRAPHY

The state now has a total population of 36,73,917 persons (Male – 18,74,376 & Female – 17,99,541) as per Census 2011; out of which 27,12,464 is rural population, which constitutes 74 % of the total population and 9,61,453 persons are under urban population, which is 26 % of the total population (Table 1.2). West Tripura district is the most populous district which constitutes about 24.99% (9,18,200 persons) of the total population of the state with population density of 973 persons/sq. km (Table 1.2). Unakoti district has the minimum population of 2,76,506, with population

density of 157 persons/sq. km. The density of population for the whole state is 350 persons/sq. km, whereas in 2001 the density was 305 persons/sq. km. The percentage of decadal variation for the period 1991-2001 was 15.68 %, which indicate a sharp decline from that (34.30 %) of period 1981-91 (Table 1.2). Percentage of decadal variation for the last decade i.e. 2001-11 is found to be 14.84 %. Current population details of the state has been presented in Table 1.2 (2011 census).

There are 19 Scheduled Tribe communities with a total population of 11,66,813 which comprises 31.76% of the state's total population. 17.82% of the total population of the state of Tripura comes under Scheduled Caste category, which is amounting to be 6,54,918 persons.

Table 1.2: District-wise Population (Census 2011)

District/ Sub-Division	Total Population			Rural		Urban		Percentage of decadal growth		Density per sq. km.	
	Person	Male	Female	Male	Female	Male	Female	1991-01	2001-11	2001	2011
West Tripura	918200	466152	452048	535911	511434	342019	335255	18.48	12.88	862	973
Khowai	327564	167401	160163						11.51	292	326
Sepahijala	483687	247829	235858						12.48	412	463
Dhalai	378230	194544	183686	173599	163914	20743	19732	10.96	22.776	128	157
North Tripura	417441	212650	204791	291577	281477	60894	59333	26.49	13.65	249	288
Unakoti	276506	140210	136296						19.66	392	469
Gomati	441538	225428	216110	384418	367721	62706	60299	6.78	13.348	253	287
South Tripura	430751	220162	210589						14.726	251	283
TRIPURA	**3673917**	**1874376**	**1799541**	**1385505**	**1324546**	**486362**	**474619**	**15.68**	**14.84**	**305**	**350**

Table 1.2 A: Decadal population Variation

Year	Total Population	Percentage of Decadal variation
1874-75	74,523	-
1881	95,637	23.83
1891	1,37,575	43.85
1901	1,73,325	25.98
1911	2,29,613	32.48
1921	3,04,437	32.59
1931	3,82,450	25.63
1941	5,13,010	34.14
1951	6,45,707	24.56
1961	11,42,005	78.71
1971	15,56,342	36.28
1981	20,53,058	31.92
1991	27,57,205	34.30
2001	31,99,203	16.03
2011	36,73,917	14.75
2021	40,90,000	Projected

*The projected population of Tripura is estimated to be 40,90,000 in 2021, out of which male is 20,80,000 and female is 20,10,000. (Source: Economic review of Tripura, 2020-21)

1.6 ACTIVITIES OF CGWB AND PREVIOUS WORKS

The ground water resources in the state remained unexplored till the end of 1970 although the Geological Survey of India had taken up Short-Term Investigations and Systematic Hydrogeological Investigations from time to time. In 1974 Central Ground Water Board undertook the initiative of scientific exploration for ascertaining the ground water potentialities of the state aided by exploratory drilling in semi-consolidated Tertiary Formations. Under exploration programme of

Central Ground Water Board till date, a total 102 Wells at 76 different locations have been drilled, that includes 65 EW, 26 OW, 9 Deposit Wells and 2 Slim holes. The valley portions of the state have proved to be ground water worthy up to the depth of 300+m. Under Systematic Hydrogeological Surveys, all the four districts of the state have already been covered. Reappraisal hydrogeological survey has also been carried out since early nineties and further hydro-geological surveys are being conducted from time to time. National Project on Aquifer Mapping and Management (NAQUIM) has been carried out for all the districts in the State.

Central Ground Water Board has established 106 including 96 DugWells and 10 Pz (Updated Jan, 2023) Ground Water Monitoring Wells under National Hydrograph Station Network for periodic monitoring of the behavior of ground water level including its chemical aspect in the state. The various reports on hydro-geological surveys, exploratory drilling and ground water resource estimation are carried out for the state from time-to-time.

1.7 SOIL

The soils of the state of Tripura can be classified into two major groups based on their origin, namely residual soil and transported soil or alluvial soil. Each group of soils consists of association of several taxonomic units, which are developed in different phases of the landscape. Soils in the state are generally acidic in nature, contains low nitrogen and phosphate, medium to high available potash and deficient of calcium, magnesium and sulfur.

The humid tropical monsoon climate has given rise to many groups of soils. Based on LANDSAT Imagery (1986) and Atlas of Agricultural Resources of India (Das Gupta, 1980) the soils of the state have been classified into five board groups, i.e. (i) Reddish yellow-brown sandy soils, (ii) Red loam and sandy loam soils, (iii) Older alluvial soils, (iv) Younger alluvial soils and (v) Lateritic soils. The distribution of soils is shown in Figure 1.2 and the details are given in Table 1.3. The detailed descriptions of each group of soils are given as follows:

(i) Reddish yellow brown Sandy soil: Reddish yellow-brown sandy soils are extensively residual in nature occurring on the north-south oriented hill ranges and other upland areas of Tripura, crowned with the lush evergreen tropical forests and near inter-montane valleys. Nearly 33% of the geographical area of the state is covered with the reddish yellow brown sandy soils. This soils occurring in ridge tops and sloping flanks of the hill ranges, are highly susceptible to erosion. Due to continuous erosion and chemical weathering of the bed rock, the finer fractions of the soil mantle have been leached down to the lower horizons of the soil profile, leaving the epipedon littered with a layer of coarse silty or fine sandy material of reddish brown hue. The surface colour of these soils is usually found to be yellowish brown to dark brown. Taxonomically, the reddish yellow brown sandy soils are alfisol (mainly ultic) mixed with erosion-affected Inceptisols. As a result of continuous leaching under heavy rainfall conditions, these soils are rather poor in nutrients.

***(*ii) Red loam and Sandy loam soil:** The red loam and sandy loam soils are the most extensive formation, covering about 43 % of the total geographical area of the state. Genetically, the red loam and sandy loam soils are associated with the intermountain valleys and the forest cover of undulating uplands. These soils are largely of residual nature are generated under forest environment. Taxonomically, they are fairly mature soils, can be classified as Alfisols comprising association of Ultic Hapludalfs and Typic Paleudalfs.

These red soils are fairly rich in nutrients. They are susceptible to heavy erosion under heavy rainfall condition; especially those located on sloping grounds. There are as many as 14 soil series in this particular group.

(iii) Older alluvial soil: Older alluvial soils, though of recent origin are fairly matured soils of transported in nature. These soils cover nearly 10 % area of the state occurring on river terraces and high plains. They are fairly rich in nutrients and are subject to gully erosion. At least five soil series have been identified in this group.

In the high plains, the profiles of the older alluvial soils are usually well developed and these soils are taxonomically branded as Alfisols (Type Ochraqualfs) though at places are associated with

rather immature Inceptisols (Typic Haplaquepts). Due to chemical weathering of some of older alluvial belt, lithomargic ocher has been deposited in the lower part of soil horizon.

(iv) Younger alluvial soil: Younger alluvial soils are mainly confined to flood plains of rivers and covers only 9% of the total area of the state. These soils usually comprise clay loams and loams and belong to the Entisol group. Taxonomically, the soils can be classified as Typic Udifluvents. These soils are extremely rich in nutrients and are capable to yield assured harvest of rice and jute. However, they are liable to erosion by lateral cutting and bank collapse.

(v) Lateritic soil: There are some Moorish uplands with Lateritic soils confined close to the western boundary of the state mostly south of Sonamura, which cover only 5% of state's total area.

Lateritic soils are of residual in nature and are extremely poor for agricultural activities. The water soluble materials occurring in the bed rocks having been washed down to the lower horizon of the soil profile, the upper part is then left with a suff which comprises the lateritic soils. The texture of the lateritic soils is coarse and the soils are extremely poor in nutrients. Such soil supports tolerably good vegetal cover, which usually consists of grasses, scrub and bushes. Taxonomically, the lateritic soils are Ulticols, consisting largely of Typic Palehumults.

Table 1.3: Soil types of Tripura

Sl. No.	Soil Group	Area		Soil taxonomic unit	Occurrence
		Sq. Km.	Percent		
1	Reddish yellow brown sandy soils	3,468	33.06	(i) Ultic Hapludafs	Hill ranges
				(ii) Udic Ustochrepts	
				(iii) Typic Udorthents	
2	Red loam and sandy loam soils	4,514	43.07	(i) Ultic Haplustalfs	Intermontane valleys and forest covered undulating lands
				(ii) Typic/Ultic Hapludalfs	
				(iii) Typic Paleudalfs	
				(iv) Typic Ustochrepts	
				(v) Typic Drystochrepts	
				(vi) Udic Ustochrepts	
				(vii) Typic Ustochrepts	
3	Older Alluvial soils	1,019	9.71	(i) Typic Ochraqualfs	River terraces and high plains
				(ii) Typic Haplaquepts	
4	Younger Alluvial soils	980	9.34	(i) Typic Udifluvents	Flood plains of streams
5	Lateritic soils	510	4.86	(i) Typic Palehumults	Western boundary of the state
				(ii) Typic Plinthustults	
				(iii) Typic Plinthudults	
				(iv) Typic Paleudults	

A number of micro watershed projects both in the rain fed areas and in shifting cultivation areas are being implemented all over the state in order to minimize the hazards of soil erosion and to maintain soil health for increased cultivation of different crops. The essential components of these projects are treatment of arable and non-arable land according to the capability following the principles of soil and water conservations.

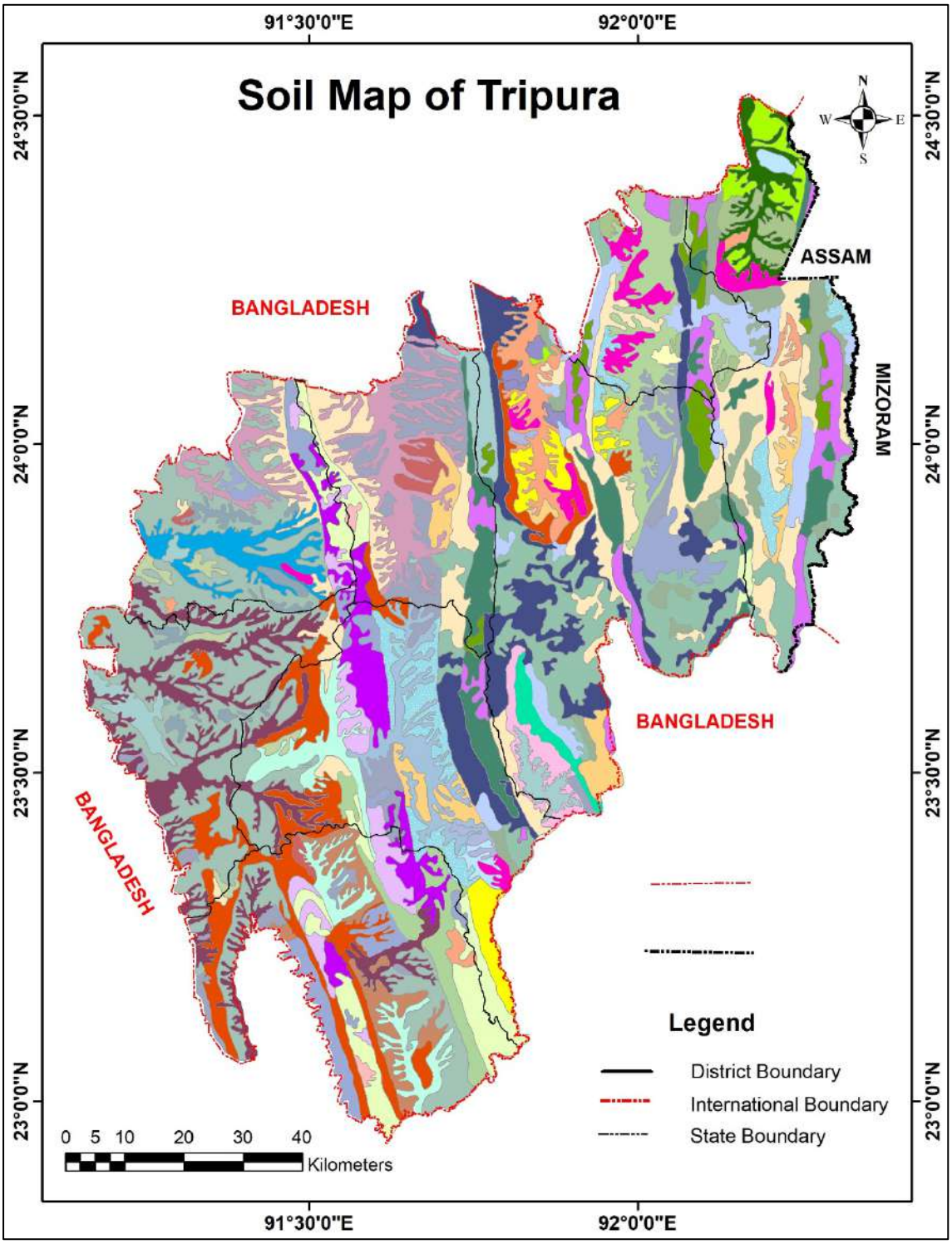

Figure 1.2A: Distribution of different types of Soils in the state of Tripura

Figure 1.2B: Index Map of the distribution of different types of Soils in the state of Tripura

1.8 LAND UTILIZATION

The land available for cultivation is relatively restricted. Nearly 60 % of the state's total area is classified as forest. As on 2020-21, the total cultivable land in the state is 2,70,755 ha which is highest in Sepahijala (47,591) followed by South Tripura (43,491), Gomati (40,453), West Tripura (34,322), Khowai (32,644), North Tripura (28,725), Dhalai (22,578) and Unakoti(21,960). The net sown area in the year 2008-09 was 2,55,510 ha , in 2010-2011 was 2,55,426 ha, in 2012 – 13 was 255213 ha, in 2017-18 it was 2,55,095 and in 2020-21 it was 2,55,466. The gross cropped area has increased from 4,46,703 ha in 2008-2009 to 4,69,984 in 2010-11, 4,74,368 ha in 2012 – 13, 4,88,500 ha in 2018-19 and to 4,87,400 in the year 2020-21. The cropping intensity has increased from 175% in 2008-09 to 191% in 2020-21. Table 1.4 is the illustrative of land utilization pattern of Tripura during last three years i.e. from 2016-17 to 2020-21 (Projected).

Table 1.4: Land Utilization Pattern in Tripura during the period of 2016-17 to 2020-21

LAND USE STATISTICS (AREA IN HECTARE)					
LAND USE CLASSES	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21 (P)**
Geographical area	1049769	1049169	1049169	1049169	1049169
Forest area	629426	629426	629426	629426	629426
Land not available for cultivation	147413	147979	148304	148691	148988
Land under Misc, tree crops & Groves not including in net area sown	10525	10423	10125	10037	9838
Permanent pasture & other grazing land	944	944	944	925	888
Culturable wasteland	2878	2878	2578	2578	2478
Current fallow	898	890	1055	955	896
Fallow land other than current fallow	1595	1534	1189	1189	1189
Net cropped area	255490	255095	255548	255368	255466
Gross cropped area	490540	486770	488500	487000	487400
Area sown more than once	235050	231675	232952	231632	231934
Cropping intensity	192	191	191	191	191
Total cultivable area	272330	271764	271439	271052	270755

Source: Agriculture Department, Tripura (Economic Review 2020-21)

District wise Land Use details during the period from 2016-17 to 2017-18 for the state of Tripura and the land use of the whole state of Tripura have been presented in Table 1.5.

1.9 IRRIGATION AND AGRICULTURE :

Agriculture is the main source of the economy of the state and irrigation is an important input for enhancing the productivity of the agricultural sector. Tripura still has no major irrigation scheme and irrigation is mainly dependent on the minor surface water irrigation schemes like lift irrigation, diversion schemes, pick-up weirs (commissioned mainly by PWD, WR), tanks fitted with small 5 HP pumps, water harvesting and watershed management works etc. and to some extent on ground water from Deep Tube Wells, Small Bore Tube Wells, Shallow Tube Wells and Artesian Wells. However, recently three medium irrigation projects namely Gomati, Khowai and Manu irrigation schemes have been commissioned partially. The irrigation programmes of the state are being jointly implemented by the PWD (Water Resources), Rural Development Department (RDD), Agriculture Department, Forest Department and the Tripura Tribal Areas Autonomous District Council (TTAADC). Nearly all the minor irrigation schemes have been handed over to Gram Panchayats or Panchayat Samitis for better operation and maintenance in future. As in 2020-21, total cultivable land of Tripura was 2,70,755 hectares and land under cultivation i.e. the net sown area is 2,55,466 hectares.

Table 1.5: District wise land use pattern in the state of Tripura during the period from 2016-17 and 2017-18 (Area in Ha.)

Name of the District	Year	Geographical area	Area under Forest	Land not available for cultivation	Permanent pastures & other grazing land	Land under Misc. Tree crops and groves not included in Net area sown	Culturable Waste Land	Total (5+6+7)	Fallow Land			Net Area Sown	Total Cropped Area	Area sown more than once	Total Cultivable Area	Cropping Intensity (%)
									Fallow Land other then Current Fallow	Current Fallow	Total					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
North Tripura	2016-17	141837	89292	23725	391	4679	1180	6250	295	264	559	22011	37405	15394	28820	170
	2017-18	141837	89292	23820	391	4633	1180	6204	283	261	544	21977	37118	15141	28725	169
Unakoti	2016-17	68779	33039	13714	258	2739	852	3849	258	190	448	17729	32038	14309	22026	181
	2017-18	68779	33039	13780	258	2712	852	3822	248	188	436	17702	31791	14089	21960	180
Dhalai	2016-17	231394	185940	22809	142	1238	261	1641	600	188	788	20216	34531	14315	22645	171
	2017-18	231394	185940	22876	142	1226	261	1629	578	186	764	20185	34270	14085	22578	170
Khowai	2016-16	92005	54319	4987	0	93	90	183	117	30	147	32369	58293	25924	32699	180
	2017-18	92005	54319	5042	0	92	90	182	113	30	143	32319	57845	25526	32644	179
West Tripura	2016-17	104596	29265	40949	83	495	189	767	97	85	182	33433	62054	28621	34382	186
	2017-18	104596	29265	41009	83	491	189	763	93	85	178	33381	61578	28197	34322	184
Sepahijala	2016-17	103080	30996	24407	11	891	286	1188	123	107	230	46259	102655	56396	47677	222
	2017-18	103080	30996	24493	11	883	286	1180	118	106	224	46187	101866	55679	47591	221
Gomati	2016-17	148910.6	100704	7689	39	103	7	149	62	16	78	40291	79727	39436	40518	198
	2017-18	148910.6	100704	7754	39	102	7	148	60	16	76	40229	79114	38885	40453	197
South Tripura	2016-17	158567	105871	9133	20	287	13	320	43	18	61	43182	83837	40655	43563	194
	2017-18	158567	105871	9205	20	284	13	317	41	18	59	43115	83188	40073	43491	193
State	**2016-17**	**1049169**	**629426**	**147413**	**944**	**10525**	**2878**	**14347**	**1595**	**898**	**2493**	**255490**	**490540**	**235050**	**272330**	**192**
	2017-18	**1049169**	**629426**	**147979**	**944**	**10423**	**2878**	**14245**	**1534**	**890**	**2424**	**255095**	**486770**	**231675**	**271764**	**191**

Table 1.6: Change in District-wise and structure wise irrigation potential created by PWD (WR for irrigation of crops with time)

District	Lift Irrigation (LI + HPLI)		DTW		Diversion		Medium Irrigation		Low/High Pickup Weir		Total Potential Created (Ha)	
	Potential Created		Potential Created		Potential Created		Potential Created		Potential Created			
	2016	2019	2016	2019	2016	2019	2016	2019	2016	2019	2016	2019
West Tripura	7979	8119.69	1647	1888	575	575	0	0	0	0	10201	10582.69
Khowai	6501	6566.32	742	742	535	669	4515	4515	0	0	12293	12492.32
Sepahijala	8666	8755	1199	1473.6	190	190	0	0	0	0	10055	10418.8
Gomati	10177	10314	879	937.5	872	872	4383	4437	0	0	16311	16560.85
South Tripura	6116	6210	600	680.8	2243	3095.5	0	0	0	0	8959.9	9986.4
Unakoti	5735	5903	147	167	0	0	1710	1759	0	0	7592	7829.5
North Tripura	5817	5877	404.5	404.5	140	140	0	0	32	32	6393.5	6454.05
Dhalai	5976	6096	113	123	759	810	0	0	0	0	6848	7029.95
Total	**56967**	**57841.01**	**5731.5**	**6416.4**	**5314**	**6351.5**	**10608**	**10711**	**32**	**32**	**78653.4**	**81354.56**

Table 1.7: Particulars of total area brought under irrigation

Description	Up to March 2015	Upto March 2016	Upto March 2017	Upto March 2018	Upto March 2019
	Area brought under irrigation (ha)				
PWD (Water Resources)	77408	78653	79655	80469	81354
R.D.D	30642	30642	30642	30642	30642
Agriculture	3594	3594	3594	3594	3594
TTAADC	1069	1069	1069	1069	1069
FOREST	885	885	885	885	885
Total	**113598**	**114843**	**115845**	**116659**	**117544**
Net Potential Creation in long past : 52,197 ha (**2000**); 77,722 ha (**2004**) & 1,04,995 ha (**2010**)					

Table 1.8: Medium irrigation project under PWD (WR) Tripura (as on 31.01.2020)

Sl No	Name of medium irrigation Project	Command area (CCA) (in Ha)	Structures (in nos.) (canal)	Net Potential Created upto 31.01.2020 (CCA) (in Ha)
1	Gumti	4486	138	4437
2	Khowai	4515	385	4545
3	Manu	4198	78	1759
	Total	13199	601	10711

Source- PWD (WR)

Net irrigation potential created by different departments of the state has been presented in Table 1.6.

At present there are three medium irrigation projects namely, Gomati in South Tripura, Khowai in West Tripura and Manu in North Tripura.

- **Gomti Irrigation Project** is situated at Maharani, South Tripura district. It has a culturable command command area of 4486 ha and gross command area is 9800 ha. The potential created till March 2014 was 3283 ha, which has been increased to be 4437 ha as on January 2020.
- **Khowai Irrigation Project** is situated at Chakmaghat, West Tripura district. It has culturable command area of 4515 ha and ultimate potential is 8120 ha. Potential created till as on January 2020 was 4545 ha.
- **Manu Irrigation Project** is located at Nalkata in Dhalai district. It has a culturable command area of 4198 ha and ultimate potential is 6025 ha. The potential created till March 2014 was 1710 ha, where as it has now increased to 1759 ha as on January 2020.

As per the record available with PWD (WR) department, the total actual irrigation coverage as on March 2019 by surface water (with 1592 nos. LI, 7 nos. HPLI, 48 nos. of Diversion Schemes, 4 nos. Low & high Pick-up Weir and 3 nos. of medium irrigation scheme i.e. river barrage) is 74353.5 ha, whereas by ground water (through 260 nos. of DTW) the coverage is only 6116 ha. So, the total area brought under irrigation or Irrigation Potential Created by PWD (WR) is 81354 ha (Annexure II) against the Cultivable Land of 255241 ha, Irrigable area of 117000 ha. The actual irrigated area as on march 2019 by PWD (WR) is 81354 ha, whereas the total actually irrigated land or net potential utilization in Tripura by all agencies is 80701 ha.

Agriculture in the state largely depends upon timely monsoon. Soils are very fertile and the state receives abundant rainfall, which is conducive to agriculture and horticulture crops including rubber and tea plantations. Out of total geographical area of 10491.69 sq. km., the net area under agriculture (net area sown) was 2554.66 sq. km. in 2020-21, which constitutes 24.33 % of total geographical area. Proportion of area under agriculture thus is low compared to national level (51%).

Economy of the state is basically agrarian and about 51 % of the population is dependent on agriculture and allied activities for their livelihood as it is the single largest provider of employment to the rural people here. Favorable agro-climatic conditions, fertile soils, sub-tropical climate with pockets of temperate zones, large tilla lands and high rainfall promotes development of horticulture comprising of fruits, vegetables, spices, floriculture, medicinal and aromatic plants etc. Contribution of agriculture and allied activities to the Gross State Domestic Product (GSDP) exceeds 26 %.

60% of the geographical area is high land and covered by forest and only about 27% is available for cultivation. Presently there is a gap between actual production and requirement of food grains in Tripura. Fragmentation of land holding is continuing and the average present holding is 0.60 ha. People in the hills cultivate on high slopes by practicing traditional JHUM (shifting cultivation).

The main crop of the state is paddy; all three i.e. summer paddy (Aus), monsoon paddy (Aman) and winter paddy (Boro) are being raised, which are followed by maize, wheat, sugarcane, mesta, jute, cotton, pulses and oilseeds (Table 1.9). Over a limited area of the state, cashew nut, pineapple and orange are also grown. Rubber and Tea Plantations have also been taken up on small mounds and foothills.

Table 1.9: Details of various crops produced in Tripura for 2020-21

Area, Production & Yield of Agricultural Crops during 2020-21(3rd Advance Estimate)			
Name of Crops	2020-21 (3rd Advance Estimate)		
	Area in Ha	Production in MT	Yield in Kg/Ha
Aush	34881	93760	2688
Aman	147750	475016	3215
Jhum	15493	16423	1060
Total Kharif Rice	**198124**	**585199**	**2954**
Total Kharif Maize	13456	23548	1750
Sorghum	189	161	852
Foxtail / Kaon	978	782	800
Total Foxtail / Kaon & Sorghm	**1167**	**943**	**808**
Arhar	5191	4049	780
Moong	1879	1212	645
B/Gram	4856	3472	715
Cow pea, Assam valley etc.	3855	3123	810
Rajmash	13	12	923
Total Kharif Pulses	**15794**	**11868**	**751**
Kharif Food grains	**228541**	**621558**	**2720**
Sesamum	6056	4088	675
Kharif Ground nut	1075	1548	1440
Soyabean	7	5	0
Total Kharif Oilseed	**7138**	**5641**	**790**
Jute *	429	3754	8.75
Mesta *	255	2206	8.65
Total Jute & Mesta *	**684**	**5960**	**8.71**
Cotton **	589	895	1.52
Sugarcane	741	41663	56225
Boro Rice	66500	219317	3298
Wheat	150	343	2287
Rabi Maize	6000	14910	2485
Foxtail / Kaon (R)	600	510	850
Moong	2150	1613	750
Black gram	3500	2800	800
Lentil	2250	1631	725
Pea	4500	3938	875
Gram	255	159	624
Khesari	50	34	680
Rajmash	1055	897	850
Total Rabi Pulses	**13760**	**11072**	**805**
Rape & Mustard	8500	7242	852
Rabi Groundnut	1250	1938	1550
Total Rabi Oilseed	**9750**	**9180**	**942**

Rabi Food grains	**87010**	**246152**	**2829**
Total Food grains	**315551**	**867710**	**2750**
Total Rice	**264624**	**804516**	**3040**
* indicates Production in Bales of 180 Kg each.			
* indicates Production in Bales of 180 Kg each.			

Source: Agriculture Department, Tripura. (Economic Review, 2020-21)

2. HYDROMETEOROLOGY

2.1 CLIMATE:

The climate of the state istropical, highly humid and characterized by moderate temperature with three prominent seasons - summer, monsoon and winter, where summer spans from March to May followed by southwest monsoon lasting till September. Winter season starts in November and lasts till the end of February and is marked with pleasant days & cold nights followed by a brief spell of spring.

The climate warms up generally from the middle of March and the height of summer is reached during the period from April to May. During this period maximum temperature is generally recorded above 35^0C and the minimum temperature from 21.3^0C to 22.4^0C. Generally, the maximum summer temperature ranges from 35^0–40^0C. Monsoon usually breaks in last week of May or in the first week of June and retreats by the end of September or October. Winter sets in from November and becomes severe in January when average minimum temperature at night is recorded as 8^0C.

Humidity generally remains high throughout the year. Generally, it is high in July and low in March. Relative humidity in a year generally varies from 70% to 85%. In summer, relative humidity varies from 60 to 75% in the morning and from 50 to 60% in the evening. In rainy season, relative humidity remains over 85% in the morning and from 70 to 80% in the evening. Relative humidity recorded at Agartala during a long period in the recent past is 89% to 63% in the morning and 80% to 50% in the evening.

Monthly evaporation varies from 1.6 to 6.9 mm/day (ICAR complex, Lembucherra, West Tripura district). Wind speed varies from 1.0 to 3.8km/hr in winter season and 3.7 to 18.3km/hr in summer and rainy season.

2.2 RAINFALL:

Rainfall occurs under the spell of southwest monsoon and the maximum rainfall is commonly recorded in the month of June and July. The average annual rainfall for the last 42 years (1977–2018) of the state is 2262 mm. The average nos. of rainy days for last 5 years is 95. Both the maximum rainfall of 4009.5mm (1978) and the minimum rainfall of 1205.6 mm (1994) had been recorded at Agartala. The co-efficient of variation of rainfall ranges from 7– 30%, which suggests a low variability of annual rainfall. Broad patterns and distribution of rainfall is shown in Figure 2.1, which reveals that rainfall increases from SW to NE in the state. The highest rainfall value of 2500mm has a N-S disposition through North Tripura district. The lowest rainfall lies around Udaipur-Amarpur area of Gomati district.

The distribution of rainfall in Tripura has been shown in Figure 2.1. The disposition of isohyets brings out the fact that the amount of rainfall gradually decreases from east to west in the northern part of the state and northward in the western district. The variability in aerial distribution of normal annual rainfall can be understood from the recorded rainfall of the following stations: (1) Dharmanagar - 2493.034 mm; (2) Kailashahar - 2471mm; (3) Kamalpur - 2535 mm; (4) Khowai - 2321 mm; (5) Agartala Sadar - 2203 mm; (6) Sonamura-2199mm; (7) Udaipur- 1906 mm; (8) Amarpur- 1724 mm; (9) Belonia - 2311 mm and (10) Sabrum - 2303 mm. Annual Rainfall of Tripura for the year 2013, as recorded in different stations.

Table 2.1: Station wise Average Rainfall in the State of Tripura

Sl. no	Stations	Monthly rainfall (in mm)												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	Kailasahar	3.2	22.5	25.5	197.8	636.3	418.3	173.2	143.1	197.7	97.3	3.4	35.7	1954.0
2	Dharmanagar	0.0	18.6	60.2	208	624.3	490.8	268.8	241.6	248.7	106.3	36.0	20.3	2323.6
3	Kanchanpur	0.0	4.2	75.1	142.6	548.9	719.6	266.5	274.7	150.2	160.1	9.6	24.8	2376.3
4	Kamalpur	22.0	14.2	43.6	300.4	894.0	544.6	174.2	578.0	265.0	130.6	8.2	46.4	3021.2
5	Chawmanu	0.0	2.5	37.5	163.5	472.0	693.2	162.4	262.4	159.5	137.2	29.0	15.5	2134.7
6	Gandacherra	0.0	1.5	18.8	235.5	756.8	676.8	385.2	157.1	67.1	122.1	5.2	9.6	2435.7
7	Khowai	12.4	11.4	79.2	158.4	834.0	511.6	312.0	257.6	98.2	55.8	2.2	33.6	2366.4
8	Teliamura	19.4	9.0	71.0	122.0	676.8	645.6	202.4	186.8	50.0	65.6	25.2	11.6	2085.4
9	Sonamura	0.0	0.0	9.0	205.0	381.2	386.6	184.6	129.4	173.4	38.2	29.4	2.2	1539.0
10	Bishalgarh	0.0	19.2	27.4	240.7	521.2	393.6	169.6	45.2	41.3	17.2	0.0	6.2	1481.6
11	Sadar	0.0	9.1	28.4	172.0	558.0	444.9	215.0	160.7	83.2	46.9	21.0	23.5	1762.7
12	Jirania	0.0	8.2	28.2	149.2	661.6	521.5	202.0	228.7	108.5	53.7	19.0	25.0	2005.6
13	Matabari	0.0	0.5	18.6	271.7	561.5	326.6	249.0	231.8	233.3	47.9	19.2	2.0	1962.1
14	Amarpur	0.0	0.0	36.7	208.9	647.8	433.7	298.9	232.1	51.7	28.5	32.4	6.2	1976.9
15	Belonia	0.0	2.4	5.6	248.8	388.4	484.8	381.0	346.4	114.2	76.2	0.2	6.4	2054.4
16	Sabroom	0.0	0.0	11.0	0.0	480.4	916.2	679.2	340.5	109.6	165.8	10.8	0.0	2713.5
17	Bogafa	0.0	4.2	12.2	215.0	504.4	595.0	344.5	239.6	75.2	68.8	1.6	5.0	2065.5
	Average	**3.4**	**7.5**	**34.6**	**190.6**	**596.9**	**541.4**	**274.6**	**238.6**	**131.0**	**83.4**	**14.8**	**16.1**	**2132.9**

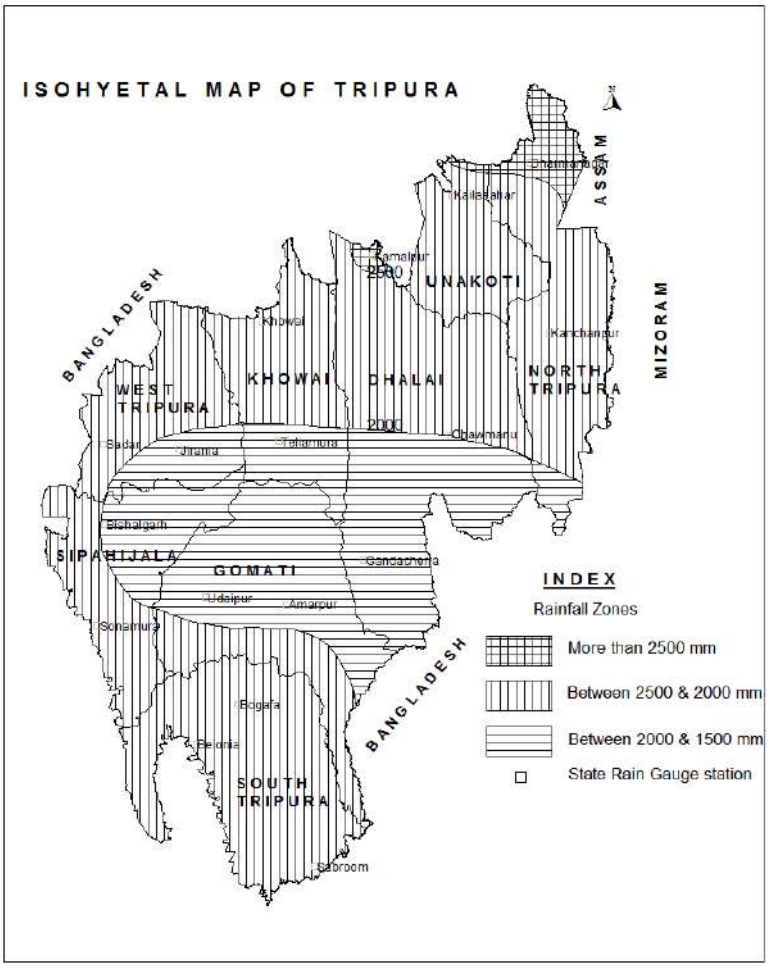

Figure 2.1: Isohyetal Map of Tripura

Table 2.2: Month wise rainfall during 2015 to 2020 in the State:

Rainfall (in mm)							
Name of Month	**Normal**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
January	9.6	0.4	1.8	0.0	3.3	0.0	27.6
February	21.7	12.2	49.8	16.7	8.9	45.4	1.4
March	65.4	14.7	98.2	185.2	35.7	39.7	3.8
April	179.1	318.0	184.2	392.5	190.6	177.2	190.7
May	339.6	333.6	431.0	225.9	601.2	294.8	336.1
June	452.0	282.2	247.8	617.6	519.9	306.7	456.2
July	367.5	514.7	330.9	442.8	258.3	610.8	355.2
August	316.7	338.8	329.5	516.2	222.3	218.4	193.7
September	257.8	296.9	246.4	358.4	135.1	202.6	304.5
October	165.6	105.3	119.6	334.4	80.1	164.1	266.2
November	33.2	3.9	162.3	2.2	14.8	47.2	24.6
December	5.6	10.0	0.6	88.5	17.6	4.8	0.0
Annual Rainfall	**2213.4**	**2229.7**	**2202.2**	**3180.4**	**2087.8**	**2111.7**	**2160.0**

Source: Agriculture Department, Tripura.

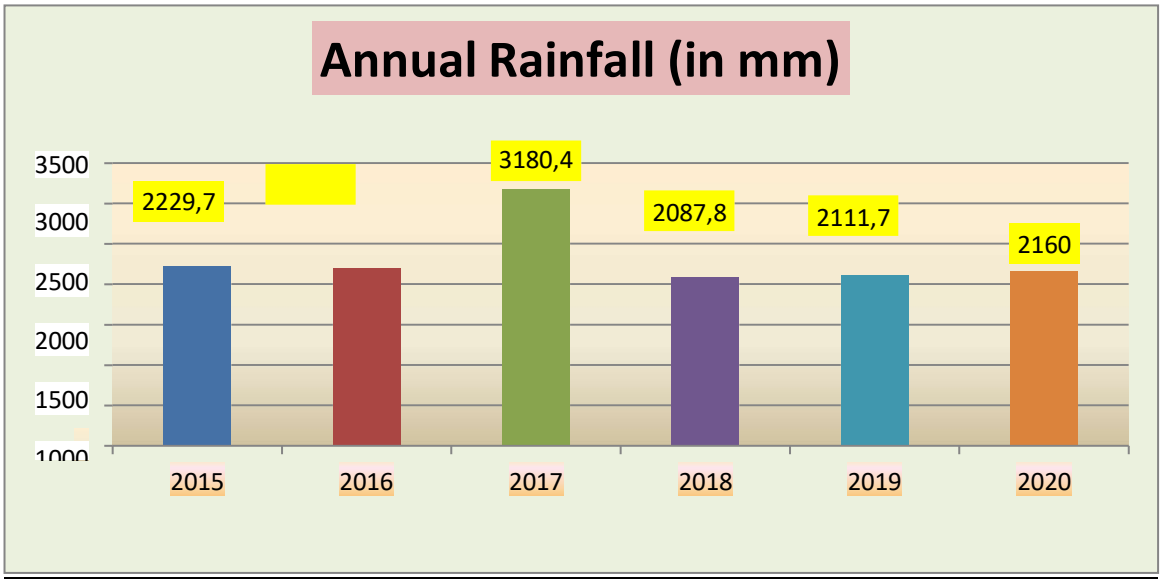

Figure 2.2: Annual Rainfall in Tripura

2.3 EVAPOTRANSPIRATION:

Seasonal and annual potential evapotranspiration (PET) have been estimated by using Thornthwaite's (1955) empirical formula, making use of the available long term average of monthly minimum and maximum temperature and normal monthly rainfall as recorded at Agartala airport and at other district headquarters. PET is about 50 to 60% of normal rainfall. It is found that PET exceeds for precipitation during five water deficit months i.e. January, February, March, November and December.

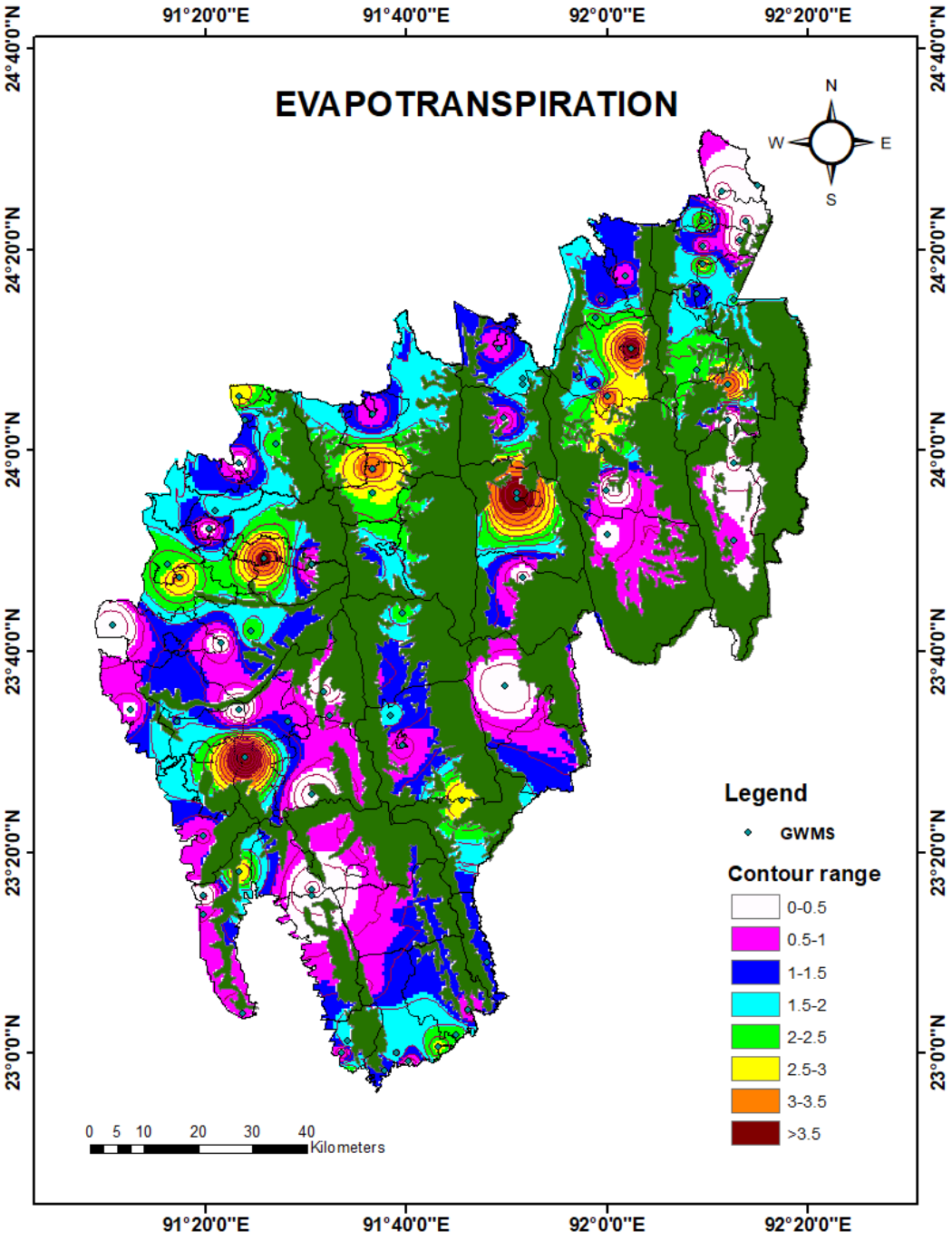

Figure 2.3: Evapotranspiration Map of Tripura

3. GEOMORPHOLOGY

3.1 PHYSIOGRAPHY

Physiographically, the state of Tripura consists of hilly terrain with an immature topography, which represents the western fringe of the typical ridge and valley (structural) province of the Late Tertiary fold mountain belt, commonly known as the Indo-Burman Ranges (**Purbachal** Range). The major geographic features are tightly folded anticlinal hill ranges and broad synclinal valleys in between. Five principal hill ranges running parallel in roughly N-S direction, namely (i) the Jampui, (ii) the Sakhantlang, (iii) the Longtarai, (iv) the Atharomura and (v) the Baramura traverse the state from east to west. The altitude of the hill ranges increases progressively form west to east attaining a maximum of 975.36 m above mean sea level (AMSL) at Betling Shib in Jampui hill range, 816.25 m AMSL at Sakhan in the Sakhantlang and 481.83 mAMSL at Phengpur in the Longtarai range. The Atharomura and the Baramura have comparatively lesser elevations of 346 m AMSL and 249 m AMSL respectively. Apart from these major hill ranges, two smaller dome-like ridges namely Sonamura anticline and Agartala dome, which comprise the folded Neogene strata; are lying to the west of Baramura-Deotamura hill ranges. The general altitude of the state varies from 750 m AMSL in the northeastern part to 15 m AMSL in the western part.

There are five broad longitudinal valleys in the state, namely (i) Agartala-Udaipur-Sabroom valley, (ii) Khowai-Teliamura-Amarpur valley, (iii) Kamalpur-Ambassa-Gondacherra valley, (iv) Kailasahar-Kumarghat-Chawmanu valley and (v) Dharmanagar-Panisagar-Kanchanpur valley, located between N-S trending parallel to sub-parallel anticlinal hill ranges. Within the major valley portions, there are numerous isolated hillocks or mounds attaining a height of 20-30 m above the valley floor.

3.1.1 Genetic Classification of Land Systems

Geomorphologically, the state can be defined as a second order morpho-structural land system similar to that of "**Ridge and Valley Province**" of USA. The erosional and depositional units of land system are confined mainly to the structural valleys. Genetic geomorphological map by GSI enables recognition of 17 landform units, which are grouped under these genetic types. Nine Landform units are of structural origin, five units are of denudational origin and the remaining three units are of fluvial origin. All the units can be shown in relation to their bedrock geology and structural pattern.

The units of structural origin characterize the structural pattern of folded rock bodies and include the features, which occur only within the anticlinal hill ranges. On the other hand, units of denudational origin are confined to the structural valleys, where erosional processes predominate, developing an eroded topography, represented by residual hillocks/mounds and an incised net of stream beds. Incised stream beds form the conspicuous geomorphic feature of valley landscape and are partly filled by the alluvial materials derived from adjacent hill slopes. The units of fluvial origin include only the flood plains of major rivers confined to the flat part of structural valleys.

(a) Units of Structural Origin:

(i) Cores of Sardengmura and Atharamura anticlines represented by a mega hogback are made of Bhuban Sandstone. Units are less dissected and having high relative relief, sharp ridge crest, steep valley side slopes (18).

(ii) Along the western flank of both Atharamura and Sardengmura structures, to the immediate west of the above mega hogback unit, linear, parallel strike ridges of Bokabil sandstone constitute the smaller cuesta-hogback unit. This unit shows moderate dissection and is characterized by the development of short parallel and trellis drainage pattern.

(iii) In the Raimachera catchment a discrete structural landform unit occurs between the mega hogback (to the east) and the badland valley (to the west) units. This is characterized by

broadly parallel discontinuous low-lying strike ridges of Bokabil silty shale. This unit shows a higher degree of drainage dissection and development of sub-dentriditic drainage pattern.

(iv) The eastern flank of Atharamura structure is represented by highly dissected, non-oriented, low-lying discontinuous strike ridges developed in Bokabil sandstone. The drainage pattern is mainly fine dendritic. The discontinuity in ridge structures is due to the effects of transverse faults and fractures. Valley side slope is moderate to steep. Dominant land cover is forest.

(v) Eastern flank of Baramura structure is characterized by a narrow zone of fault-guided, sub-parallel step like ridges on Bokabil sandstone. The scarp faces developed on the sides of ridges are highly eroded. Dominant land cover is forest.

(vi) The western flank of Baramura structure, on the other hand, is gently sloping and is represented by moderately dissected mega-cuesta like form developed on Bokabil silty shale. Medium dendritic drainage pattern characterizes this unit. Ground slope is moderate. Dominant land cover is forest.

(vii) The Maharani-Pitragong basin occurs within the Baramura structure and is characterized by a narrow elongated strike valley which has developed due to raid erosion of the soft Bokabil shale, bordered on both sides by fault scarps.

(viii) A moderately dissected linear zone of eroded strike ridge developed on the soft Bokabil sandstone forms the western foothills of Atharomura structure. Ground slope is moderate. Dominant land cover includes forest.

(ix) Highly dissected, low-lying elongated domal hills of structural origin occur in the western part of Gomti sub-basin. This unit shows shallow, flat topped anticlinal structures, developed on Bokabil silty shale and has gentle to moderate slope. Fracture controlled streams are more incised with flat channel beds. Dominant land cover is forest.

(b) Units of Denudational Origin:

(i) In the upper catchment of the Khowai river sub-basin, to the east of Atharamura range, the soft Bokabil shale forms a unit characterized by intensely dissected badland valley, with the development of sharp crested, non-oriented, small hillocks. Valley side slope varies considerably. Land degradation advances with gully erosion. Dominant land cover includes forest.

(ii) Between the Raima and Sarma streams a discrete unit of slightly raised platform within the structural valley is characterized by intensely dissected badland topography. This unit can be traced to the upper catchment of the Khowai sub-basin in the north. It developed on Bokabil silty shale and is intensely traversed by WNW-ESE and NE-SW trending fractures. Ground slope is moderate (5-10). Hill crests are sharp to rounded and the hill side slopes are degraded by gullies. Dominant land cover is forest.

(iii) The western foothill zone of Baramura structure shows development of moderately dissected round to sharp crested low-lying denudational hill on Tipam sandstone. Slope varies from gentle to moderate. Hill side is characterized by debris slopes.

(iv) Within flat portions of structural valleys, hillocks form a discrete denudational unit on Dupitila formation. Hillock tops show development of lateritic deposits. Dominant land covers are forest and other plantations. Gully and rill erosion predominate.

(v) Flat topped, isolated, low residual mounds (locally known as ‘tilla’) with lateritic caps are seen to form a unit in the valley especially around the major flood plains of rivers. Ground slope is gentle. Sheet and rill erosion predominate. Dominant land covers are settlements and various plantations.

(c) Units of Fluvial Origin:

(i) Alluvial flood plains have developed along the present day major river beds. Fluvial forms include point bars, levees and back swamps. The unit serves as the site for seasonal cultivation.

(ii) Older alluvial plains on either side of major rivers are restricted in occurrence and form sites for cultivation and rural settlements.

(iii) Incised flat stream valleys appear as fossil drainage net. This incised fossil drainage net shows trapezoidal valley form and is ephemeral in nature. Channel slope varies from 0 to 1. Valley side slopes are steep and are unstable because of unconsolidated nature of materials that compose the valley walls. Debris slides are common. Newly formed rill and gullies on the sides of residual mounds join this older incised drainage net and appear as misfit linkage in regards to channel slope and valley forms. Most of the major tributaries in the fossil drainage net are along the fracture lineaments. These infilled valleys, locally known as "lungas", constitute an area for seasonal cultivation.

3.1.2 Terrain Characteristics

Although the seventy percent of land area is hilly, three distinct physiographic zones nevertheless are discernible here. These are (i) N-S oriented hill ranges, (ii) Undulating plateau land and (iii) Low lying alluvial plains. Hydrogeomorphic and structural map of Tripura is furnished in Figure. – 4.1.

Zone - I: Hill Ranges: The State is traversed by five major hill ranges with a roughly north-South orientation and separated by narrow valleys. The valleys are by and large 20 km wide. The hill ranges continue southward into Chittagong Hill Tract.The Jampui Hill is the easternmost. The westernmost range is formed by the Baramura-Deotamura Hills. In between these two ranges lie the other three ranges. The Jampui range is successively followed to the west by the Sakhantlang, the Longtarai and the Atharomura.

Zone - II: High Lands and Plateaus: This zone covers extensive areas and marks the western limit of the hilly region. The plateau gradually rises from the west to east with elevation ranging from 15 m to 75 m and merges with the eastern hilly tract. This zone is dissected by medium and narrow valleys, streams and gullys and is severely eroded.

Zone - III: Alluvial Valleys: The elevation of the alluvial valley is restricted within 15 m above. Low lands interspersed by hillocks and swamps are locally called "lunga".

3.1.3 Landforms

There are two fundamentally different landform domains in the State:

A. Neogene Fold Ridges: This constitute the roughly N-S aligned anticlinal ridges with rounded to nearly flat-topped Baramura, Rokia and Sonamura and comparatively more rugged Atharomura with several spurs, comprising sub-flysch and molasses sediments of Mio-Pliocene age.

B. Alluvial Terrain: The terraced alluvial terrain is divisible into three groups on the basis of characteristic relief, slope, degree of dissection, soil character, landform assemblage and nature of alluvial fill. These in chronological order are: (1) the table lands (tilla lands) and rolling mounds formed by the Upper Pleistocene terraces characterized by maximum dissection, drainage density and weathering, (2) the low lands ('loonga lands') of the Holocene terrace comprising stabilized, undissected, higher flood plains and (3) the recent flood plains constituting the present-day flood-prone belts fringing the rivers and streams (Ramesh 1987).

3.2 DRAINAGE

The state is criss-crossed and drained by as many as 10 major rivers, which originate in the hill ranges and flow either in a northerly or westerly direction through the narrow valleys lying between the principal hill ranges. The rivers are fed by numerous tributaries arising from the catchment areas.

The trunk streams and major tributaries run parallel as well as transverse to the structural trend of the area. The two important rivers of West Tripura viz. the Khowai (perennial 6th order) and Haora (perennial 5th order) drain into Bangladesh plains towards north and west respectively. The valleys are terraced, a greater part being made up of deeply dissected highland of the uppermost terrace, characterized by steep erosional scarp of 15-20m in height along river banks. The intermontane Khowai valley, which broadens and slopes down towards north and lies in between the Atharomura and the Baramura, is drained by the northerly flowing meandering Khowai River. In contrast, the valley sectors situated due west of the Baramura ridge, has a general westerly slope and is drained by the perennial streams e.g. Haorah, Buri Gang, Sonai Gang, Sonai Nadi, Lohar Nala etc. which flow in a highly meandering paths generally towards west into Bangladesh. Trellis drainage is obvious where strike ridges of Neogene rocks are present, while dendritic pattern is well marked in the uppermost (Pleistocene) terrace developed in the valley regions and in some pockets of the hill ranges.

The rivers are significantly perennial and flows are directly related to the rainfall. During summer, the rivers maintain very slender flows, but in rainy seasons, they become swollen and brimful. Drainage pattern is in conformity with topography, thus supporting the sub-parallel drainage system. Anticlinal hill ranges form watersheds from which the various drainage channels emerge. Drainage pattern is typically trellis. Dendritic pattern is also observed at few places, which is of parallel to sub-parallel and rectangular type and here the streams are of first and second order.

3.2.1 Flow Characteristics: Total annual flows generated by the rivers have been estimated from the flow measurements made by Irrigation Dept., Government of Tripura. Monthly flow measurements are available for 8 rivers at 8 specific measurement points from which annual flows have been worked out for these rivers. Flow characteristics of the Longai, Fenny and other major rivers have been determined by extrapolation. The total volume of surface water generated within the state by the river systems originating in the major hills is approximately estimated as 793 million cubic meters. The maximum volume of water is carried by the Gomati River. Manu ranks next in terms of total annual volume of water. Khowai is the third largest river with the annual flow of 115 MCM. Major part (67.5 %) of the total surface water is contributed by Gomati, Manu and Khowai rivers. Flow of surface water ranges from 1.05 lakh m^3/km^2 in Gomati basin to 0.2 lakh m^3/km^2 in Buri Gang basin.

3.2.2 Harnessing of Rivers: Annually a large volume of water generated by the river systems is being lost to the neighboring Bangladesh. At present the Gomati is being harnessed for generation of hydel power. Three medium irrigation projects namely, Gomati in South Tripura, Khowai in West Tripura and Manu in North Tripura are under operation for irrigation of cultivated land in a small scale.

3.2.3 Major River Systems: Major rivers namely Khowai, Manu, Deo, Juri, Dhalai and Longai are characterized by northerly flow, while Gomati, Haora, Muhuri and Buri Gang flow westward into Bangladesh territory. Gomati is the biggest river of the state. Total annual river flow generated within the state is approximately estimated as 793 mcm. Rivers Longai and Fenny are forming the eastern and southern boundaries of the state respectively. The catchment of Longai is shared by Tripura, Mizoram, Assam states whereas that of Fenny is shared by Tripura and Bangladesh. This whole drainage system of the state ultimately forms a part of the Meghna basin, which is depicted in a drainage map in Figure 3.1. Combined flow length of the 10 major rivers within the state is about 896 km. The general hydrographic features of each major river system are as under :

(1) Longai River: Rises from Jampui Hill range and characterized by a northerly flow between Mizo and Jampai Hills and enters Karimganj district of Assam near Damcherra. Flow length is about 98 km.

(2) Juri River: The Jampui hills are the sources of this river. It has a northerly flow through the Dharmanagar valley on the eastern side of the SakhanTlang range.

(3) Deo River: Rising from the Jampui Hill range, it flows northward through the Kanchanpur valley between the Jampui and the Sakhan range and then turns westward, crosses the Sakhan and meets Manu river near Kumarghat in central part of the valley between Sakhan and Longtarai. Flow length of Deo river is 98 km in the state from its source up to its confluence with Manu.

(4) Manu River: It originates from Kahoishib peak of SakhanTlang range and is joined by two tributaries namely the Chhamanu, originating from Longtarai hills and the Deo, coming from Jampui hills and their combined flow drains the valley between Sakhan and Longtarai ranges in a northern direction. After intercepting the flow from Deo river the Manu flows northward into Bangladesh past Kailasahar. Length of the Manu River is about 167 km. With its tributary Deo, Manu has a combined catchment area as 1979 sq. km. in the state. Manu river has an annual flow of about 170 MCM.

(5) Dhalai River: It has its source in the Longtarai range near Dulajari peak. It is characterized by a northerly flow through the Kamalpur valley of Dhalai district between the Longtharai and the Atharomura ranges. It flows into Bangladesh near Kamalpur town after completing 117 km course in the state. It has a catchment area of 695 sq. km. and an annual flow of about 42 MCM.

(6) Khowai River: The river has its source in the Longtarai and flows northwestward up to a point near Teliamura town and then it takes a northerly course draining Khowai valley between the Longtharai and the Baramura ranges. It flows into Bangladesh near Khowai town. The river has a flow length of 166 km within the state. The river receives water form a number of tributaries. The Khowai valley extends for about 70 km in length and is about 25 km in width and the land is very fertile. The river has a catchment area of about 1378 sq. km. and has annual flow of 115 MCM.

(7) Haora River: It originates from the eastern side of Baramura range, flows westward through alluvial plain of Agartala valley, passes by the southern periphery of the capital city of Agartala and ultimately enters Bangladesh near Ganga Nagar (west of Agartala town) to disgorge itself into the Titas river of Bangladesh. Flow length of the river in Tripura is about 53 km and has about 570 sq. km. of catchment area. Annual flow as estimated by Irrigation Department, Govt. of Tripura is 36 MCM.

(8) Gomati River: The catchment of the river lies in the southern parts of the Longtarai and Atharomura ranges. The river flows westerly through the sub-divisional towns of Amarpur, Udaipur and Sonamura and debouches into Meghna River in Bangladesh. The river Gomati is about 133 km long and has about 2492 sq. km. of catchment area and has about 249 MCM of annual flow. A dam has been constructed in the gorge between the Atharomura and Kalijhari ranges for generation of hydel power and development of Irrigational facilities as well.

(9) Muhuri River: It is originated in the Deotamura hill range and has a westerly course through hilly areas and plains, draining the central portion of the South Tripura district and enters Bangladesh near Belonia town. It has a length of 64 km and has a catchment area of 1014 sq. km. in the state. It has annual flow of about 76 MCM.

(10) Fenny River: The River forms the border between Tripura and Bangladesh. At the source there are 3 streams namely Asalong, Rangafenni and Taindung, the Asalong being the main channel. It flows initially southwards, thereafter takes western direction and finally enters into Bangladesh.

3.2.4 Basin Characteristics

Out of the 10 river basins, 8 basins are within the territorial limit of the state, while the basin areas of Longai is shared by Tripura, Assam and Mizoramand that of Fenny is shared by Tripura and Bangladesh. The basin-wise details are presented in Table 3.1. The Gomati is the biggest basin with 22.66 % of the total geographical area of the state and the Longai is the smallest (3.25 %).

Table 3.1 : Area occupied by Various River Basins in Tripura

Sl No	Name of river	Basin area in sq. km.	% of basin area to geographical area of the State	Annual flow in 1000 cubic meter	% of flow to total flow	Districts Covered
1	Burima	658	6.27	13428	1.69	West Tripura
2	Dhalai	695	6.61	42778	5.40	Dhalai
3	Fenni	555	5.28	50433	6.36	South Tripura
4	Gumti	2378	22.66	249399	31.45	Dhalai, South & West Tripura
5	Haora(Saidra)	570	5.43	36032	4.54	West Tripura
6	Juri	586	5.57	15709	1.98	North Tripura
7	Khowai	1378	13.13	115854	14.61	West Tripura & Dhalai
8	Longai	342	3.25	9166	1.66	North Tripura
9	Manu-Deo	1979	18.86	170034	21.44	North Tripura & Dhalai
10	Muhuri	839	8.00	76247	9.63	South Tripura
11	Other streams	511	4.90	13797	1.74	
	Total	**10491**	**100**	**792877**	**100**	

Source: Department of science, technology and environment

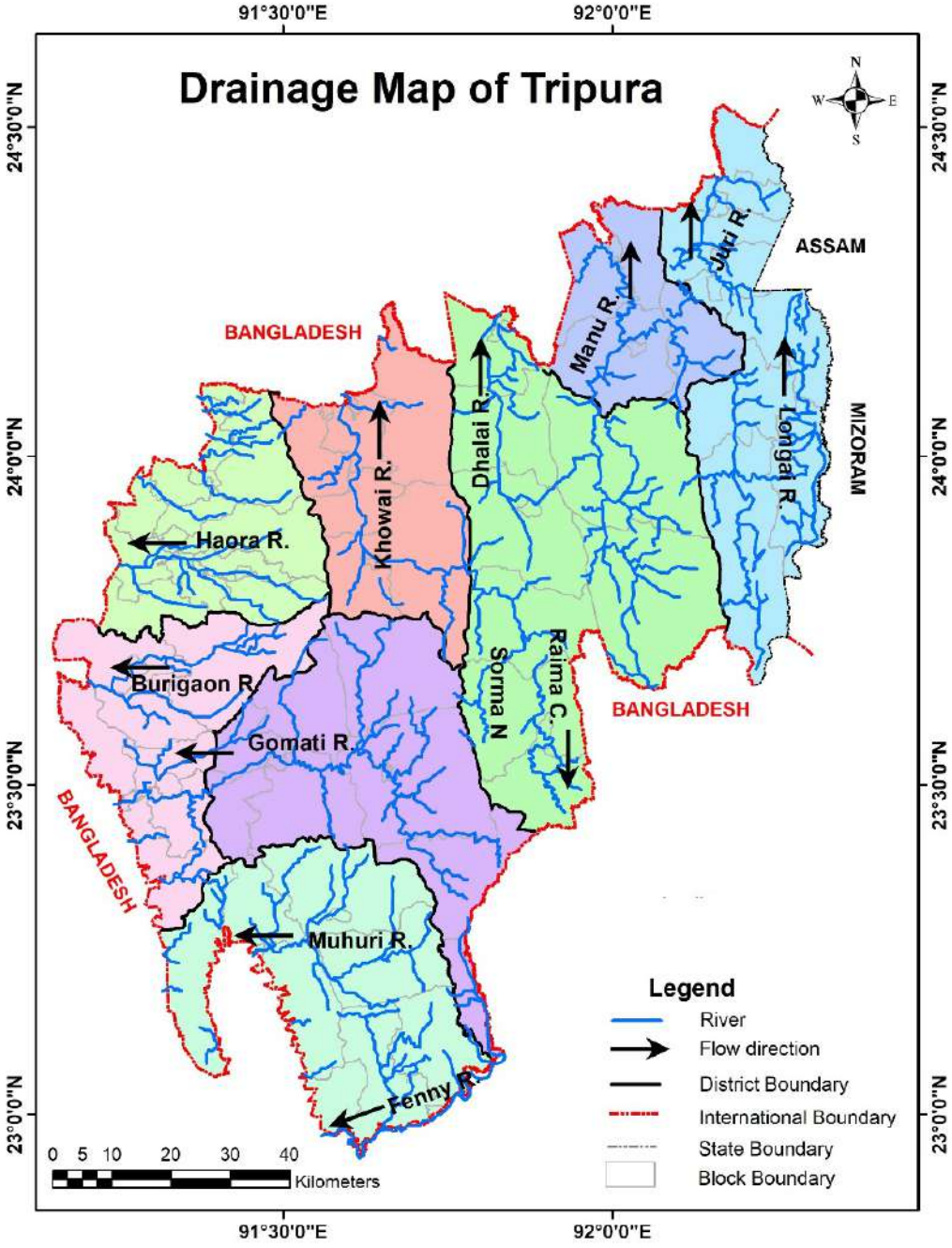

Figure 3.1: Map showing the major drainage system of Tripura

4. GEOLOGY

4.1 REGIONAL GEOLOGICAL SETTING

The geologically of the state of Tripura is characterized by a succession of hill ranges and valleys of meridional and sub-meridional trends. The hill ranges are actually box-like anticlines with relatively compact and resistant older rock units exposed in the narrow crests, whereas the valleys are flat synclines with younger and softer rock units exposed in the wide troughs. The folded belt constitutes the frontal sub-belt of the Assam-Arakan geosynclinal basin being separated on the east by the inner mobile sub-belt of the Mizoram consisting of tight linear folds.

4.2 GENERAL STRATIGRAPHY

Geologically, Quaternary and Upper Tertiary Groups of sediments occupy the state of Tripura. Mobile trough geosynclinal deposition of Barail Group followed by Flysch type of Surma and molasse type of Tipam sediments is noticed in the state. The Geological Succession of the State is given in Table 4.1.

Table 4.1: Geological Succession in Tripura State

Age	Group	Formation	Lithology
Quaternary	Recent	Recent	**Alluvium**: represented by unconsolidated pale to dirty gray silt, sand, clay, silty clay, sandy clay etc. with decomposed vegetable matter and yellowish brown coarse river sand, gravels, pebbles and various other concretions.
	---------- UNCONFORMITY----------		
Upper Tertiary	Dupitila	Dupitila	**Shale/Sandstone:** Brown to buff sandy clay with grayish sandy loam, clayey sandstone with ferruginous materials and laterites.
	---------- UNCONFORMITY----------		
	Tipam	Champaknagar Manubazar	**Sandstone:** Massive medium to coarse sandstone with sandy shale. **Sandstone:** Fairly laminated, bedded fine to medium sub-arkosic sandstone with sandy shale and siltstone.
	---------- UNCONFORMITY----------		
	Surma	Bokabil Bhuban	**Sandstone:** Thinly laminated, bedded sandstone and silt (repetition) with ferruginous materials, medium to coarse micaceous sandstone with mudstone **Shale/Sandstone:** Intruded, hard compact, both massive and well-bedded sandstone, dark to olive shale repeated (exposed in core of anticlines)

------- Basement not known ---------

The succession from bottom to top has been lithostratigraphically sub-divided into Surma, Tipam and Dupitila Groups. The more argillaceous rocks exposed in the cores of the anticlines are equivalent to the Surma Group of Mio-Pliocene age which is about 4 km thick in Tripura. The younger arenaceous beds in the flanks comprise the Tipam Groups of probable Upper Pliocene age and are over 2 kms thick. The sediments in the synclinal troughs in the west Tripura are at places unconformably overlain by a sequence of unconsolidated to semi-consolidated sediments arranged in neat terraces, which is named as Dupitila Group.

4.3 DISTRIBUTION OF VARIOUS GEOLOGICAL FORMATIONS

The distribution of the geological formations is shown in Figure 4.1 and is described as follows:

a) Surma Group: The Surma Group of rocks have been further subdivided into a lower, the relatively more arenaceous, Upper Bhuban unit and an upper, the mainly argillaceous Bokabil Unit. The rocks of Bhuban Formation, consisting compact calcareous sandstones and calcareous shales, fine grained sandstone and limestone are exposed in the cores of the anticlines of the state, viz Atharomura, Longtarai and Jampui hills etc. The sandstone forms the predominant rock type with shales occurring as the alternating unit. The limestones occur as small discontinuous lensoidal bodies within the shale, and vary in thickness from 0.2 to 2.3 m. Some of the sandstone and limestone beds contain fossils of mainly bivalves and gastropods. These formations usually from high hills with steep slopes and are conformably overlain by Bokabil Formation. The rocks of Bokabil Formation are predominantly of argillaceous composition, consisting of siltstone with small interbedded sandstone and are exposed on both limbs of the anticlines. The thin sandstone units are restricted to the lower portion of the Bokabil Formation.

b) Tipam Group: The Tipam Formations are conformable and transitional to the underlying Bokabil Formation. These Formations are arenaceous in character and comprise light yellow to light buff and brownish yellow sandstones with occasional thin bands of siltstone and boulders of calcareous concretion and coal streaks, which occur along the outer flanks of the anticlinal hill ranges with moderate dip to near horizontal disposition. The sequence of these formations shows variations due to facies changes within the group. The group could be divided into two district formations, the lower formation being finer than that of the upper formation, although both retain the principal sub-arkosic character. The maximum thickness of these formations is estimated to be around 1400 m and the minimum is 400 m.

c) Dupitila Group: The Dupitila sediments consisting of earthy brown to buff sandy clay, mottled clay, clayey sandstone and coarse to gritty ferruginous sandstone unconformably overlie the Tipam Formation and are well developed in central portion of the synclinal valleys, especially in the west of Baramura anticline. These formations occur in the form of disconnected mounds. The thickness of these formations varies from 10 - 30 m.

d) Recent Group: Most of the longitudinal synclinal valleys of the state are the basins of deposition of the Recent Formation. Recent alluvium occurs along streams and flood plains of major rivers. It consists of coarse sand, sandy silt, silty clay and clay. This Recent Alluvium formation belongs to Quaternary age. Study of Quaternary Geology of Tripura through the Quaternary mapping from a morpho-stratigraphic approach in parts of the Khowai, Haorah, Sonai Gang and adjacent valleys, has demonstrated the existence of extensive outcrops of Quaternary fluvial sediments which form a four tier system of terraces; two belong to the Pleistocene and the other two to the Holocene.

(i) Pleistocene Sediments: The Pleistocene sediments in West Tripura occur in the form of river terraces designated as T1 & T2 and are best developed in valley sections having the maximum areal coverage and thickness in the state. The salient geo-morphological/geological charactersof these sediments are as follows.

(a) Upper Terrace Formation (T1): This constitutes the uppermost and the oldest terrace extensively developed in the valley sections, having the maximum areal coverage and thickness. It has a paired character and is intricately dissected into incipient badlands. Lying generally between 15 m and 93 m above MSL, it forms a gently sloping plateau surface, abutting against the hill ranges. The fluvial sediments of this unit unconformably overlie the folded sedimentary sequence of the Mio-Pliocene age.

(b) Lower Terrace Formation(T2): It occurs as low mounds and small islands, a step (6 – 8 m) lower than the upper terrace (T1). It is a minor component in the terrace sequence and contains mainly oxidized, lemon yellow, sticky clay with thin soil (Entisol) cap. It is also assigned an Upper Pleistocene age on geomorphological/ geological rounds.

(ii) Holocene Sediments :

(a) Unit- 3 (T3): This unit (paired terrace) is less extensive than Unit - 1 and occurs in roughly linear belt flanking all the present day major rivers/streams and as minor valley fills. Its upper surface, flat, lies at the level of the general valley floor . It consists of unoxidized or feebly oxidized/altered yellowish gray and grayish yellow silty clay, grading down to pure sand (rarely silica sands) and occasionally pebble beds.

(b) Unit - 4 (T4): It is the youngest unit and still forming. This occurs in linear belts fringing the extant drainage to which it is clearly related. Extraordinary flood plains and neo-flood deposits of the channel bars, point bars and channel fills constitute this unit. It is made up of fresh deposits of well-sorted sands, silts and some clay. Semi-carbonized tree trunks and twigs are commonly present.

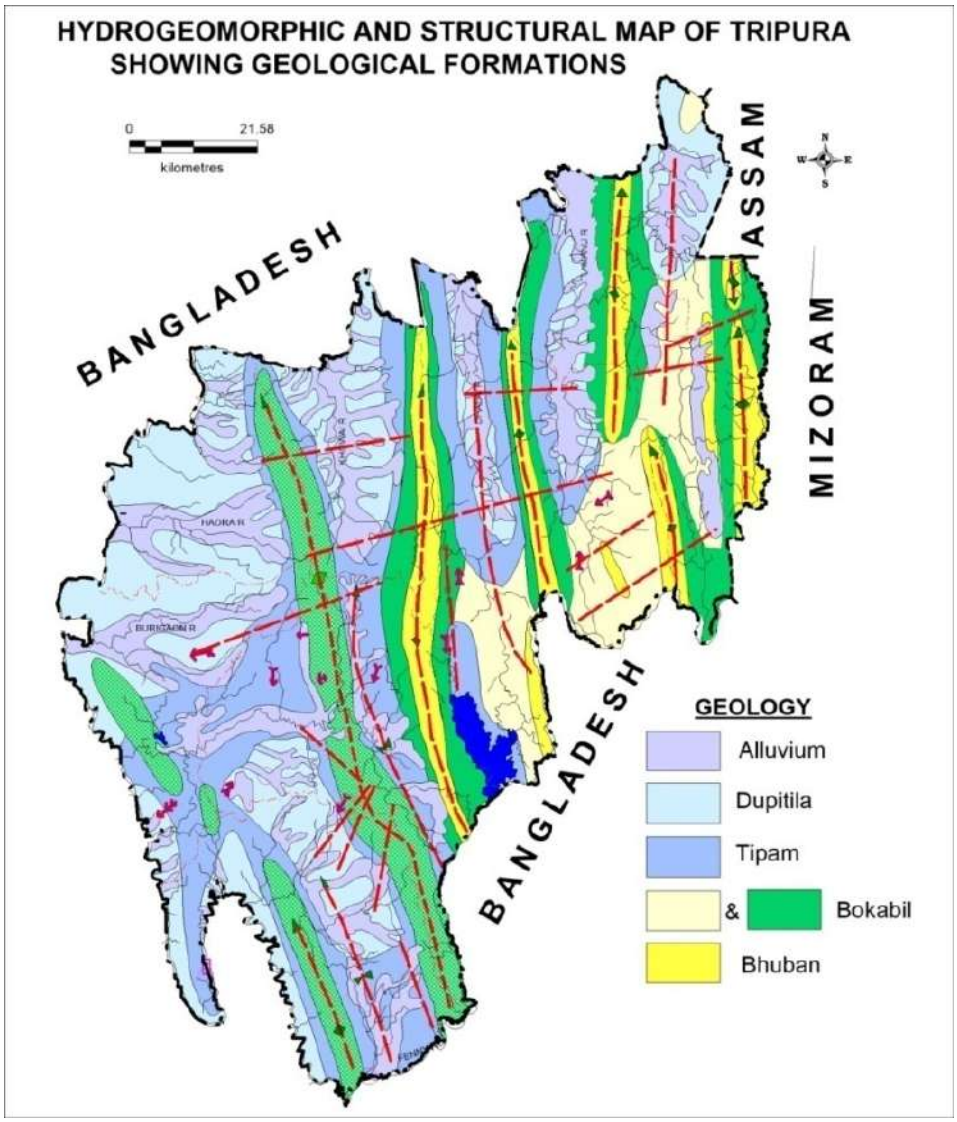

Figure 4.1A: Map showing distribution of Geological Formations, Geomorphic Units and Structures.

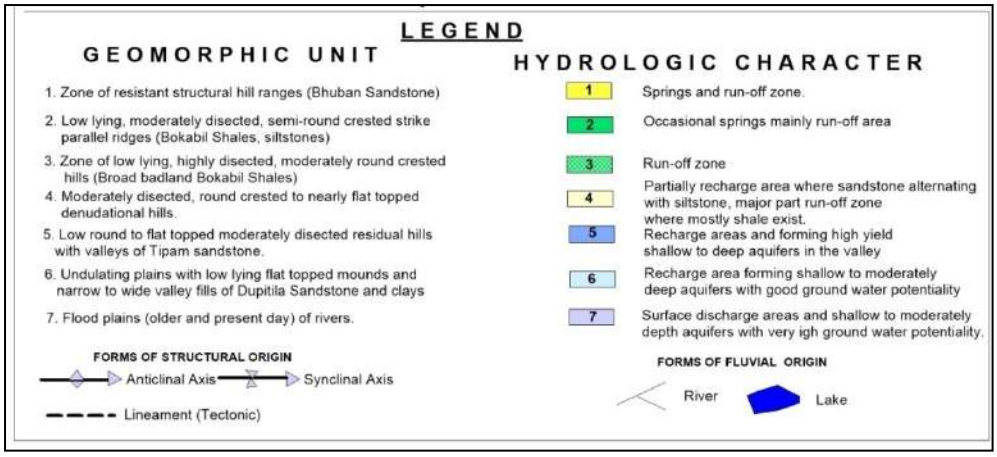

Figure 4.1B: Legend of the Map showing distribution of Geological Formations, Geomorphic Units and Structures.

4.4 SUB-SURFACE GEOLOGY

The state of Tripura is underlain by folded sedimentary formations ranging from Lower Tertiary to Recent. Tightly folded anticlines and synclines traverse the most parts of the state roughly in an N-S direction. Anticlinal crests are occupied by Bokabil Series of rocks which are argillaceous in nature. Valley areas are underlain by the Tipam Group of rocks with a fine to medium coarse grained sandstones with intercalations of argillaceous lenses. The argillaceous sands occurring in upper horizons form shallow aquifers. Tipam sediments occurring in deeper horizon constitute the principal aquifers in Tripura.

Sub-surface geology has been interpreted from boreholes drilled by CGWB and various State Government Agencies. Granular zones encountered down to a depth of 300 m belong to semi-consolidatedTipam and Dupitila groups and constitute medium to coarse grained, sub-rounded quartz, feldspathic material, whose occurrence and thickness vary laterally as well as vertically.

(A) North Tripura District: Sub-surface geology and disposition of aquifers in the N - S oriented parallel Dharmanagar- Kanchanpur of North Tripura district is depicted in Figure 4.2 & 4.3.

Dharmanagar – Kanchanpur valley: This valley is dominated by thick sandstone horizons with thin intervening shale/clay horizons. In the central part of the valley sand layers exist but comparatively thin granular zones intercalated with shale occur within 90 m bgl. However, towards the north (Ichailalcherra) and south (Machmara) the thickness of clay/shale is more.

Sand layers occur at a depth range from 7 to 14 m bgl. Below this, a thick clay bed occurs all along the valley and its thickness increases towards north (Ichailalcherra). Below this clay bed sandstone, fine to medium grained, yellowish brown in color occurs.

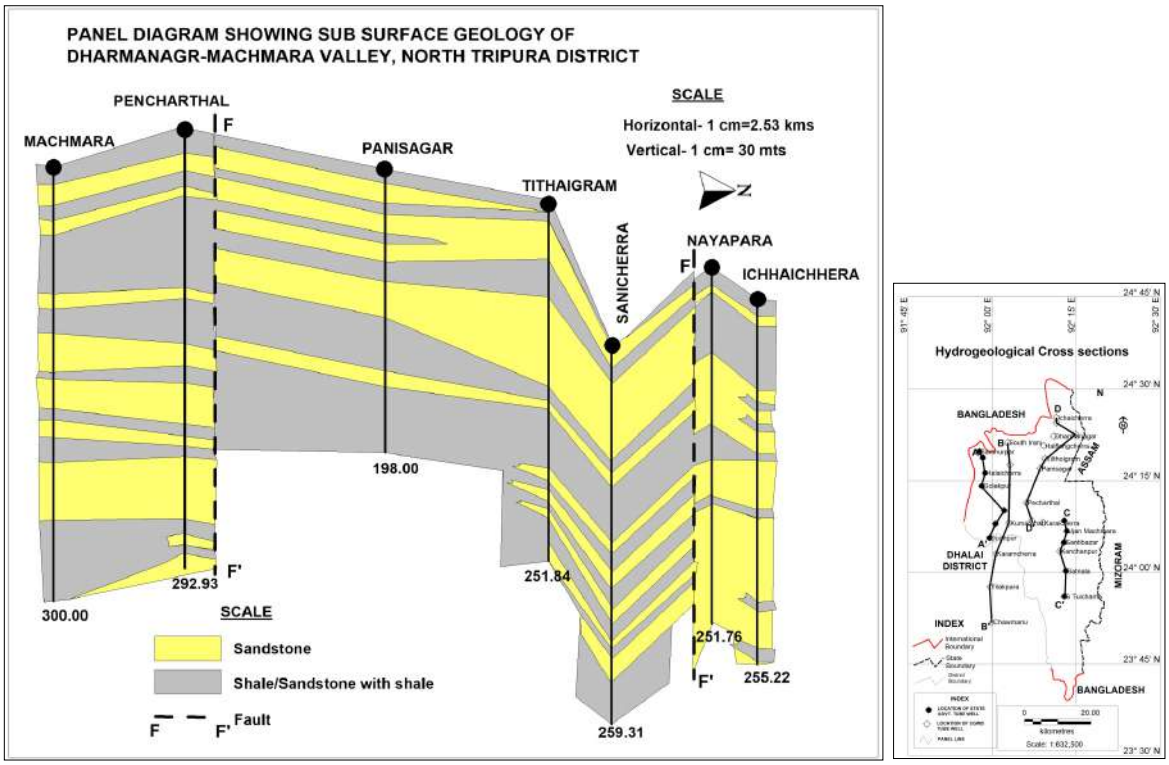

Figure 4.2: Co-relation of Sub-Surface Formations in Dharmanagar-Machmara valley of North Tripura District

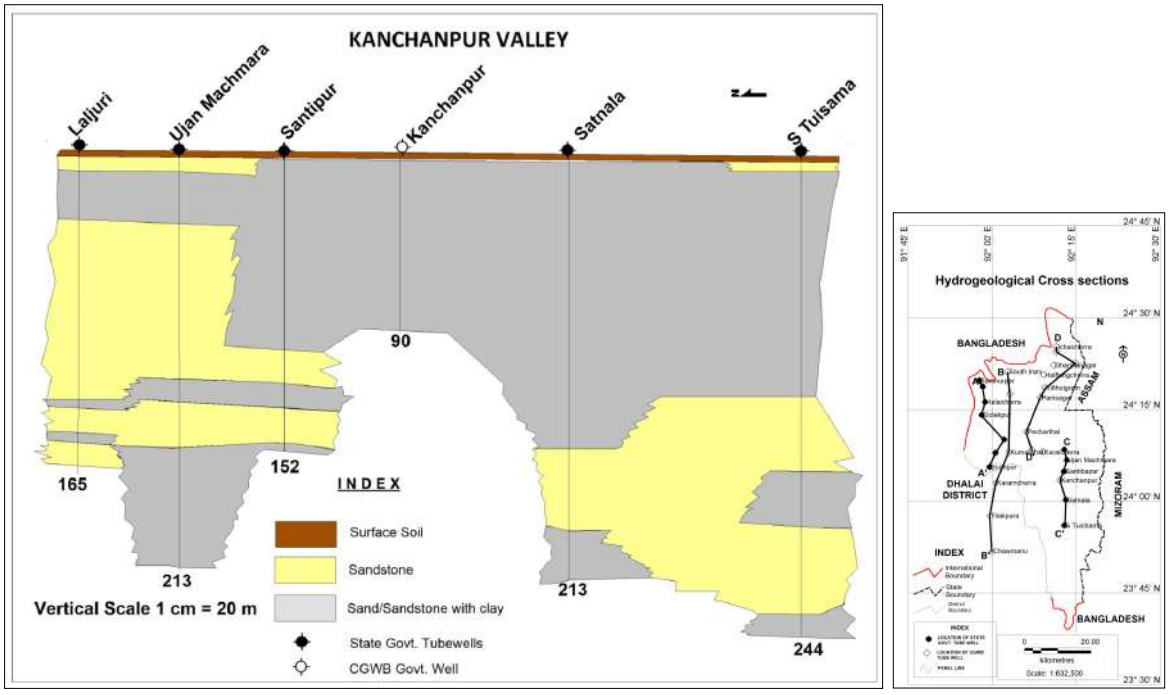

Figure 4.3: Co-relation of Sub-Surface Formations in Kanchanpur valley of North Tripura District

(B) Unakoti District:

Kailashahar valley: The panel diagram of Kailashahar valley (Figure 4.4) shows that in the central part of the valley, Kumarghat – Karamcherra area, a continuous granular zone of thickness varies from 100 – 135 m occur below 5 m. The thickness of this zone gets reduced towards north and south due to the presence of clay/shale horizons. Other granular zones present at depth are comparatively much thinner and intercalated with clay/shale horizons. Another granular zone of some significance occur below 200 m with thickness varies from 25 to 40 m.

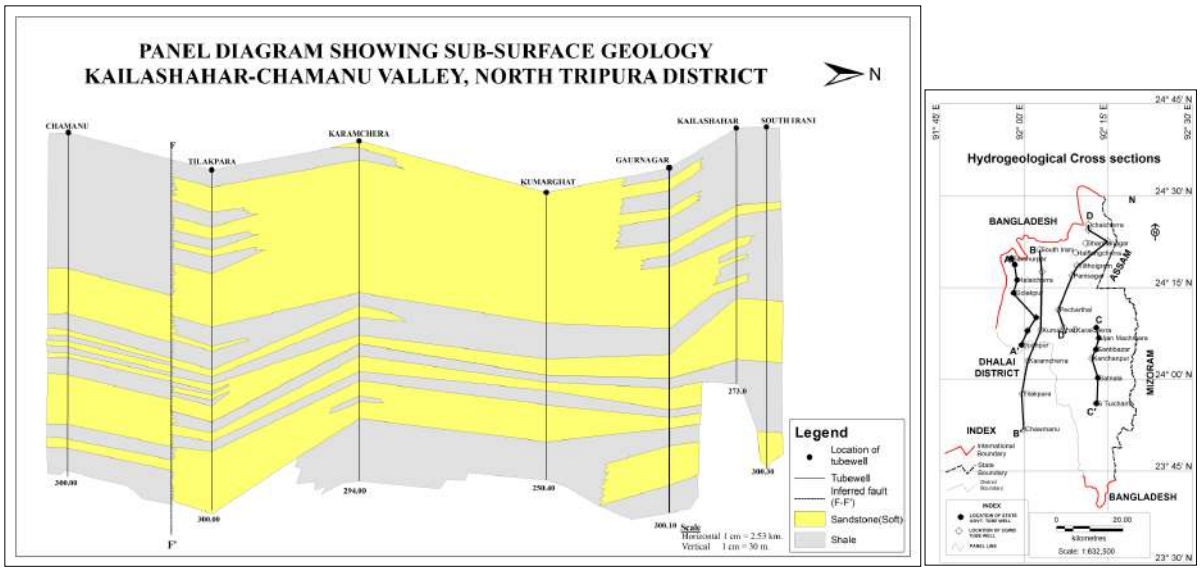

Figure 4.4: Panel Diagram showing Sub-surface Geology of Kailashahar-Chaumanu valley in North Tripura district

(C) Dhalai District :

(i) Manu valley: The Manu and Chawmanu block area is a part of southern extension of Kailashahar valley. The panel diagram for Manu valley (Figure 4.5) shows the presence of fairly good thickness of fine to medium grained sandstone horizon in the northern part of the valley, covering Karamchera (Manu) area. However, in the fringe area of Langtarai and SakhanTlang hill ranges, clay/shale predominate in the top horizon. Possibly this phenomenon is due to lithofacies change. But in the south while the thickness of granular zone within the first 120 m depths gets reduced due to appearance of tongues of clay/shale horizon the entire thickness of sandstone appears to have been displaced by clay/shale at Chawmanu. This may happen due to fault or lithofacies change. Below the first 100-120 m thick granular horizons observed in the central part of the valley, the other granular horizons at depth are of minor nature and thickness and are intercalated by clay/shale horizons. Another significant granular horizon occurs at a depth below 200 m with almost uniform thickness of 25 to 40 m. These granular horizons form productive aquifers in this valley.

In Manu block, between Manu and Karamcherra, 4 to 5 granular zones are available. The first zone is quite thick and is occurring between 20 – 135 m bgl. Other granular zones are occurring in the depth ranges of 145 – 155 m bgl, 160 – 170 m bgl, 190 – 210 m bgl and 210 – 240 m bgl. Exploratory wells drilled by CGWB at Chawmanu shows the area is dominated by shaley horizons within 300 m bgl. Two good granular zones are occurring in the depth ranges of 120 – 165 m bgl & 210 – 250 m bgl. Apart from this a few very thin granular zones also occur in the depth ranges of 170 – 200 m bgl & 260 – 300 m bgl.

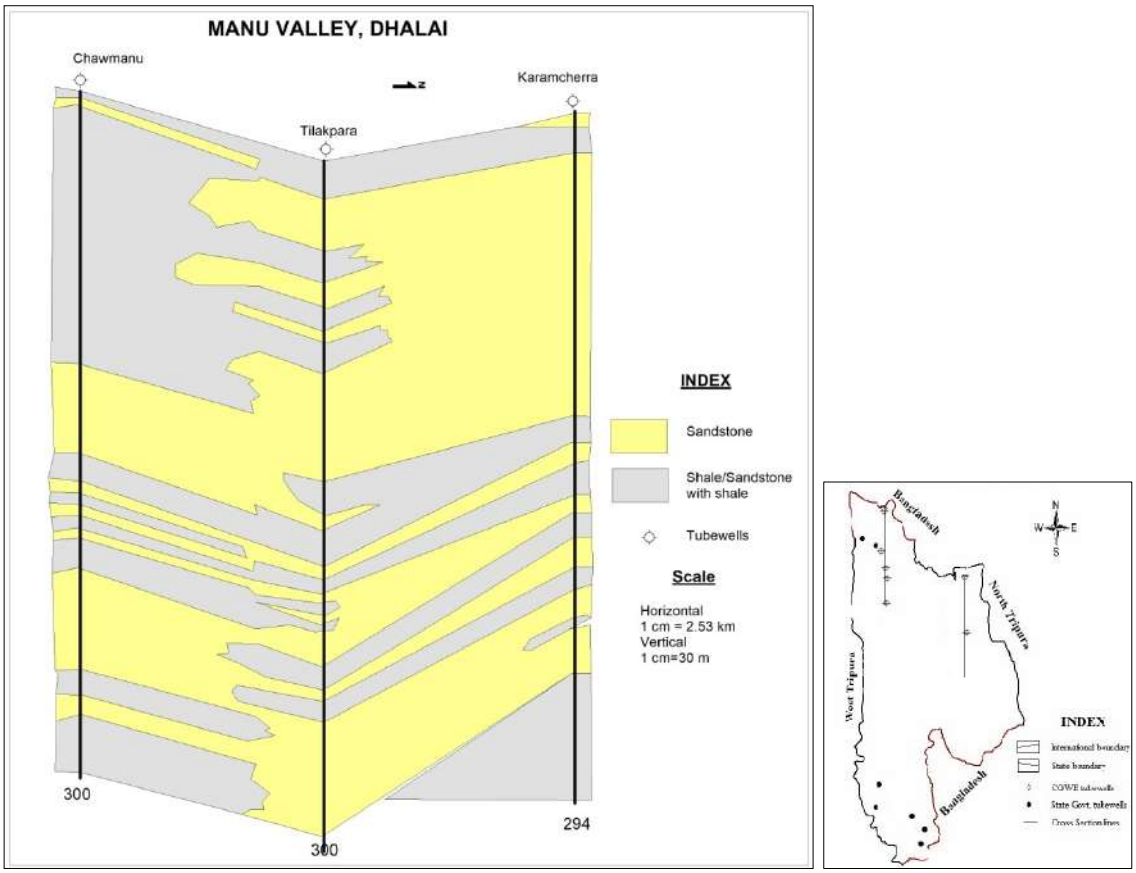

Figure 4.5: Sub-Surface Formations and Aquifer disposition in Manu valley, Dhalai District

(ii) Kamalpur valley: Kamalpur valley containing Salema and Durga Chowmuhani blocks is largely dominated by shaley horizons except in the central part of the valley at Bhatkhowri where three distinct deeper sandstone horizons of significant thickness can be seen. These granular horizons appear to have been displaced due to subsurface faults towards north. The sub-surface conFigureurations of different granular zones in this valley have been shown in a panel diagrams (Figure 4.6). Three to four numbers of thin granular zones occur within 250 m bgl.

In Ambassa area (Figure 4.6), which is the southern extension of Kamalpur valley, the first shallow granular zone is encountered at 21 m bgl and its thickness is 8 – 10 m and the second granular zone occurring below 50 m bgl. In Bhatkhowri area total 4 nos. of aquifers are available within 300 m bgl. The granular zones are found within the depth ranges 15 – 75 m bgl, 100 – 120 m bgl, 180 – 270 m bgl and also below 285 m bgl.

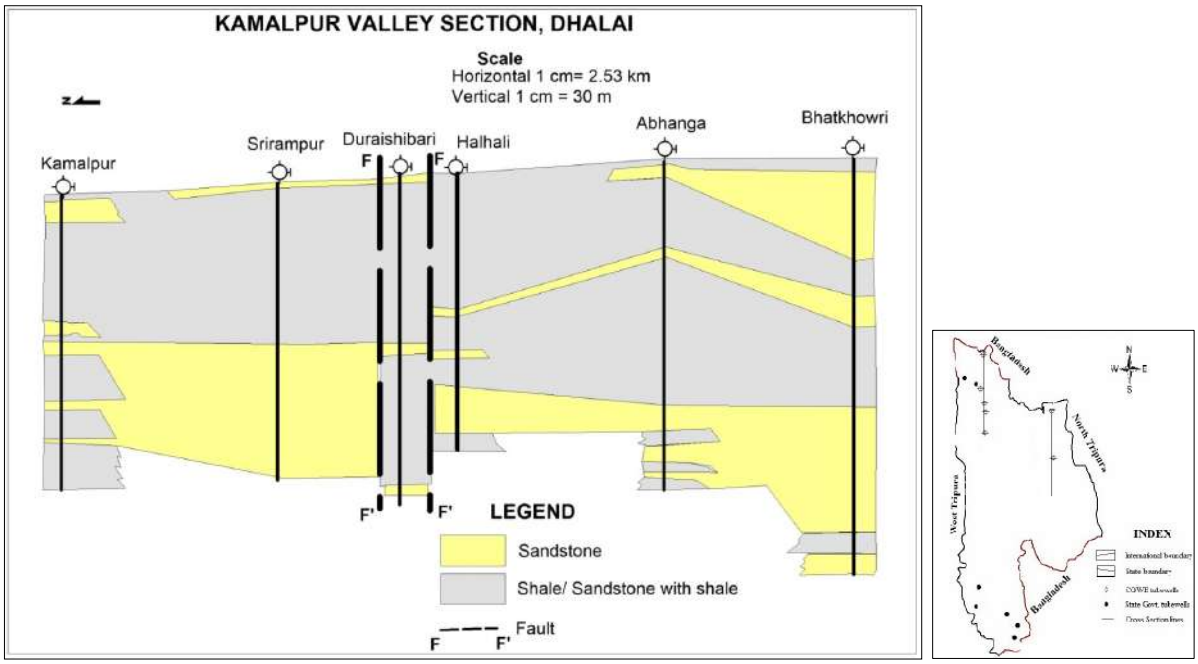

Figure 4.6: Co-relation of Sub-surface Formations in Kamalpur valley of Dhalai District

(D) Khowai District:

30 to 45 m thick granular zone was encountered within 50 m depth. It thins down to 6 m towards Khowai-Baijalbari area. Four granular zones were encountered within 50 to 300 m bgl and thickness of these granular zones varies from 15 to 100 m, which laterally grade into clay. The same is depicted in Figure 4.7.

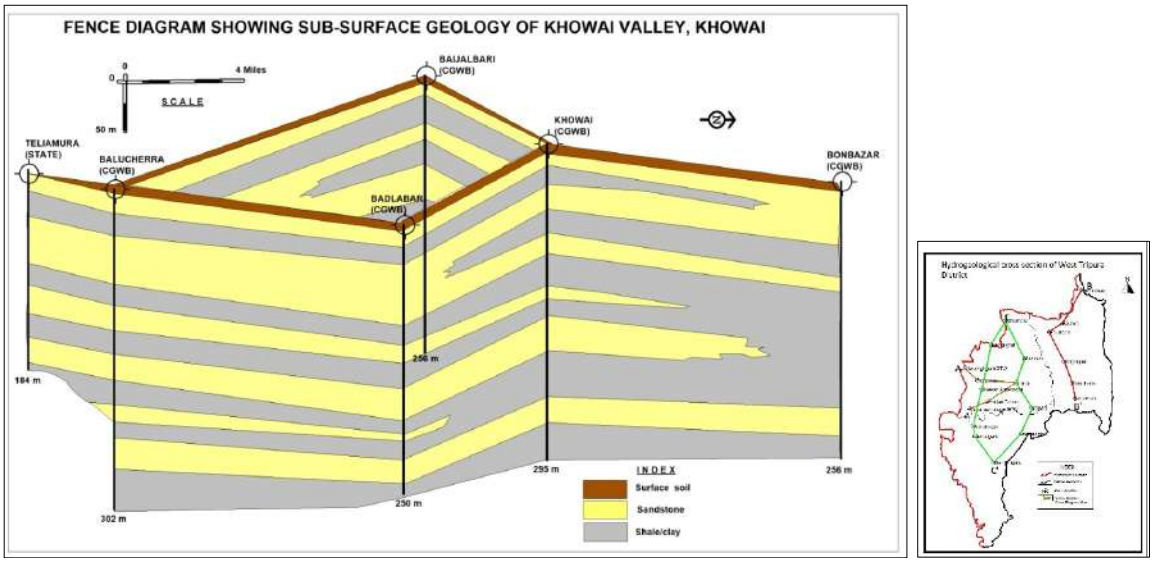

Figure 4.7: Panel Diagram showing Sub-Surface Formations Khowai valley of Khowai district

(E) West Tripura District:

Sub-surface configurations of different granular zones in Agartala valley of West Tripura district have been shown through panel diagrams in Figure 4.8.

Agartala valley: 40 – 100 m thick granular zone occur within 120 m depth. This zone is without any consistent clay capping, but in Veluarchar area, it is confined by 40 m thick clay horizon. In Jirania - Mohanpur area, the granular zone continues uninterruptedly down to a depth of 280 m. In Mohanpur - Sasubari area, within this thick granular zone, 20 – 40 m thick clay horizon is found at a depth range of 40 to 70 m bgl. In western half of Bishalgarh block three more granular zones occur with 20 – 70 m thickness and laterally grade into massive plastic clays towards eastern part of the block. In Agartala town, a thick granular sandstone zone occurs between 20 & 185 m bgl and is intercalated with claystone/shales. Granular zone consists mainly of fine-grained sandstone with grain size increasing a little bit downwards. Sub-surface formations and aquifer dispositions as deciphered by exploratory drilling of CGWB in and around Agartala have been presented in the Figure 4.8.

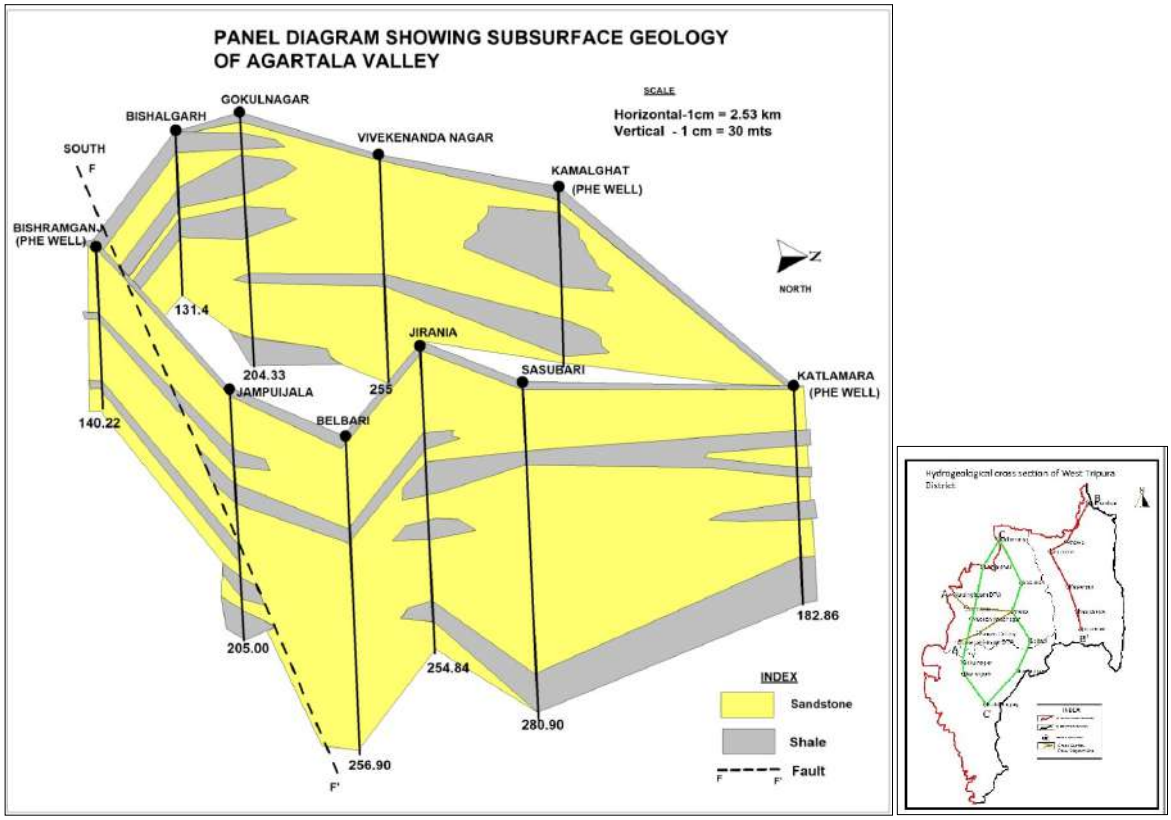

Figure 4.8: Panel Diagram showing Sub-Surface Formations in Agartala valley of West Tripura district

(F) Gomati District:

Amarpur valley: The panel diagram of Amarpur valley shows disposition of sandstone horizons is more or less uniform in Amarpur – Ompinagar area, where four prominent zones are discernible. First granular zone is occurring below 30 to 40 m thick clay/shale bed and having thickness of 6 – 10 m. Second horizon is encountered at the depth of 40 – 50 m and the thickness of granular zone is almost 30 – 40 m. Below 160 to 180 m depth the sediment is prominently clayey up to the depth of 250 m or more (Figure 4.9).

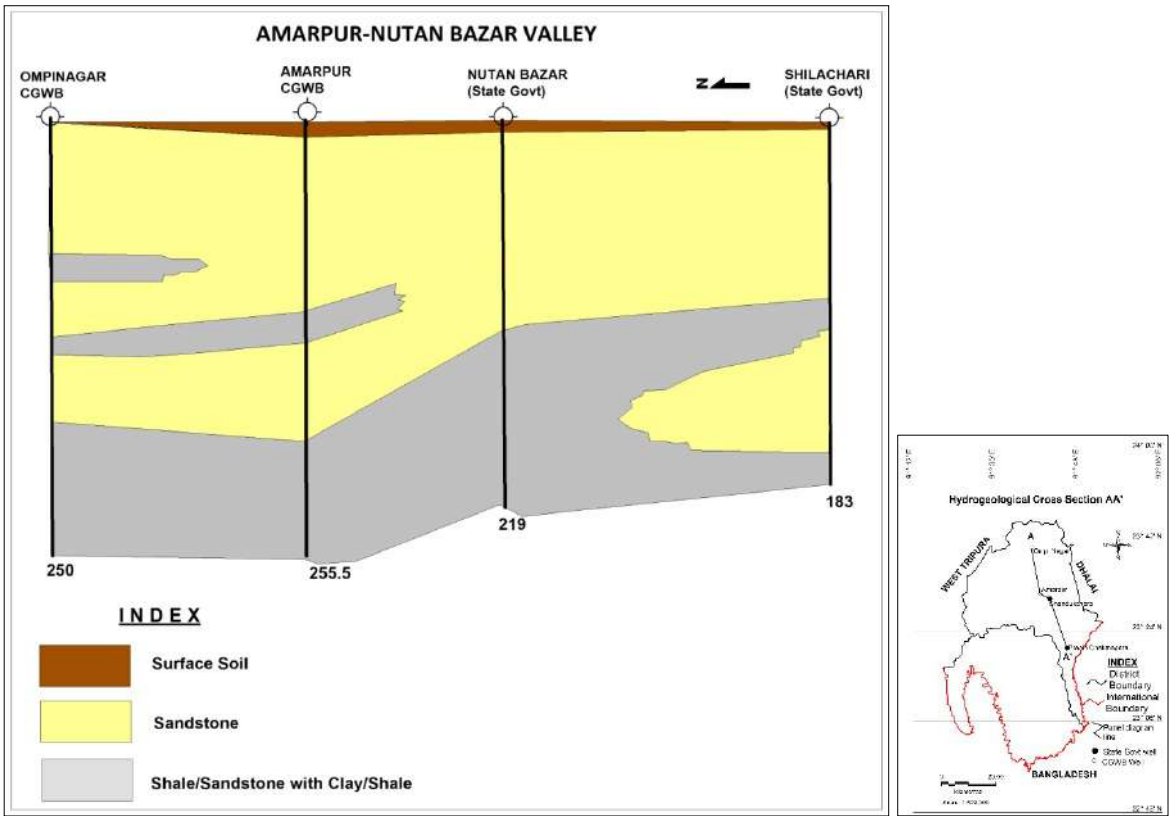

Figure 4.9: Sub-Surface Formations and Aquifer dispositions in Amarpur-Natunbazar valley of Gomati District

(G) South Tripura District:

The granular zones encountered down to 255 m bgl belong to semi-consolidated Tipam and Dupitila formations and constitute medium to coarse grained, sub-rounded quartz, feldspathic material. Occurrence and thickness of these zones vary laterally as well as vertically. It has been interpreted on the basis of lithological logs of boreholes drilled by CGWB and various State Government Agencies. Sub-surface conFigureurations of different granular zones have been shown in panel diagrams (Figure 4.10).

Udaipur – Subroom valley: This valley is a southern extension of Agartala valley and dominated by thick sandstone horizons with thin intervening shale/clay horizons particularly in the northern and southern part. In this valley, generally the first granular zone occurs between 40 & 56 m bgl and second granular zone between 60 & 140 m bgl. In Udaipur – Rajapur - Tulamura area three alternating layers of sandstone and shale occur between 20 & 250 m bgl. The first granular zone is encountered in the range of 25 to 56 m bgl and the thickness of the zone varies from 14 to 25 m. The second granular zone occurs in the range of 60 to 140 m bgl. In the central part around Baikhora and Satchand the sandstone is quite thick and forms almost a single aquifer system with layers of clay occurs locally creating a confined condition. In Subroom - Manubazar area 60 - 90 m thick first granular zone occured between 35-135 m bgl and second granular zone encountered at a depth of 150 - 195 m bgl. In the southern part of Belonia and eastern part of Manu-Bhanga hill range (around Srinagar) the sedimentary formation is more argillaceous.

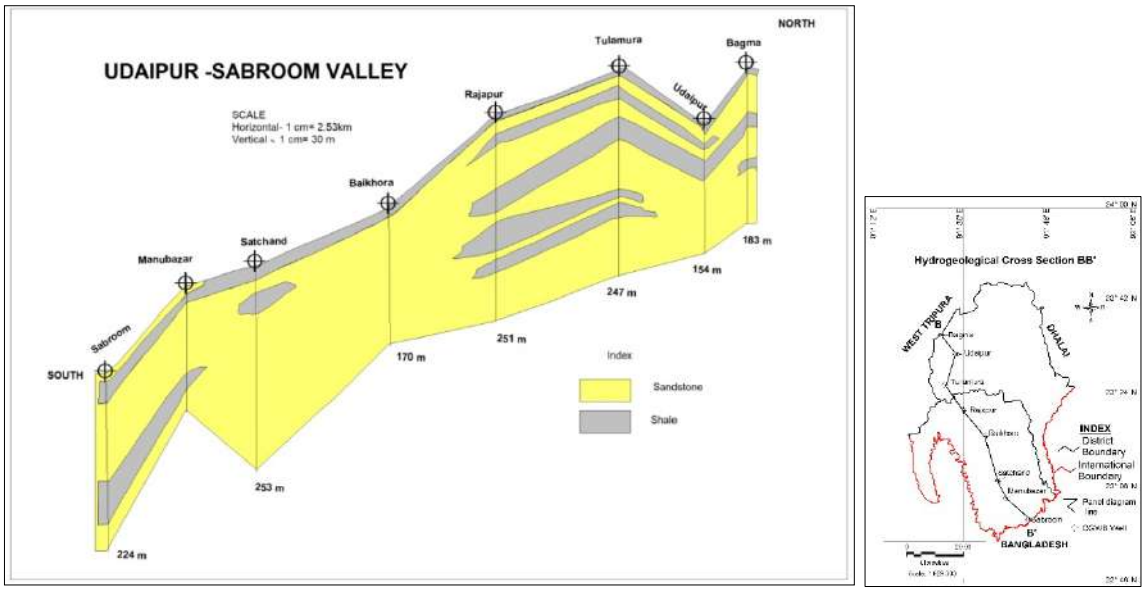

Figure 4.10: Sub-Surface Formations and Aquifer dispositions in Udaipur-Sabroom valley of South district

4.5 STRUCTURE

Tectonically, the state comprises a series of sub-parallel, arcuate, elongated, doubly plunging folds arranged en-echelon and trending in an average north-south direction with slight convexity to the west (Kher and Ganju, 1984). Passing from east to west the deformation in this belt becomes progressively younger and less intense and thus the intensity of folding increases eastward. The folds are characterized by tight and narrow, box like anticlines alternating with broad flat synclines. The anticlines forming ridges are asymmetrical or symmetrical and traversed, in most cases, by north-south longitudinal reverse faults. The steeper flanks of the asymmetrical anticlines commonly form monoclinal steps, and these are often dislocated and upthrown against the dipping flanks of the adjoining synclines. Most of these faults disappear towards the plunge of folds. Individual structures have internal complexities in the form of cross-faults, oblique faults and lineaments trending in NW-SE and NE-SW to ENE-WSW directions and dividing the structures into separate blocks. In short the salient features are as follows:

a) Folds are elongated and aligned in sub-meridional to meridional trend mostly with westerly convexity.
b) Folding is of parallel to sub parallel type
c) Anticlines are tight relative to the intervening synclines.
d) Intensity of folding increases eastward.
e) Anticlines are asymmetrical or symmetrical and traversed in most cases by N-S longitudinal reverse faults.
f) Most of the longitudinal reverse faults disappear towards the plunge of folds.
g) N-S faults are offset by NW-SE and NE-SW to ENE-WSW trending lineaments/faults, latter being younger.
h) Most of the surface gas shows are located near or along lineaments/faults.
i) More than one culmination is recognized in majority of anticlines.
j) Anticlinal axis is not sinuous as referred by earlier workers, but is offset by various cross trends.

k) Some of the anticlines, e.g. Langtarai, Sakhan and Gojalia are flanked by longitudinal faults trending in opposite directions.

l) Faults with a dominant strike slip component appear to intervene between anticlines arranged in an en-echelon pattern e.g., Rokhia-tichna, Baramura-Teliamura and Machli-thum-Khabal.

m) A longitudinal reverse fault flanking the southern part of Sakhan structure and ending up as a splay appears to link up with a major NNW-SSE trending Kaladam fault having dominant strike slip component.

n) The Kaladan fault limits the structural style of Tripura folds to the east from compressed Mizo folds.

o) A prominent NE-SW trending lineament aligned along sudden deflections of the river Meghna appears to limit the structural style of Tripura folded belt to its west.

p) This lineament follows an alignment of gravity contour kinks and earthquake epicenters and hence may represent a deep-seated fracture.

Seismic surveys have, however, revealed the subsurface occurrence of faults, subsidiary folds and other structural complications even within the superficially undisturbed, gentle folds. Drilling results have shown the presence of a few anomalous zone of steeply dipping beds in central parts of the structures and the possible presence of upward spreading fault zones in the sub-surface.

The microscopic folds are varied in style. They are preserved mostly in the thinly laminated multilayer of silt-shale alternations of both Bhuban and Bokabil Formations. Two types are common sharp crested and disharmonic. Parallel (concentric) folds, overturned, recumbent and box folds are confined to the eastern sector.

4.6 SEISMOTECTONICS

The Surma Basin in the Tripura-Mizoram area lies in between the seismically active Shillong Plateau to the north and Arakan Yoma to the east. Though epicenters of very few earthquakes recorded during the recent past fall in this area, it has, however, been affected by some of the famous earthquakes like the Bihar-Nepal (1934), Kangra (1905), Greater Assam (1897), Dhubri (1930), Srimangal (1918) and Assam (1975) earthquakes. The epicenter of the devastating Srimangal earthquake of 1918 lies very close to the northern border of Tripura. Tripura, being in this seismically active zone, experiences mild to moderately severe seismic shocks very often.

The style of folding into a series of longitudinal N-S/NNW-SSE trending anticlines and synclines, the conjugate fracture systems and the deformation of the rock types involved in such folding indicate that the whole region was subjected to E-W compressive stress since Pliocene time which continued up to the Pleistocene period. There was a period of quiescence when the flat-lying Dupitilas were deposited in the structural valleys over an erosional surface marking the beginning of the Quaternary period. It is also surmised that the region is still under the influence of E-W stresses, apparently directed from the east. Hand in hand with this, isostatic adjustment is going on in this area being located to the south of the Shillong Plateau with a strong positive Bouguer gravity anomaly. This is also apparent from the occurrence of 0 - gravity anomaly line in the center of the Tripura state. Neotectonic movements due to such isostatic adjustment has produced some cross fractures in Surma Basin, viz. northern border of Gomati flood plain in between Udaipur and Kakraban.

The presence of this misfit streams in the narrow valley (‘loonga’) area and the presence of upright tree trunks and submerged logs indicate that the narrow valleys (loongas) in most of the cases viz. Burigang near Bishalgarh, Charilam, Sekerkote, Bamutia etc. was uplifted during the Holocene times along the conjugate system of fractures and faults.

5. HYDROGEOLOGY

Geologically the state of Tripura is occupied by sedimentary formations of Recent to Tertiary age. Hydrogeologically the state is divided into 4 units i.e Alluvial formation, Dupitila formation, Tipam formation and Surma formation (Bokabil and Bhuban). Fourth hydrogeological unit i.e. Surma formation comprising shale/sandstone is mostly hard, compact and non-porous, thus not considered to be an important unit in terms of ground water potential.

5.1 WATER BEARING FORMATIONS

(i) Alluvial formation: It occurs along the banks of main rivers and in valleys and its thickness is only upto 15m. Ground water occurs under unconfined condition. The ground water development in this formation has not been very significant because of high clay and sandy clay content. Ground water is developed through dug wells and shallow tube wells fitted with hand pumps. These alluvial formations are underlained by Dupitila and Tipam formations.

(ii) Dupitila formation: It occurs nearly in horizontal disposition and its thickness varies from 10 to 30 m forming the near surface aquifers within 30 m bgl. The formation consists of mainly clay and silt with some intercalations of gritty and ferruginous sandstones. It is exposed in the central portion of all the major valleys and also on northern part of Manu valley. In general, it has low permeability and low storage capacity due to high clay content. Ground water in this formation occurs under unconfined condition, which is developed through dug wells and hand pumps.

(iii) Tipam formation: Tipam formation constitutes the principal and productive aquifer horizons. Due to higher porosity and permeability; transmissivity and storage co-efficients of the formation is much higher than that of Dupitila formation or Surma formation. The recharge area of the formation is in the surrounding anticlinal hills. This formation consists of sub-rounded, fine to medium grained, friable sandstone with intercalated clay. Ground water occurs under unconfined, semi-confined to confined conditions. This formation is developed by deep tube wells and mini deep tube wells fitted with electric motors, shallow tube wells, Mark - II/III and hand pumps.

5.2 OCCURRENCE AND MOVEMENT OF GROUND WATER

Ground water in Tripura occurs under unconfined to confined conditions. At shallow depths, in shallow aquifers ground water occurs mainly under unconfined condition. In some small isolated zones ground water at shallow depths occurs under semi-confined to confined conditions and sometimes shows artesian condition due to presence of top clay. Water bearing formation occur both in shallow Quartanary alluvial formation and Tertiary coarse clastics occurring in deeper horizons.

In Alluvial, Dupitila and Tipam formation (at shallow depths) groundwater occurs under unconfined condition. However, in Tipam formation groundwater occurs under semi-confined to confined condition in most of the cases.

5.3 HYDROGEOLOGICAL CONDITIONS

The semi-consolidated Tertiary Formations constitute the main hydrogeological units in the state. Other small depositions of alluvial formations of Recent age also constitute the local hydrogeological units along major river courses. The hydrogeological units of Tertiary Formations consist of friable sandstones, claystones and shales which can be subdivided into two groups namely Dupitila Group and Tipam Group. Formations belonging to Dupitila Group are mainly clay and silt with some thin intercalations of gritty and ferruginous sandstones, whose thickness is limited to 10 - 30 m and prominent in the western parts of the state. Storage Capacity and permeability of the formations of Dupitila Group are very low due to the occurrence of thick clay layers. Formations of Tipam Group are mainly soft, massive and friable sandstones and alternating layers of shales, which

are exposed throughout the state along the outer flanks of the anticlinal hills with moderate dips and are occupying the synclinal valleys as well. Thickness of Tipam Group is about 1400 m. Due to their poor consolidation and moderately medium grained texture, the Tipam sandstones form the principal and only productive aquifer system. General hydrogeological setup of Tripura is presented in Figure 5.1.

CGWB has carried out Intensive hydrogeological surveys and ground water exploration through drilling and construction of 65 EW, 26 OW, 2 SH and 9 Deposit Wells Ground Water Exploration Program & NAQUIM Studies. Besides CGWB, Drinking Water and Sanitation Department (DWS); Govt. of Tripura, PWD (Water Resource), Govt. of Tripura and other state agencies have drilled a number of deep tube wells in the state. Based on the lithological logs of these tube wells, valley-wise hydrogeological sections have been drawn to study the lateral and vertical distribution of the aquifer system in Tripura.

Hydrogeological sections in Agartala-Udaipur-Sabroom valley show the presence of clay intercalations and two to four granular zones (Figure 4.8 and 4.9; Annexure - IX). The first granular zone occurs in the depth range of 7 to 60 m bgl, second granular zone occurs within 70 to 130 m, while the third granular zone occurs in depth range of 170 to 250 m. In the central part around Baikhora and Satchand the sandstone is quite thick and forms almost a single aquifer system with layers of clay occurs locally creating a confined condition.

The perusal of the hydrogeological section in Khowai-Teliamura-Amarpur valley shows the predominance of clay over sandy layers (Figure 4.7 & 4.9; Annexure - IX). Up to 300 m depth, four to five granular zones are occurring. The thickness of these granular zones varies from 5 – 20 m.

The sub-surface configuration in Kamalpur-Ambassa-Gondacherra valley reveals the high variation in the facies laterally as well as vertically (Figure 4.5 & 4.6; Annexure - IX). It is also evident that clay is dominating in the middle portion of the valley as compared to the southern parts of the valley. Generally, down to 300 m bgl depth four granular zones are occurring viz. (i) 5 - 30 mbgl, (ii) 50 - 65 mbgl (iii) 80 - 120 mbgl and (iv) 130 - 240 mbgl. The deeper aquifer from 80 m below ground level are confined and exhibit artesian condition around Abhanga and Ambassa, while the Shallow aquifer are found under unconfined to semi-confined conditions.

Sub-surface set-up in Kailasahar-Chawmanu and Dharmanagar-Machmara valley shows the wide litho-facies variation both laterally and vertically (Figure 4.2, 4.3 & 4.4; Annexure - IX). Aquifer at shallow depth is not persistent. However, in deeper zones it is persistent, but at different levels, it is discontinuous due to presence of three inferred faults. These faults, one at south of Trilokpara, second at Gaurnagar and the third one at south of South Irani, have resulted in wide and abrupt lateral variation of litho-facies. Both the shallow and deep aquifers around Kailashahar show artesian condition. Analysis of aquifer performance test data of the exploratory/deposit wells has shown that transmissivity ranges from 4.5 to 1577 m^2/day and permeability from 0.1 to 28.4 m/day. Storage Co-efficient ranges from 2.25 x 10^{-5} to 2.20 x 10^{-3} showing confined nature of the aquifers.

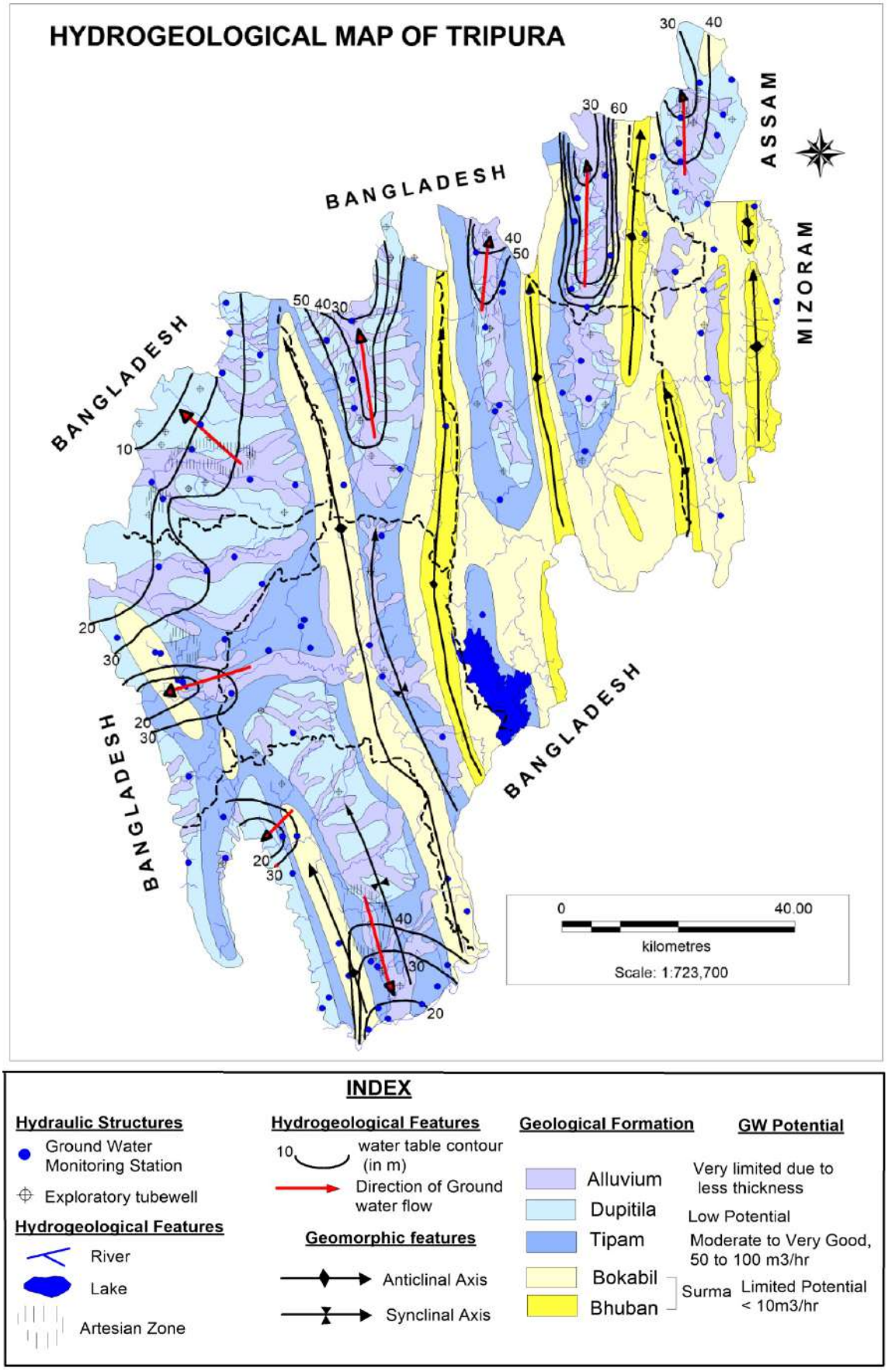

Figure 5.1: Hydrogeological Map of Tripura

Table 5.1 Aquifer Disposition and Groundwater Potential of Tripura

Age	Group		Formation	Lithology	Aquifer Disposition	Ground Water Potential
Quater-nary	Un- consoli-dated	Recent	Recent Alluvium	Clay, Silt and Sand	Limited thickness along river valleys	Yield Prospects very limited due to superficial thickness
Upper Tertiary	Semi Consolidated	Dupitila	Dupitila	Coarse to gritty Sandstone with dominated Clay layers	Forms Unconfined aquifer in dug well zones near surface. Maximum thickness : 30 m	Limited yield prospect due to poor permeability
		Tipam	Champaknagar/ Manu Bazar	Fine to coarse Sandstone with intercalations of Shale layers	Forms major aquifer system for shallow and deep tube wells up to 300 m depth at favourable locations.	Moderate yield prospect, yields varies from 20 to 150 m^3/hr for drawdown up to 30 m
		Surma	Bokabil/ Bhuban	Thinly bedded Sandstone, Siltstone and Shale	Occurs on anticlinal hill ranges	Not potential for ground water development, due to argillaceous nature of formations

5.4 : SUBSURFACE HYDROGEOLOGY

5.4.1 Ground Water Exploration in North Tripura district

Under Ground Water Exploration programme CGWB has constructed 10 wells in 9 locations (8 EW, 1 OW & 1 Deposit Well) in the district, down to a maximum depth of 255 m bgl tapping Tipam sandstone to determine the aquifer characteristics of the deeper aquifer.

The depth range of the Tubewells constructed ranges from 92mbgl to 255mbgl. The Thickness of the aquifer zones tapped veries from 24 to 63m. The discharge of the wells varies from 1 to 26 lps and the drawdown varies from 4 to 42 m. The Specific Capacity of the well ranges from 2.7 to 87.2 lpm/mdd, Transmissivity of the wells varies from 6 to 627 m^2/day, Permeability varies from 0.1 to 12.6 m/day and storativity lies in the range of $2.7x10^{-4}$. Exploratory wells constructed at Ichaicherra, Nayapasra, are found to be in flowing / artesian condition. The piezometric head measured varied from 0.42 to 2.34 m agl.

Springs / seepage zones : Springs / seepage zones are available in the area. Traditionally tribal people living in the hilly areas are using spring water for drinking and domestic purposes. In the foothill areas people used to arrest the spring water by constructing seasonal / permanent bund on small streamlets / cherras and used this water for irrigation purpose and sometimes used for drinking and domestic purposes also. In Kadamtala seepage zones occur in paddy fields. In hilly areas of Damcherra, and Jampui hill blocks it is reported that springs are available.

Artesian zones: A few artesian zones occur in the district. These wells are mainly used for drinking and domestic purposes but some of the wells are even used for irrigation purposes. Artesian zones are found in Kadamatala, Panisagar, Dasda and Damcherra blocks. The artesian zones found are discontinuous and are localized phenomenon. It is reported that the wells are constructed within a depth range of 10 to 100 m bgl. Discharge of the wells varies from 0.01 to 0.83 lps during pre-monsoon period and from 0.02 to 1.00 lps during post-monsoon period.

5.4.2 Ground Water Exploration in Unakoti district

Under Ground Water Exploration programme CGWB has constructed 8 wells in 6 locations (5 EW, 2 OW & 1 Slim Hole) in the district down to a maximum depth of 300m bgl tapping Tipam sandstone to determine the aquifer characteristics of the deeper aquifer. But two of them were abandoned due to lack of granular zone.

The depth range of the Tubewells constructed ranges from 250mbgl to 300mbgl. The Thickness of the aquifer zones tapped veries from 42 to 55m. The discharge of the wells varies from 4 to 26 lps and the drawdown varies from 6 to 30 m. The Specific Capacity of the well ranges from 8.5 to 226 lpm/mdd, Transmissivity of the wells varies from 4.5 to 1213 m^2/day, Permeability varies from 0.1 to 23.7 m/day and storativity lies in the range of $4.2x10^{-4}$ to $2.2x10^{-3}$. Exploratory wells constructed at Pecharthal are found to be in flowing / artesian condition. The piezometric head was measured at 2.85 magl. Pilot hole was drilled in Karaicherra upto 116.60 m bgl but due to lack of granular zone it was abandoned.

Springs / seepage zones: Springs / seepage zones are available in the area. Traditionally tribal people living in the hilly areas are using spring water for drinking and domestic purposes. In the foothill areas people used to arrest the spring water by constructing seasonal / permanent bund on small streamlets / cherras and used this water for irrigation purpose and sometimes used for drinking and domestic purposes also. In Gournagar and Kumarghat seepage zones occur in paddy fields. In hilly areas of Pecharthal blocks it is reported that springs are available.

Artesian zones: A few artesian zones occur in the district. These wells are mainly used for drinking and domestic purposes but some of the wells are even used for irrigation purposes. Artesian zones are found in Panisagar and Gournagar blocks. The artesian zones found are discontinuous and are localized phenomenon. It is reported that the wells are constructed within a depth range of 10 to 100 m bgl. Discharge of the wells varies from 0.01 to 0.83 lps during pre-monsoon period and from 0.02 to 1.00 lps during post-monsoon period.

5.4.3 Ground Water Exploration in Dhalai district

Under Ground Water Exploration programme, CGWB has constructed 11 wells in 9 locations (9 EW & 2 OW) in the district down to a maximum depth of 305 m bgl tapping Tipam sandstone to determine the aquifer characteristics of the deeper aquifer.

The depth range of the Tubewells constructed ranges from 240mbgl to 305mbgl. The Thickness of the aquifer zones tapped veries from 36 to 60m. The discharge of the wells varies from 10 to 60 lps and the drawdown varies from 14 to 38 m. The Specific Capacity of the well ranges from 16.4 to 190 lpm/mdd, Transmissivity of the wells varies from 26.4 to 1582 m^2/day, Permeability varies from 0.52 to 44 m/day and storativity lies in the range of $5.9x10^{-4}$ to $2.85x10^{-4}$.

Artesian zones: A few artesian zones occur in the district. These wells are mainly used for irrigation purposes but a few of the wells are even used drinking and domestic purposes also. Artesian zones are found in Ambassa, Salema, Dumburnagar, Manu and Chawmanu Blocks. The artesian zones found are discontinuous and are localized phenomenon**.**

5.4.4 Ground Water Exploration in Khowai district

Under Ground Water Exploration programme CGWB has drilled 11 wells in 8 locations (8 EW & 3 OW) down to a maximum depth of 302 m bgl tapping Tipam sandstone to determine the aquifer characteristics of the deeper aquifer.

The depth range of the Tubewells constructed ranges from 128/mbgl to 302mbgl. The Thickness of the aquifer zones tapped veries from 24 to 71m. The discharge of the wells varies from 4.4 to 22.52 lps and the drawdown varies from 5.3 to 13.6 m. The Specific Capacity of the well ranges from 44.6 to 217 lpm/mdd, Transmissivity of the wells varies from 1047 to 1689 m^2/day,

Permeability varies from 15.52 to 28.8 m/day and. The tube wells drilled at Khowai, Ashrambari and Bonbazar are auto flowing.

Springs / seepage zones: Springs / seepage zones are available in the district. Traditionally tribal people living in the hilly areas are using spring water for drinking and domestic purposes. In the foothill areas people arrest the spring water by constructing seasonal / permanent bund on streamlets / cherras and used this water for irrigation purpose and sometimes used for drinking and domestic purposes also. In hilly areas of Mungiakami blocks springs are available.

Artesian zones: A few artesian zones occur in the district. These wells are mainly used for irrigation purposes but a few of the wells are even used drinking and domestic purposes also. Artesian zones are found in Khowai, Kalyanpur, Teliamura blocks. The artesian zones found are discontinuous and are localized phenomenon. It is reported that the wells are constructed within a depth range of 10 to 125 m bgl. Discharge of the wells varies from 0.1 to 1.00 lps.

5.4.5 Ground Water Exploration in West Tripura District

Under Ground Water Exploration programme, CGWB has drilled 26 wells in 17 locations (13 EW, 9 OW & 4 Deposit Wells) in the district down to a maximum depth of 281 m bgl tapping Tipam sandstone to determine the aquifer characteristics of the deeper aquifer.

The depth range of the Tubewells constructed ranges from 190mbgl to 281mbgl. The Thickness of the aquifer zones tapped veries from 24 to 64m. The discharge of the wells varies from 0.22 to 46 lps and the drawdown varies from 0.5 to 30.53m. The Specific Capacity of the well ranges from 10.3 to 217 lpm/mdd, Transmissivity of the wells varies from 86.67 to 6859m^2/day, Permeability varies from 2.93 to 134.5m/day and storativity lies in the range of $7.5x10^{-4}$ to $2.06x10^{-3}$.

Artesian zones: A few artesian zones occur in the district. These wells are mainly used for irrigation purposes but a few of the wells are even used drinking and domestic purposes also. Artesian zones are found in Dukli, Mohanpur and Jirania blocks. The artesian zones found are discontinuous and are localized phenomenon. In Agartala valley artesian wells are reported to be constructed within a depth range of 5 to 67 mbgl. The piezometric head varies from 0.05 to 2.10 magl. Discharge varies from 0.05 to 0.75 lps during pre-monsoon and from 0.10 to 0.75 lps during post monsoon.

5.4.6 Ground Water Exploration in Sepahijala district

Under Ground Water Exploration programme CGWB has drilled 8 wells in 6 locations (4 EW, 2 OW, 1 Deposit Well & 1 Slim Hole) down to a maximum depth of 270m bgl tapping Tipam sandstone to determine the aquifer characteristics of the deeper aquifer.

The depth range of the Tubewells constructed ranges from 200mbgl to 270mbgl. The Thickness of the aquifer zones tapped veries from 40 to 66m. The discharge of the wells varies from 2.87 to 31.41 lps and the drawdown varies from 4.95 to 28m. The Specific Capacity of the well ranges from 32.1 to 211.7 lpm/mdd, Transmissivity of the wells varies from 91 to 1438 m^2/day, Permeability varies from 1.83 to 32.92m/day and storativity lies in the range of $4.4x10^{-4}$ to $2.06x10^{-3}$.

Artesian zones: A few artesian zones occur in the district. These wells are mainly used for irrigation purposes but a few of the wells are even used drinking and domestic purposes also. Artesian zones are found in Bishalgarh, Boxanagar, and Melaghar blocks. The artesian zones found are discontinuous and are localized phenomenon. It is reported that the wells are constructed within a depth range of 5 to 65 m bgl. Discharge of the wells varies from 0.06 to 1.00 lps.

5.4.7 Ground Water Exploration in Gomati district

Under Ground Water Exploration programme CGWB has drilled 10 wells in 8 locations (6 EW, 2 OW & 2 Deposit Wells) in the district down to a maximum depth of 255m bgl tapping Tipam sandstone to determine the aquifer characteristics of the deeper aquifer.

The depth range of the Tubewells constructed ranges from 190mbgl to 255mbgl. The Thickness of the aquifer zones tapped veries from 27 to 76m. The discharge of the wells varies from 3.33 to 44 lps and the drawdown varies from 6.8 to 24.3m. The Specific Capacity of the well ranges from 78 to 181 lpm/mdd, Transmissivity of the wells varies from 246 to 794.7 m^2/day, Permeability varies from 4.8 to 10.43 m/day and storativity lies in the range of $1.77x10^{-3}$.

Springs / seepage zones: Springs / seepage zones are available in the area. Traditionally tribal people living in the hilly areas are using spring water for drinking and domestic purposes. In the foothill areas people used to arrest the spring water by constructing seasonal / permanent bund on small streamlets / cherras and used this water for irrigation purpose and sometimes used for drinking and domestic purposes also.

Artesian zones: A few artesian zones occur in the district. These wells are mainly used for drinking and domestic purposes but some of the wells are even used for irrigation purposes. Artesian zones are found in Kakraban, Matabari and Killa blocks. The artesian zones found are discontinuous and are localized phenomenon. It is reported that the wells are constructed within a depth range of 6 to 58 m bgl. Discharge of the wells varies from 0.03 to 1.25 lps during pre-monsoon period and from 0.13 to 2.00 lps during post-monsoon period.

5.4.8 Ground Water Exploration in South Tripura district

Under Ground Water Exploration programme CGWB has drilled 18 wells in 13 locations (12 EW, 5 OW & 1 Deposit Wells) down to a maximum depth of 253 m bgl tapping Tipam sandstone to determine the aquifer characteristics of the deeper aquifer.

The depth range of the Tubewells constructed ranges from 185mbgl to 253mbgl. The Thickness of the aquifer zones tapped veries from 37 to 60m. The discharge of the wells varies from 3.33 to 42 lps and the drawdown varies from 0.75 to 25 m. The Specific Capacity of the well ranges from 11.4 to 1066 lpm/mdd, Transmissivity of the wells varies from 47.4 to 1783.08 m^2/day, Permeability varies from 0.87 to 27.4 m/day and storativity lies in the range of $3.8x10^{-4}$ to $2.38x10^{-3}$.

Springs / seepage zones: Springs / seepage zones are available in the area. Traditionally tribal people living in the hilly areas are using spring water for drinking and domestic purposes. In the foothill areas people used to arrest the spring water by constructing seasonal / permanent bund on small streamlets / cherras and used this water for irrigation purpose and sometimes used for drinking and domestic purposes also. In Satchand and Rajnagar blocks many small seepage zones are present.

Artesian zones: A few artesian zones occur in the district. These wells are mainly used for drinking and domestic purposes but some of the wells are even used for irrigation purposes. Artesian zones are found in Bagafa, Kakraban, Rajnagar and Satchand blocks. The artesian zones found are discontinuous and are localized phenomenon. It is reported that the wells are constructed within a depth range of 10 to 200 m bgl. Discharge of the wells varies from 0.01 to 1.5 lps during pre-monsoon period and from 0.03 to 2.00 lps during post-monsoon period.

5.5 DESIGN OF GROUND WATER STRUCTURES

Based on the hydro-geological situation and yield-draw down relationship, the state has been divided into three sectors viz. 'A', 'B, and 'C'. Sector 'A' coincides with the central part of the valleys, (Figure 5.2) where high yielding tube wells for moderate draw down are considered to be feasible, while sector 'B' forms the foot hill areas, where low yielding tube wells at considerable

drawdown are considered to be feasible. Lastly, sector 'C' coincides with the hills of the state, which are by and large not suitable for construction of tube wells except some of the intermontane valleys, where some very low capacity tube wells may be constructed.

Shallow tube wells up to 60 m depth with expected low yield can be constructed through lowering 150/100 mm diameter pipe assembly with 25 m of housing and 10 m slotted portion by tapping 20-30 m cumulative thickness of granular zones. The annular space between the borehole and the well assembly should be shrouded preferably with 100 mm thick zone of pea sized (2 to 4 mm) gravels. The yield of such tube wells in sector 'A' in valley portions, where draw down less than 5 m and where non-pumping water level is less than 2 mbgl, enables the use of centrifugal pumps.

Deep tube wells of large yield potentiality can be constructed down to the depth of 300 mbgl by 250/150 mm dia. assembly pipes and 40 m housing length tapping cumulative 36-42 m granular zones in sector 'B' i.e. in foot hill area. Results of mechanical analysis of aquifer materials through drill cuttings suggest that the tube wells should be with slot sizes 0.50 to 1.00 mm and the annular space between the borehole and the tube well assembly should be packed with 100-120 mm thick layer of quartzitic sub-rounded to sub-angular gravel of 2 to 4 mm size.

The design aspects of tube wells are mainly controlled by the permeability of aquifer materials in the sub-surface formations. Based on pumping test results, the permeability values in the state are considered as 15 to 30 m/day. Larger life of a tube well can be guarantied by avoiding the movement of fine particles from the aquifer to the screen, which subsequently causes clogging of the screen openings. Movement of fine particles can be avoided by keeping screen entrance velocities sufficiently low. Permeability values suggest that the optimum velocities should be 1 to 2 cm/sec.

Minimum spacing between two shallow tube wells should be kept at 500 m and that between two deep tube wells should be 2000 m at initial stage of development, which may be reconsidered and revised with collection of more pumping tests data and field observation on behavior of piezometers and discharge-draw down relationships in different parts of the state. It is noticed that sufficient number of tube wells have been constructed in the central part of all the valleys. So now the foot hill areas of the state should be emphasized for further ground development by tube wells.

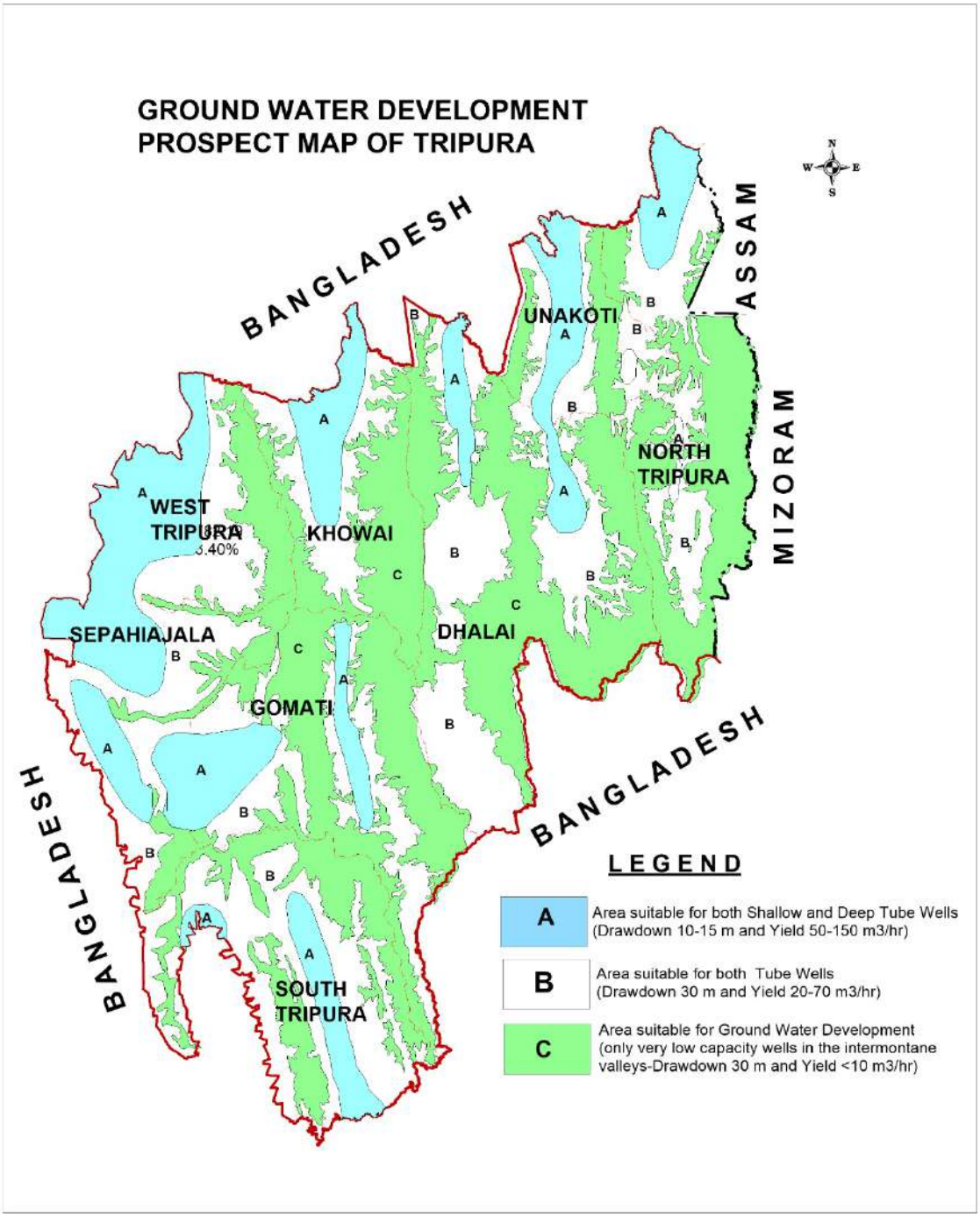

Figure 5.2 : Map showing the Ground Water development Prospect Map in both deeper and shallow aquifer.

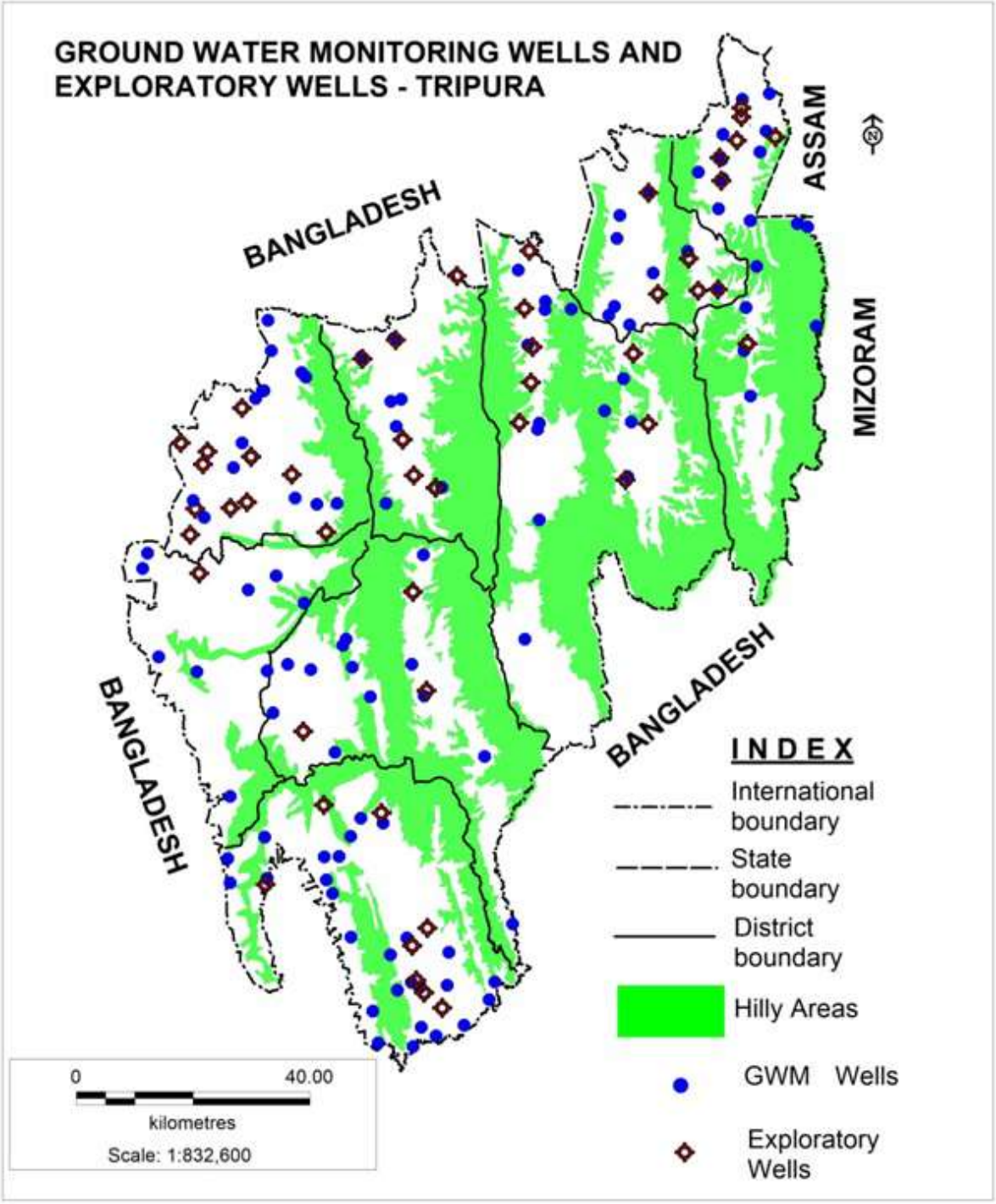

Figure 5.3 : Map showing the locations of Exploratory Wells by CGWB and GWMWs (up to January 2023)

6. GROUND WATER REGIME CONDITION

Ground water regime of Tripura is being monitored regularly through a network of 106 wells (96 Dugwells and 10 Pz) established as National Hydrograph Network Stations (NHNS). Under monitoring work, depth to water level from these wells is measured four times in a year i.e. in the months of January, March, August and November. Water samples are also collected from the NHNS in the month of March i.e. during pre-monsoon in order to assess the chemical quality of ground water. District wise as well as block wise distribution and details of all the Monitoring Stations in the state are furnished in Annexure VIII & IX.

A few GWM dug wells situated in a several districts of Tripura are monitored every month through participatory water level monitoring programme. Moreover, some GWMWs, established in and around Agartala city, are monitored on monthly basis throughout the year. Monthly water level data of these wells show that depth to water level remains minimum during the months of July-August and maximum during the months of February-March.

6.1 WATER LEVEL AND ITS SEASONAL FLUCTUATION

From long term water level data, it has been observed that the depth to water level during the pre-monsoon period generally lies within 0.5 to 9.76 mbgl and during post-monsoon period it lies within 0.5 to 9.18 mbgl, whereas the seasonal fluctuation (Pre-monsoon to Post-monsoon) in water levels normally varies from 0.06 to 2.98 m. The pre and post-monsoon water levels and seasonal fluctuations for last 10 years (2013-2022) are presented in Annexure III & IV respectively.

6.1.1 North Tripura District

Depth to water level in unconfined aquifer varies from 1.05 (Satnala) – 6.93 m bgl (Laljuri) during pre-monsoon and 0.68 – 6.51 m bgl during post-monsoon. Seasonal fluctuation in water level varies from 0.17 to 4.24 m. In deeper aquifer, ground water occurs under semi-confined to confined condition and piezometric surface in deep tube wells is 5.56 m bgl during pre-monsoon and 4.88 m bgl during post-monsoon. Fluctuation of piezometric surface is 0.68 m

6.1.2 Unakoti District:

Depth to water level in unconfined aquifer varies from 2.51 (Kanchanbari) – 7.55 m bgl (Pecharthal) during pre-monsoon and it varies from 1.35 (Jarulthali) – 6.71 m bgl (Kumarghat) during post-monsoon. Seasonal fluctuation in water level varies from 0.34 to 3.13 m.

6.1.3 Dhalai District:

Depth to water level in unconfined aquifer varies from 1.16 (Chawmanu) – 7.91 m bgl (Ambassa) during pre-monsoon and it varies from 0.78 (Durga Chaumuhani) – 6.23 m bgl (Ambassa) during post-monsoon. Seasonal fluctuation in water level varies from 0.12to 3.62 m. The piezometric surface in deep tube wells is 3.9 m bgl during pre-monsoon and 2.87 m bgl during post-monsoon. Fluctuation of piezometric surface is 1.06 m.

6.1.4 Khowai District

Depth to water level in unconfined aquifer varies from 2.03 (Khowai) – 7.46 m bgl (Kathalbari) during pre-monsoon and it varies from 1.98 (Khowai) – 7.38 (Tuimadhu) m bgl during post-monsoon. Seasonal fluctuation in water level varies from 0.05 (Khowai) to 2.10 m. The piezometric surface in deep tube wells varies from 3.37 (Chakmaghat) – 15.42 m bgl (Totabari) during pre-monsoon and from 2.97 – 14.36 m bgl during post-monsoon. Fluctuation of piezometric surface varies from 0.40 to 1.06 m.

6.1.5 West Tripura District

Depth to water level in unconfined aquifer varies from 1.93 m bgl (Sadhupara) – 7.43 m bgl (Chandmari)during pre-monsoon and it varies from 0.55 – 5.39 m bgl during post-monsoon. Seasonal fluctuation in water level varies from 0.65 to 1.72 m. The piezometric surface in deep tube wells varies from 4.54 m bgl (Badharghat) – 28.35 m bgl (Nagichera) during pre-monsoon and from 3.37 m bgl to 26.38 m bgl during post-monsoon. Fluctuation of piezometric surface ranges from 1.17 to 2.40 m.

6.1.6 Sepahijala District:

Depth to water level in unconfined aquifer varies from 2.25 (Golaghati) – 4.77 m bgl (Shivnagar) during pre-monsoon and it varies from 0.54 (Konaban) – 3.63 m bgl (Tufaniamura) during post-monsoon. Seasonal fluctuation in water level varies from 0.55 to 2.70 m.

6.1.7 Gomati District:

Depth to water level in unconfined aquifer varies from 1.04 (Joingkami) – 10.30 m bgl (Kakraban) during pre-monsoon and it varies from 0.92 – 9.48 m bgl during post-monsoon. Seasonal fluctuation in water level varies from 0.04 to 1.67 m.

6.1.8 South Tripura District

Depth to water level in unconfined aquifer varies from 0.75 (Manurmukh) – 8.63 m bgl (Baishnabpur) during pre-monsoon and it varies from 0.98 (Manurmukh) – 6.89 m bgl (Barkashari) during post-monsoon. Seasonal fluctuation in water level varies from 0.58 to 4.51 m. In deeper aquifer ground water occurs under semi-confined to confined condition and piezometric surface in deep tube wells varies from 8.17 (Rajibnagar) – 15.22 m bgl (Tuichama) during pre-monsoon and the same varies from 7.74 – 12.27 m bgl during post-monsoon. Fluctuation of piezometric surface is varies from 0.43 to 2.95 m.

6.2 VALLEY- WISE GROUND WATER CONDITIONS

6.2.1 Agartala Valley:

The synclinal valley of Agartala lies to the west of the Baramura anticline and forms a wider and continuous stretch of land merging with the plains of Bangladesh. It has an area of 1150 sq. km. and the general slope of the valley is towards west. The rivers Haorah and Gomati with their tributaries form the main drainage system of the valley.

The valley of Agartala is principally underlain by the semi-consolidated formations of Upper Tertiary age, comprising sandstones and shales. The valley is dominated by thick sandstone horizons with intervening shale/clay horizons. Because of intercalation of shale, the granular zones occur in three main horizons. The shallow aquifer zone occurs at depth below 3 to 10 m bgl and the thickness varies from 5 to 60 m, which is persistent almost throughout the valley. The deeper aquifer zones occur in the depth span of 80 to 300 mbgl (Figure 4.8). Ground water occurs under unconfined to semi-confined condition in shallow aquifers and semi-confined to confined conditions in deeper aquifers.

Confined condition at shallow depths prevails in some areas of Agartala valley, like in western and Central Part of Bishalgarh Block, in southwestern part of Dukli block; in Nalchar, Chowmuhani and Urmai area of Melaghar block, in central part of Mohanpur block; in northern bank of Haorah river (central part of Agartala valley) in Jirania block in Ashbari-Boxanagar area of boxanagar block. In other parts of this valley ground water occurs under unconfined to semi-confined conditions in shallow depth. In deeper aquifers ground water occurs under semi-confined to confined conditions.

Artesian flowing condition occurs in patches at depth varying from 6 to 50 mbgl. These patches occur along NH - 8 around Jirania, Kamalghat, Fatikcherra, Jogendranagar (Agartala), Bishalgarh, Melaghar etc. Some of the artesian wells cease to flow during the peak summer due to lowering of piezometric head. Yield of these tube wells varies from 100 to 1000 lpm in monsoon and piezometic

head rises up to 2 m agl. The confined zones of medium grained Tipam sandstone has been tapped at the depth span of 98- 110 mbgl.

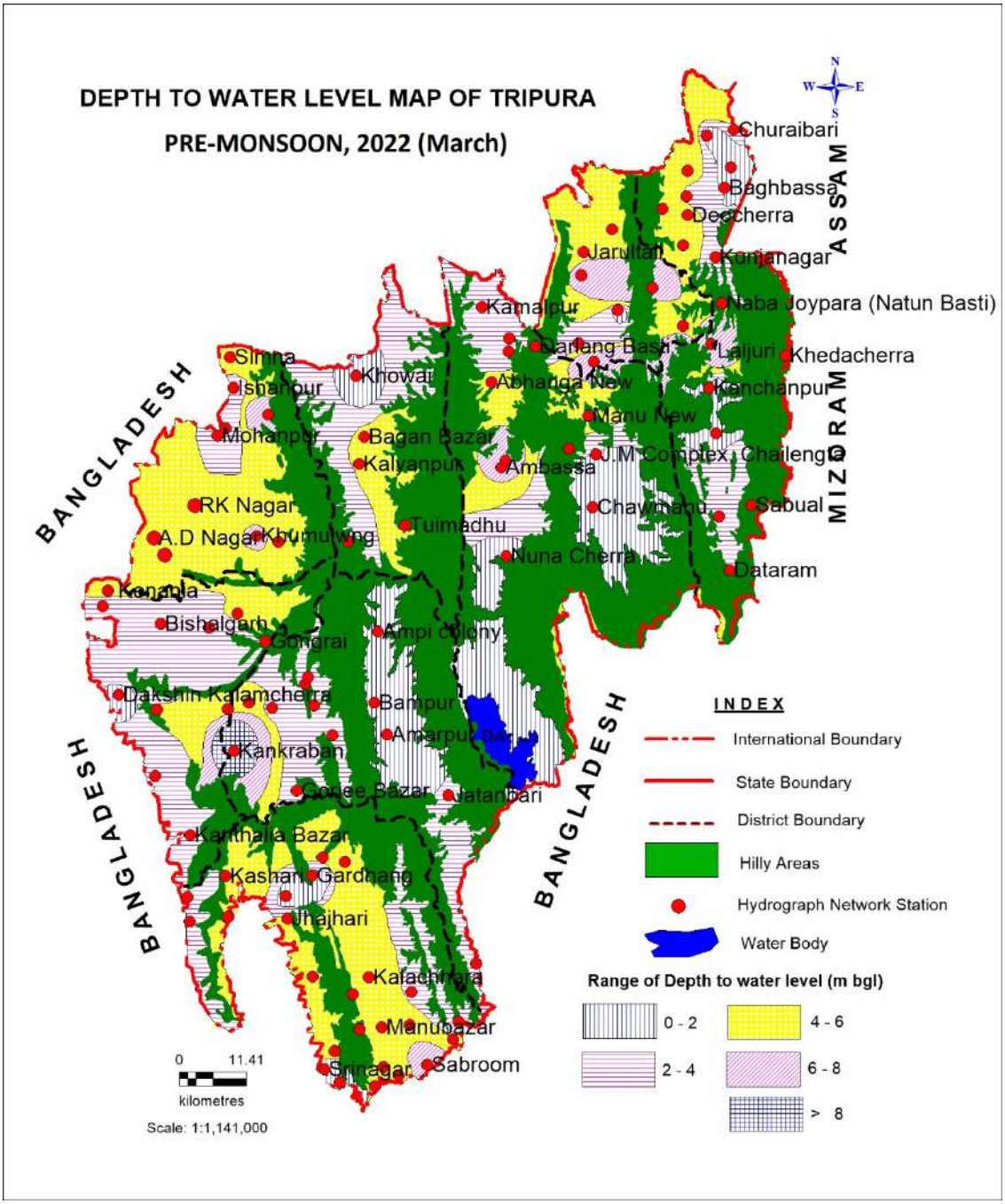

Figure 6.1: Map of Pre-Monsoon depth to water level in GWM dug wells of Tripura (2022)

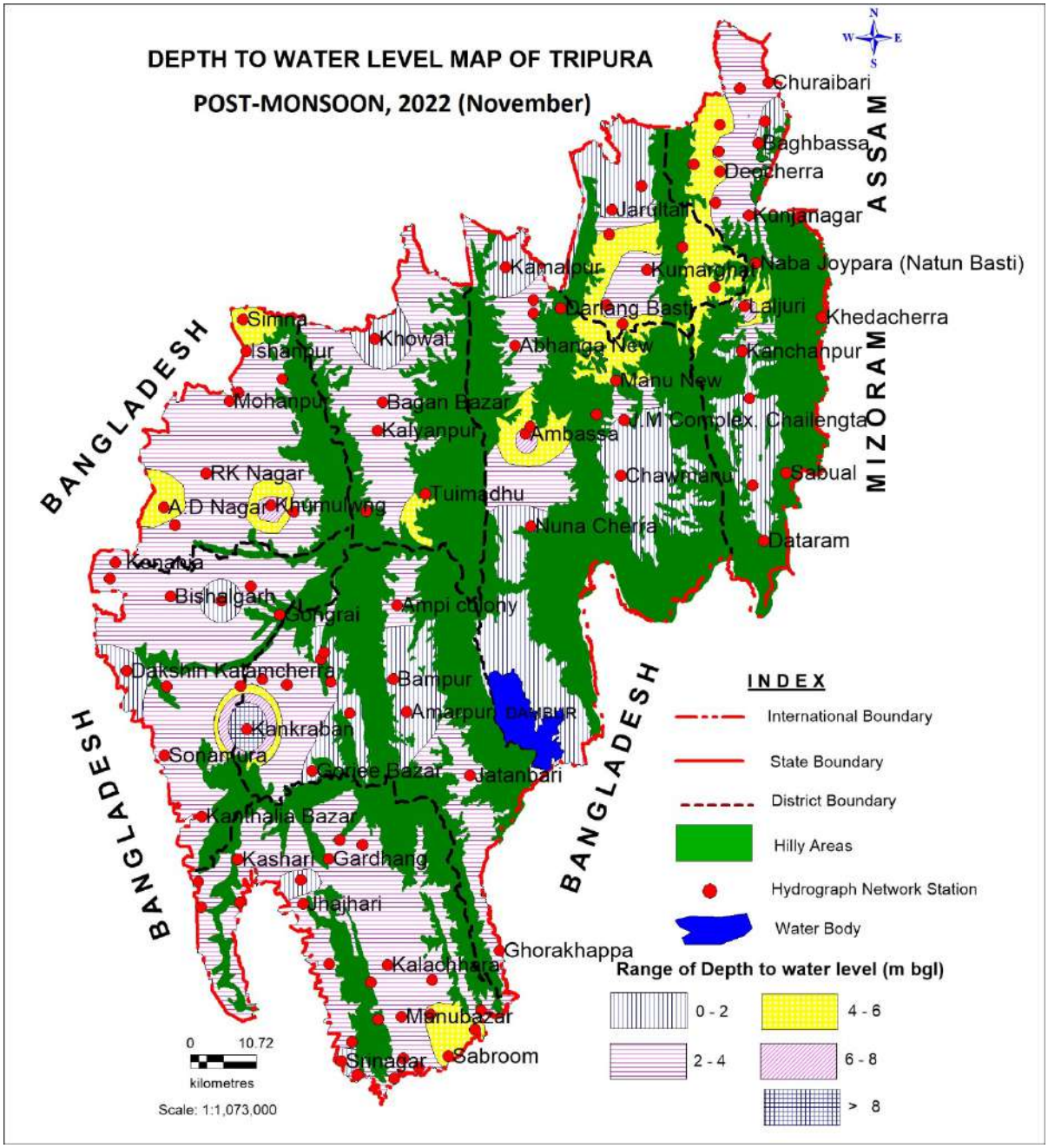

Figure 6.2: Map of Post-Monsoon depth to water level in GWM dug wells of Tripura (2022)

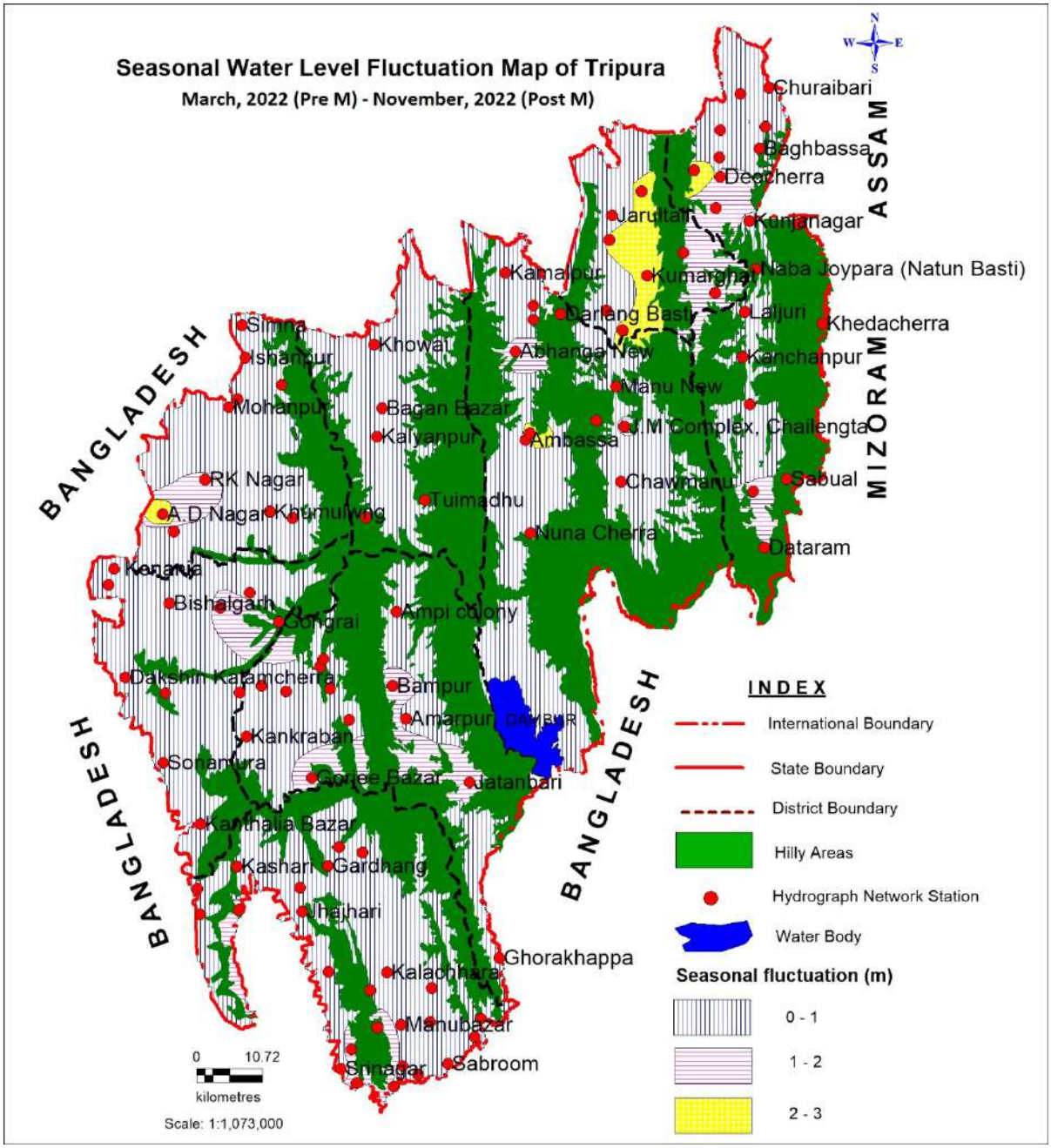

Figure 6.3: Map of seasonal fluctuation of depth to water level in GWM dug wells of Tripura (2022)

6.2.2 Khowai Valley:

The synclinal valley of Khowai lies in between the Atharamura and Baramura anticlines. It covers an area of about 650 sq. km. The general slope of the valley is northward and it also widens in the same direction. The river Khowai and its tributaries drain the valley. The average annual rainfall of the valley is 2366 mm and 2085 mm as recorded at Khowai and Teliamura respectively.

The valley of Khowai is underlain by the semi-consolidated formations of Upper Tertiary age mainly comprising sandstones and shales. The shale/clay partings are more in this valley in comparison to the Agartala valley, which has resulted in diversifications of granular zones. The aquifer occurs in the depth span of 5 to 10 m bgl and in this aquifer ground water occurs in unconfined condition and due to fine grained nature of this aquifer material, it has poor yield which

can sustain dug wells only for light domestic use. The second aquifer occurring at the depth span of 30 to 40 mbgl persists throughout the valley. The other deeper aquifers occur at the depths of 100 to 300 mbgl (Figure 4.7). The second and other deeper aquifers have ground water under semi-confined and confined condition respectively. Depth to water level in the unconfined aquifer varies from 1.8 to 5.0 mbgl and the piezometric head of the deeper aquifers varies from 2.75 to 15.22 mbgl.

In Khowai valley, confined condition at shallow depths occurs in central part of Teliamura block and some patches of Khowai and Kalyanpur block. In other parts of Khowai valley ground water occurs under unconfined to semi-confined conditions at shallow depth. At greater depths, in deeper aquifers ground water occurs under semi-confined to confined conditions.

The artesian flowing conditions are also observed within this valley. The aquifer in the depth span of 35 to 100 mbgl is sustaining several shallow tube wells having flowing conditions. These flowing conditions extend from Kalyanpur and Kamalnagar village up to the Khowai and Asharambari areas near the northern fringe of the valley. In the artesian zones around Chingicherra, a locality close to Khowai town in the north are powerful, where the auto flow discharge of an 80 m deep tube well reaches up to 6000 lph. Generally, the piezometric head is within 2 to 3 m agl, but deep tube wells drilled by the Central Ground Water Board at Khowai had a piezometric head of 7.0 m above ground level and had auto discharge of 54 m^3/hr. In general, the auto discharge of flowing tube wells in the valley varies from 350 to 6000 lph and is persistent throughout the year.

6.2.3 Kamalpur Valley:

The synclinal valley of Kamalpur lies in between Atharamura anticline in the west and Longtarai anticline in the east. The valley covers an area about 330 sq. km. The general slope of the valley is towards the north. The river Dhalai with its tributaries forms the main drainage system of the valley.

The valley is principally underlain by semi-consolidated sediments belonging to Upper Tertiary age comprising sandstones, clayey sandstones, shales and sandy shales. The shaly formations are predominant in the northern part of the valley. The presence of two faults, one at south of Durai-Sibbari in north and another at south of Trilokpara in the southern part of the valley, have caused wide variation in lithological continuity. The shallow aquifer occurs between 5 to 30 mbgl and the deeper aquifers occur in the depth span of 80 to 300 (240) m (Figure 4.5 & 4.6). Ground water occurs both under unconfined and confined conditions. The depth to water level generally varies between 1.5 to 7.33 mbgl and the piezometric head of the deeper aquifer extends to a depth of 3.93 mbgl. Some tube wells around Santirbazar, Abhanga and Ambassa show auto-flowing conditions. The free flow discharge varies from few hundred liters to 1000 liters per hour and piezometric head is up to 5.70 m above ground level as observed at Abhanga.

A large single N-S oriented valley named Kamalpur valley and another small valley along the Manu-Chhamanu tract named Manu valley (actually the southern extention of Kailashahar valley) are located in this district. The study of subsurface geology indicates that productive aquifers are restricted to the N-S elongated central parts of the valleys. Ground water occurs both under unconfined and confined conditions.

6.2.4 Dharmanagar Valley:

The synclinal valley of Dharmanagar lies in between Unakoti/SakhanTlang anticline in the west and the Jampui anticline in the east. The valley covers an area of 1000 sq. km. and the general slope is towards north. Rivers Juri and Kakri with their tributaries drain the valley and flow from south to north. Average annual rainfall of this valley is 2323 mm, whereas normal annual rainfall is 2493 mm.

The valley is underlain by semi-consolidated sediments of Upper Tertiary age, comprising mainly shale, sandstones and shale mixed with sandstones. Shallow aquifers exist within the depth range of 10 to 40 m and the deeper aquifers are generally found to occur in the depth range of 60 to 250 m (Figure 4.2). Ground water occurs both under unconfined and confined conditions. Ground water in the shallow zones is unconfined with the depth to water levels ranging from 1.76 to 5.56 mbgl. Artesian flow is observed, wherever the piezometric level rises above ground level. An artesian belt occurs in

the central portion of the valley between Ichaicherra and Nayapara. The free flow discharge ranges from200 to 1000 litres per hour.

6.2.5 Kanchanpur Valley:

The valley of Kanchanpur lies in between the Sakhantlang anticline in the west and the Jampui anticline in the east like Dharmanagar valley. But it is separated from Dharmanagar valley by a small hill of the Khobal anticline. The valley is very small in size having an area of about 100 sq. km. This valley is drained by Deo river which flows northward up to Kanchanpur and then takes a westward turn, crosses the SakhanTlang range and meets the Manu river near Kumarghat.

The Kanchanpur valley is a very narrow one and is underlain by semi-consolidated sediments of Upper Tertiary age comprising sandstones, sandstones mixed with shale and shales. Central Ground Water Board has constructed 1 exploration well in this valley. The State Govt. authorities have drilled several tube wells. Study of the available drilling data from the state Govt. authorities reveals the presence of shallow aquifer below 3 to 50 mbgl. Deeper aquifers exist between 100 m to 300 mbgl (Figure 4.3). Ground Water occurs both under unconfined and confined conditions. Depth to water level at Kanchanpur valley has been recorded from 0.9 to 6.68 mbgl during pre monsoon and 0.55 to 6.53 mbgl during post monsoon. The piezometric head of the deeper aquiferis 5.05 mbgl. Deep tube wells of the state Govt. at Satnala (195 m), Ghasirampara (158.5 m) and Anandabazar (213.4 m) have shown free flowing conditions in the valley.

6.2.6 Kailasahar valley:

The synclinal valley of Kailashahar lies in between the Longtarai anticline in the west and SakhanTlang/Unakoti anticline in the east. The valley covers an area about 900 sq. km. General slope of the valley is towards north and it also widens in the same direction. The river Manu with its tributary Deo forms the main drainage of the valley and flows from south to north. Average annual rainfall of this valley is 1954mm as recorded at Kailasahar and normal annual rainfall is 2471 mm.

The valley is underlain by semi-consolidated sediments of Upper Tertiary age, comprising mainly clay, clayey sandstones, sandstones and shales. The shallow aquifer zones are occurring near surface at the depth span of 10 to 40 mbgl and having low yielding properties. The deeper aquifer generally composed of sandstones are found to occur between the depth span of 50 to 250 m bgl (Figure. 4.4) Ground water occurs both under unconfined and confined conditions. Ground water in the shallow zones is unconfined with the depth to water levels ranging from 1.63 to 6.55 mbgl. Artesian condition is observed in some shallow and deep tube wells in and around Kailashahar and Chawmanu, showing autoflowing conditions. Depth span of such aquifers ranges from 50 to 80 mand their free flow discharge ranges from 500 to 1000 lph.

6.2.7 Udaipur - Sabroom valley:

This synclinal valley lies to the west of the Baramura anticline and forms the southern extension of Agartala valley of West Tripura district. The valley has an area of about 1500 sq. km. It is mainly underlain by semi-consolidated sediments, comprising sandy clay, clay, sandstone, sandy shales etc. of Upper Tertairy age. The shallow aquifer occurs within depth of 50 m, where shale is dominant with thin intercalations of sandstones of thickness ranging from 3 to 5 m. The deeper aquifer is occurring in the depth span of 50 to 250 mbgl with predominantly fine to medium grained semi-consolidated sandstones of Tipam formation. Ground water occurs both under water table (unconfined) and confined conditions. Depth to water level normally varies from 0.45-6.17 mbgl in pre-monsoon period and 0.55-5.6 mbgl in post monsoon period. Seasonal fluctuation in water level varies from 0.1 m to 1.33 m. The piezometric head of the tube wells tapping confined aquifers varies from 9.22-15.15 mbgl in pre-monsoon period and 7.60-12.42 mbgl in post monsoon period. The seasonal fluctuation in confined aquifer ranges from 0.1 – 2.73 mbgl.

Auto flow condition exists in both shallow and deeper aquifer zones. Deep tube wells located at Udaipur (183 mbgl), Santirbazar (183 mbgl), Satchand (200 mbgl), Rajnagar (186 mbgl), Dhupthali (132 mbgl), Tulamura (212 mbgl) and Paschim Jalefa (175 mbgl) have resulted in auto-flowing wells.

The auto-flow discharge of these wells varies from 0.5 to 5.4 m^3/hr and the piezometric surface rises up to 2 m agl. These flowing wells occur in disconnected belts spread all over the Udaipur-Sabroom valley. Shallow wells of depth 40 to 70 mbgl in Udaipur, Bagafa and Sathchand blocks have also flowing condition with auto-flow discharge ranging from 100 to 1000 lph with a usual pizometric head 0.50 to 1.0 m agl.

6.2.8 Amarpur valley:

The synclinal valley of Amarpur lies in between Deotamura/Baramura anticline in the west and Atharomura in the east and widens towards north. This valley forms the southern extension of Khowai valley of West Tripura district and covers an area of 455 sq. km. River Gomati with its tributaries forms important drainage system of this valley. The average annual rainfall is 1976 mm, whereas the normal annual rainfall is 1724 mm. There is no uniform slope in the valley, in northern half and in southern portion it has southward slope, while in center the slope is westerly.

Amarpur valley is underlain by semi-consolidated Upper Teriary formations comprising clay, sandy clay, sandstone, sandy shale and shale. Ground water occurs under both water table and confined conditions. The depth to water level in the valley is generally governed by topography and responds immediately to the precipitation. In general, the depth to water level is found at a shallow depth from 0.4 to 4m bgl. Deeper water level is noticed at Kakraban block. Artesian flowing conditions have been noticed in the valley around Ompinagar and Twidu, but the discharges are very low and limited to 100 lph.

6.3 LONG TERM TREND OF WATER LEVEL

Long Term Water Level Trend of 131 Hydrograph Monitoring Stations (Dug Wells) showed almost steady condition. During pre-monsoon, mean water level recorded from Dug Wells (April 2011 to March 2021) in the state varied from 1.03 mbgl (Manur Mukh, South Tripura) to 7.93 mbgl (Subalsingh, West Tripura), from Deep tube well it varied from 9.92 mbgl (Narsingarh DTW, West Tripura) to 27.76 mbgl (Nagicherra DTW, West Tripura). During post-monsoon (November 2011 to November 2021), mean water level from dug wells varied from 0.91mbgl (Manur Mukh, South Tripura) to 6.27 mbgl (Subalsingh, West Tripura), for deep tube well it varied from 8.05 mbgl (Narsingarh DTW, West Tripura) to 25.40 mbgl (Nagicherra, West Tripura)Annexure V.

In respect of 56 monitoring stations, pre-monsoon trend for last 10 years (2010 –19) shows a rise in water level in 39 (70 %) stations with range from 0.004 to 0.591 m/yr and fall in 17 (30 %) stations with range from 0.002to 1.117 m/yr. Post-monsoon trend of water level for last 10 years shows a rise in 36 (64 %) stations with the range from 0.003 to 0.865 m/yr and fall in 20 (35 %) stations with a range from 0.005 to 0.966 m/yr (Annexure IV). Seasonal fluctuation of water levels on yearly basis for the period 2011-21 is given in Annexure V. Long term ground water level trend can be reflected through hydrograph. The decline and rise in water level over a period of years of monitoring Dug wells and tube wells is graphically shown in the figure below:-

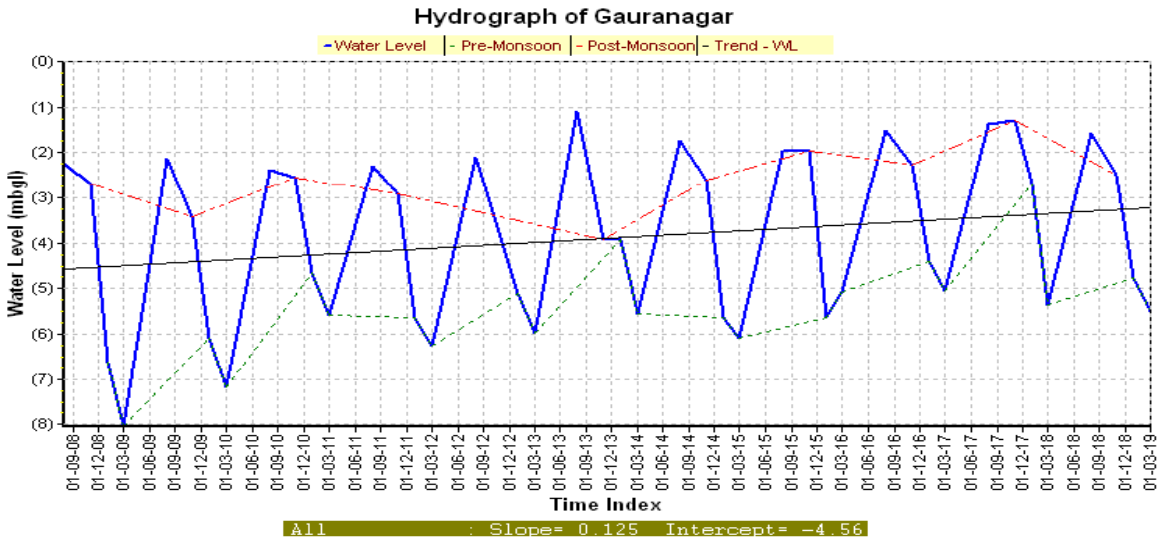

Figure 6.4(a): Hydrograph showing a steady rise in groundwater level trend of Gaurnagar Monitoring station

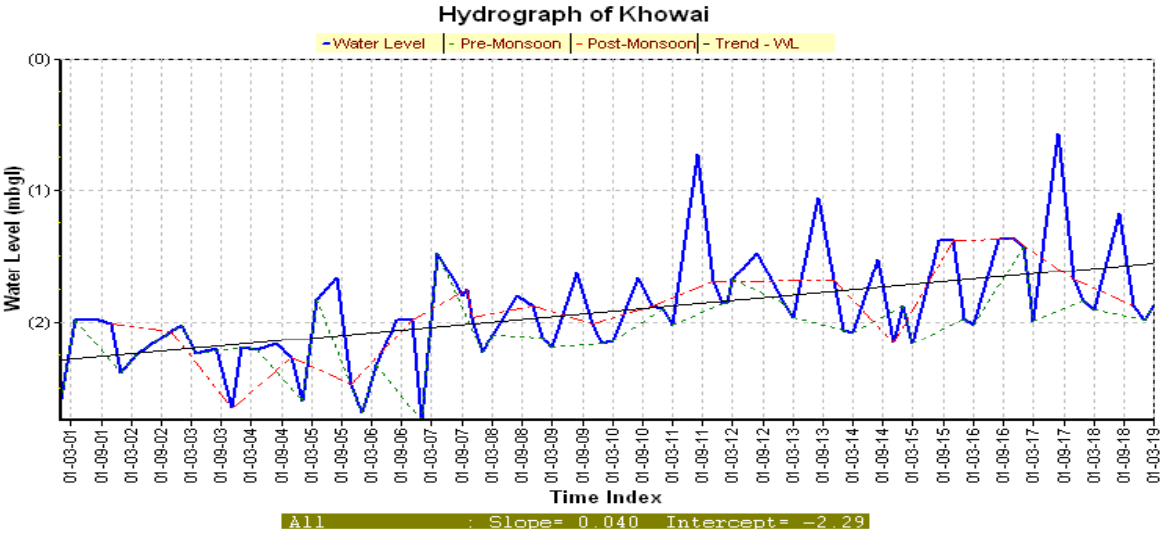

Figure 6.4(b): Hydrograph showing a rising ground water level trend of Khowai Monitoring station

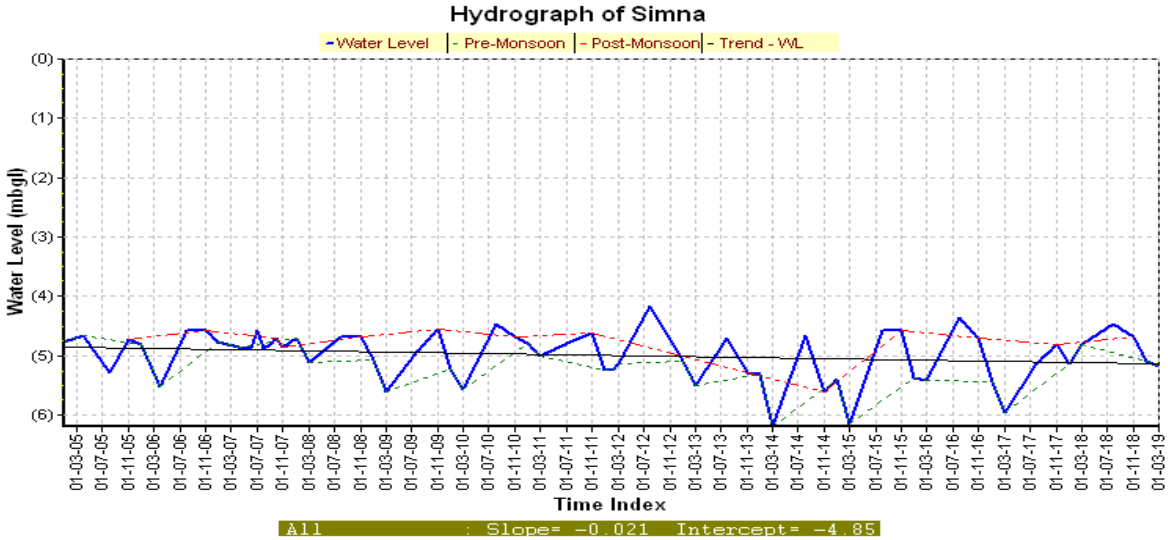

Figure 6.4(c): Hydrograph showing a neutral ground water level trend of Simna Monitoring station

6.4 WATER TABLE CONFIGURATION

The water table contours are usually influenced by the topography, proximity of surface water bodies, drainage, channel, ground water draft etc. The major trend of water table contour, at high altitude, is related to those of small hillocks and foothill regions of the valleys. At lower altitudes in Tripura, these contours turn towards the upstream side of the major drainage patterns thereby indicating the effluent nature of major rivers flowing in the respectively valleys.

The pattern of pre-monsoon of water table contours in Agartala valley reveals that the master slope of the ground water is towards west. In Udaipur valley, the flow pattern shows effluent nature of Gomati River. Hydraulic gradient in major part of the valley is 1.2 m/km.

In North Tripura, Unakoti and Dhalai districts covering Dharmanagar, Kailasahar and Kamalpur valleys, the general flow of ground water is towards north and in South Tripura district covering Sabroom valley, the movement is towards south. The water table gradient in these valleys ranges from 1.08 to 1.60 m/km. Gradient in general is steep near the foothills and becomes flatter along the riverine tracts.

During post-monsoon period the flow directions remain the same but there a major shifting in the position of respective water table contours is observed. The contours become flatter with a general hydraulic gradient of 0.88 m/km.

7. GROUND WATER RESOURCE ESTIMATION

Ground water reserves have been assessed block wise in all the eight districts of Tripura by CGWB based on the basis of available data, the results of exploratory drilling and other hydrogeological testing. The dynamic reserve which is seasonally renewable in response to monsoon recharge has been assessed based on the seasonal fluctuation of water table and specific yield of shallow aquifer materials. Dynamic reserves of ground water, extent of current utilization, balance available for further development have been calculated. From these data it is very transparent that so far only fringe of the ground water resources has been harnessed.

The previous ground water resources assessment (prior to 2017) of the state was done based on the recommendations of Ground Water Estimation Committee – 1997 (GEC'97). The GEC'97 methodology was subsequently modified in the light of enhanced database and new findings of experimental studies in the field of hydrogeology.

The present methodology used for resources assessment is known as Ground Water Resource Estimation Methodology – 2015 (GEC'2015) using the INGRESS Software. The revised methodology GEC 2015 recommends aquifer wise ground water resource assessment. Ground water resources have two components – Replenishable ground water resources or Dynamic ground water resources and Instorage resources or Static resources. GEC 2015 recommends estimation of Replenishable and in-storage ground water resources for both unconfined and confined aquifers. In GEC'2015, two approaches are recommended – water level fluctuation method and norms of rainfall infiltration method. The water level fluctuation method is based on the concept of storage change due to difference between various input and output components. Input refers to recharge from rainfall and other sources and subsurface inflow into the unit of assessment. Output refers to ground water draft, ground water evaporation, transpiration, base flow to streams and subsurface outflow from the unit.

The ground water resources assessment unit is in general watershed particularly in hard rock areas. In case of alluvial areas, administrative block can also be the assessment unit. In each assessment unit, hilly areas having slope more than 20% are deleted from the total area to get the area suitable for recharge. In Tripura, there is no such extensive and significant command area and hence not considered for the estimation work. The majority of technical data were made available by PWD (Water Resources), PWD (DWS) & Agriculture Dept., Govt. of Tripura and the same were utilized for the dynamic resource estimation.

Hydrogeological formations named Dupitila, Tipam and Surma of Upper Tertiary age are spread all over the state of Tripura and all are considered as a single hydrogeological unit. For estimation of recharge and other figures the same unit is considered for the entire state. The dynamic resource estimation is done for the ground water year 2022 (1st April 2021 to 31st Mar 2022).

The rainfall infiltration factor recommended by GEC 2015 for sandstone is 0.12. For calculating recharge from return flow from irrigation, an average water requirement of 1m & 0.1m for paddy & non-paddy has been taken from Agriculture department, Govt. of Tripura. Computation factor for return flow from ground water irrigation is taken as 0.25 – 0.45 and from surface water irrigation is taken as 0.30 – 0.50 as per GEC 2015 methodology.

Ground water drafts for various uses in the different sub-units have been estimated according to the recommended methodology. Ground water draft for domestic use has been estimated based on the number of different types of ground water abstraction structures and their unit draft per year and also on population as per 2011 Census. The unit draft of dug well is 0.2 ham and unit draft of shallow tube well (fitted with hand pumps) is also taken as 0.2 ham. Amongst these two values, ultimately the higher figure has been considered for further ground water resource assessment.

Block-wise ground water draft for irrigation was estimated based on the number of structures of shallow tubewell and the unit draft of shallow tubewell fitted with pump set is 3 ham. Ground water in the state is mostly used for domestic & irrigational purposes. Ground water for industrial draft is

negligible and has not been considered while assessing the ground water draft. The major potential aquifer in the state is Tipam sandstone and the specific yield value for Tipam sandstone is taken as 0.08 (from GEC 2015 Methodology).

Recharge from Rainfall has been computed separately for monsoon and non-monsoon periods for the entire state. The recharge from rainfall during monsoon season has been computed using both water level fluctuation method (WLFM) and rainfall infiltration method (RIFM). The results from the above two methods (WLFM & RIFM) have been compared using Percent Deviation (PD). After the computation of the percent deviation (PD) it is found that in out of 59 assessment units, 34 units were considered by RIF method and 25 units by WLF method.

Stage of ground water extraction in West Tripura district is highest i.e 20.20% and lowest in Gomati district, which is 5.42%. All the administrative blocks of Tripura have been categorized as "safe" from the ground water extraction point of view. Agartala Municipal Corporation of West Tripura district has attainted the highest stage of extraction i.e. 55.72% and Karbuk block of Gomati district has the lowest stage of ground water extraction i.e. 2.49%. Out of total 59 assessment units, 35 nos. of units have the stage of ground water extraction below 10%. The long-term water level trend of the blocks during pre-monsoon and post-monsoon periods shows almost stable condition.

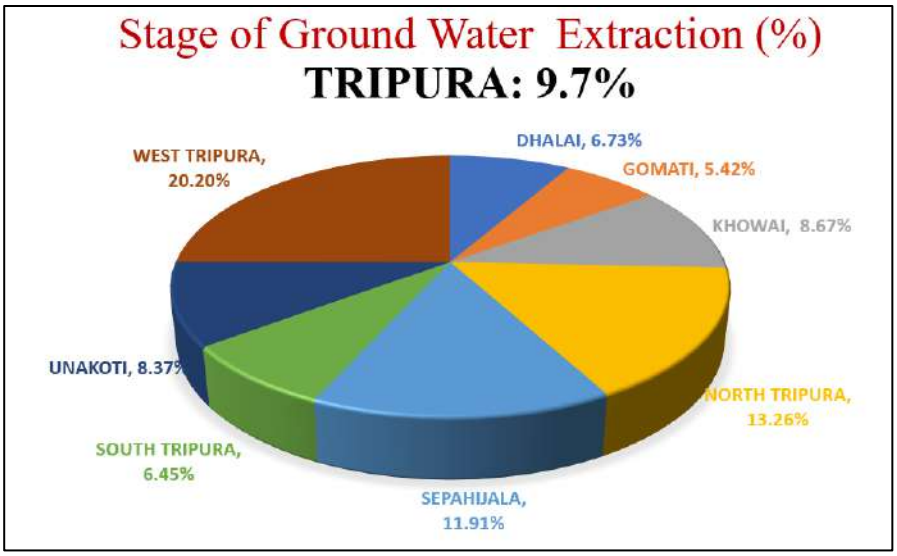

Figure 7.1: The State of ground water Extraction in Tripura (As per GWRE, 2022)

Total ground water recharge is estimated after deducting resultant flow from evaporation and transpiration, and it is 1.18 BCM. Annual extractable groundwater resources are estimated after deducting natural discharge, and it is 1.06 BCM. Ground water extraction for various uses has been estimated for all the assessment units of Tripura. Gross annual ground water extraction for all uses in Tripura is 0.103 BCM and allocation for domestic up to year 2025 is 0.09 BCM. Balance groundwater resources available for future development are 0.09 BCM. The stage of development of Tripura is 9.7 % and all the 59 blocks / assessment units (including 1 non-block, Agartala) in Tripura state falls under **SAFE** category.

8. HYDROCHEMISTRY AND CHEMICAL QUALITY OF GROUND WATER

In general, the ground water of Tripura is characterized by low total dissolved solids and low chlorides as indicated by specific conductivity varying from 33 to 954 micromhos/cm but by high concentration of Iron (Fe). Ground water appears to contain quite high Fe as testified by formation of ferric oxides as soon ground water samples are exposed to atmosphere. Otherwise, the ground water from both the shallow and deeper aquifers of the state is fresh, potable and free from other serious contaminants such as fluoride and arsenic. Ground water is characterized by low chloride contents ranging from 7.09 ppm to 212 ppm. Bi-Carbonate is also very low in concentration varying from 5 ppm to 310 ppm. Sulphate concentration is also low being restricted to only 1 to 101 ppm value. The Ca and Mg contents vary from 4 to 38 ppm and 1.2 to 23 ppm respectively. Ground water occurring in the State of Tripura may be classified as Calcium Bi-Carbonate type of water.

The state of Tripura is underlain by alluvium of Recent age and Dupitala, Tipam, Surma formations of Upper Tertiary age. The main aquifers are formed by Dupitila and Tipam formations which are ferruginous in nature. The ferruginous material is the source of high iron in ground water. The concentration of iron in deep tube wells ranges from 0.1 to 15.9 ppm. The highest concentration of 15.90 ppm is noticed at Harikumartilla (West Ghilatali) village in Kalyanpur block. The desirable and permissible limits of iron in drinking water are 0.3 and 1 ppm respectively. The high incidence of Fe renders groundwater unsuitable for drinking purposes. Therefore, arrangements should be made for removal or bringing down the Fe contents below the permissible limit, so that the waters may be used for drinking purpose without any risk of health hazards. High concentration of iron also creates aesthetic problems like colour, stains, smell etc., hence it is to be removed before put to use. The various processes involved in removal of iron are aeration, coagulation, sedimentation and filtration. Potassium Permanganate or Chlorine/Chloride may be employed for oxidizing the dissolved ferrous iron to insoluable ferric iron, which is then filtered from the water. This process is applicable very much when bacteria is present in the water. Iron can also be removed by the addition of mixture of Sodium Carbonate and Sodium Phosphate to precipitate iron as insoluble, followed by settling and filtration. The various apparatus/plants for removal of excess iron from ground water are Tripura Filter for domestic use in individual households, Modified Iron Removal Plant and Package Type Iron Removal Plant for community use. Tripura filter was evaluated by All India Institute of Hygiene and Public Health, Kolkata and found capable of removing iron and also bacteriological contamination effectively, which is highly recommended for rural, hilly and tribal areas due to its low cost.

8.1 WATER QUALITY OF SHALLOW AND DEEP AQUIFERS

In order to assess the present chemical quality of ground water in the state of Tripura, the results of chemical analysis of ground water samples (pre-monsoon – 2018) from the shallow aquifers was analyzed by the chemical laboratory of Central Ground Water Board, North Eastern Region, Guwahati have been studied minutely (Annexure – VI&XII). The results show that there is a minor difference between quality of water from water table aquifers and deeper aquifers. Minimum and maximum values of various chemical constituents in shallow and deeper ground water in the state are shown in the Table 8.1 & 8.2 below:

Table 8.1 : General range of chemical constituents of ground water from shallow aquifers

		P^H	EC	Cl	CO_3	HCO_3	Ca	Mg	TH	TDS	Na	K	Fe	Ur
				In mg/litre										ppb
2018	Min.	6.1	33.79	7.09	0	5	4	1.19	25	51	1.39	1.46	0	
	Max.	8.9	954	212	90	310	38	23	195	406	55.78	41.86	2.76	
2022	Min.	3.26	58.43	7.09	0	18.315	4.0032	1.19	25	38.564	2.73	0.9	0.105	0.0014
	Max.	8.35	612.7	63.81	21	610.49	50.04	20.629	180	404.38	125.96	68.6	3.17	0.6479

Note : EC in mirco mhos/cm at 25^0C and other constituents are in mg/lt except pH

The ground water samples collected during ground water exploration (1976-2007) from deeper aquifers specially in the districts of West Tripura (particularly in, Jirania, Lichubagar), North Tripura (particularly in Panisagar), Sepahijala(Golaghati) and Gomati (Dhuthali) is generally characterized by high concentration of Fe.

Table 8.2: General range of chemical constituents of ground water from deeper aquifers

	p^H	EC	Cl	$CaCO_3$	HCO_3	Ca	Mg	TH	TDS	Na	K	Fe
			In mg/litre									
Max.	8.9	418	41	170	188	32	11	115	130	21	3	12
Min.	6.5	50	2.8	5	31	1	Trace	5	10	1	1	0.2

8.2 SUITABILITY OF GROUND WATER FOR DOMESTIC USE

The p^H values of ground water ranges from 6.1 to 8.9 for shallow zones and from 6.5 to 8.9 for deeper zones. It is a measure of alkalinity of water. WHO (2012) has recommended acceptable range of p^H from 6.5 to 8.5 for domestic use. Water from Dug well at Panisagar has a pH value of 6.1 and from only one tube well at Pecharthal in North Tripura has pH value of 8.9, otherwise water from all over the state is fit for domestic use as per pH values.

Calcium and Magnesium are essential for human beings, but excess quantities of these elements harden the water. The desirable limits fixed by the BIS (2012) are 75 ppm for Calcium and 30 ppm for Magnesium and recommends rejecting water with more than 200 ppm of Calcium and 100 ppm of Magnesium. Keeping this in view, the ground water in the state can be said to be well below the maximum permissible limit in both cases. Calcium and Magnesium Carbonate and Bi-Carbonate are the important constituents of total hardness. In the state, Total Hardness varies from 25 to 195 ppm for shallow ground water and from 5 to 115 ppm for deeper ground water. Here the hardness is of Carbonate type, which is a temporary one and non-carbonate hardness which is a permanent hardness, however is very less as sulphate, nitrate and chloride ions are almost negligible or absent.

Ground water of the state is characterized by a generally high iron content, particularly in Dharmanagar, Kailasahar and Agartala valleys, which usually ranges from 0.2 to 12 ppm. Iron concentration in water from open dug well is comparatively less than that from tube wells (Figure 8.1). This is due to the fact that the scope of aeration is more in open dug wells which allows the precipitation of ferrous iron as ferric iron. Such reaction is, however, not possible in the deep tube wells where the exposed area of aeration is very restricted. So the people of Tripura should preferably use the ground water from dug wells for drinking purpose as dug well water is generally devoid of any high iron menaces. The enrichment of iron in water of the state is due to the ferruginous nature of Tipam Sandstones, which actually forms all the major aquifers. High contents of iron renders ground water unsuitable for drinking purpose, hence the level of concentration should be brought down before its use for drinking purpose at community level to avoid any health hazards.The iron concentration above 0.5 ppm imparts a distinct taste disorder and an inky flavor to water.

8.3 SUITABILITY OF GROUND WATER FOR IRRIGATION USE

The suitability of ground water for irrigation purpose mainly depends upon two factors - (i) the salinity i.e. total salt concentration measured by Electric Conductance (EC) and (ii) the sodicity, i.e. the proportion of sodium to other constituents.

Ground water is being increasingly used for irrigation purposes by means of both shallow and deep tube wells. Ground water in the state is generally fresh and potable with low total dissolved solids as indicated by electrical conductivity varying from 33 to 954 micromhos/cm. Ground water is mildly alkaline in reaction with p^H ranging from 6.1 to 8.9. Bi-Carbonate is also very low in concentration varying from 5 to 310 ppm. Ground water is characterized by low Chloride contents of 7 to 212 ppm. Sulphate concentration is also low and varies between 1 to 101 ppm. Ca and Mg contents vary from 4-38 ppm and 1.2-23 ppm respectively. Based on the values of cations and anions the

ground water occurring in the state may be classified as Calcium Bi-Carbonate type of water. All these chemical characteristics render the ground water suitable for irrigational uses.

Various inputs like fertilizers and pesticides are being applied to the irrigated fields for stepping up the food production. These inputs contain many harmful constituents, which may percolate to shallow ground water body by irrigation water seeping through the subsurface formations. No analysis of ground water samples from irrigated lands has yet been carried out in Tripura for detection of artificial pollutants. So it has now become necessary to regularly monitor the ground water quality in areas covered by extensive agricultural lands to find out the level of pollution, if any.

8.3.1 Salinity of Ground Water

The electrical conductivity (EC) of water expressed in micromhos/cm at 25^0C which is a measure of the salinity in water i.e. the dissolved salt in water. A perusal of the results shows that ground water from shallow aquifers has more dissolved salt than the ground water from the deeper aquifers in the state. In general, ground water occurring in both shallow and deeper aquifers of the state falls under moderate (C_2) to low (C_1) salinity class as per US Salinity Diagram. As the ground water of the state, in general have EC below 800 micromhos /cm at 25^0 C, it is suitable for irrigation for all types of crops.

8.3.2 Sodicity of Ground Water

The presence of sodium in irrigation water adversely affects the soil structure and the permeability by replacing Calcium and Magnesium content of the soil, hence the various ratio of the content of Sodium to the contents of Calcium, Magnesium and Potassium etc. have been used to depict the suitability of ground water for irrigation in the state.

Sodium adsorption ration (SAR) and the soluable sodium percentage (SSP) of ground water of Tripura have been studied. The SAR values vary from 0.1 to 4.07 suggesting low sodium (S_1) hazards of ground water. SSP values are generally well below 60 % suggesting good and permissible class of the ground water in the state. The SSP in West Tripura District is more than that of South Tripura and North Tripura Districts. According to Wilcox (1948), a SSP value of more than 60 % puts the water in doubtful class, while value up to 60 % is permissible and water belongs to a good class for irrigation.

On the basis of the salinity and the sodicity, the ground water of the state has been classified as C_1S_1 class as per US Salinity Diagram which means that the water is good for irrigation purpose for all types of crops in all types of soils in the state of Tripura.

8.4 SUITABILITY OF GROUND WATER FOR INDUSTRIAL USE

Generally, ground water of the state is more or less suitable for industrial purposes, except the high concentration of iron, which should be lowered to desirable limit before using in the factories as it causes encrustation on some metallic objects due to persistent contact and deposition of red ferric oxide sediments due to stagnation or prolonged exposure of high iron bearing water on atmosphere.

8.5 SUITABILITY OF GROUND WATER FOR WELL SCREEN

The quality of ground water has pronounced effect on tube well screens. Most of the tube wells fail or become sick due to encrustation and corrosion due to high content of iron in pumped ground water. Corrosion is a chemical action of water on metallic pipes which results in eating away or removal of slots resulting in sand rushing in pumped water. The water is non-corrosive to iron or steel, if it has EC value up to 1500 micromhos/cm and pH above 7. The EC of ground water is below 800 micromhos/cm in Tripura. But p^H value in ground water is below 7 at a tube well in Paschim Jalefa of South Tripura district, Simna in West Tripura district, Kumarghat, Jarultali and Kanchancherra in Unakoti District,Bhagabassa and Panisagar in North Tripura district, Darlang Basti and Kamalpur in Dhalai District where water is corrosive. But in general, the ground water of the state of Tripura is non-corrosive to metals like iron and steel.

Encrustation involves deposition of undesired materials either on the screen openings or in voids of the water bearing formation and is associated with diminution of well discharge. According to J. L. Mogg, water containing 2 ppm or more of iron and 1 ppm or more of manganese tend to cause encrustation. The other cause of encrustation in the state of Tripura is the presence of iron bacteria, which results in clogging of the slotted pipe. As generally deeper ground water of the state has iron content more than 2 ppm, it is encrustating in nature. Hence the well screen should be cleared periodically, roughly once in a year, even if the discharge does not decline. Glassy phosphates are known to be effective to clean the iron encrustation on the tube well pipes.

8.6 GROUND WATER CONTAMINATION

Ground water is the major source of drinking water in urban and rural areas. Water from both the shallow or deep aquifers is generally fresh and potable except high iron content. Amongst the deep tube wells constructed by CGWB in Tripura tapping deeper aquifers, iron content ranges from 0.06 to 12.38 ppm (at Lichubagan, Agartala). In North Tripura iron in deeper aquifer ranges from 0.1 to 12.00 ppm.The highest concentration of iron 12 ppm is noticed in deep tube well by CGWB in Panisagar BSF camp. In West Tripura district, iron content in shallow aquifer ranges from BDL to 10.20 ppm whereas in North Tripura district it in shallow aquifer ranges from 0 to 1 ppm.

Bacteria like **Gallionella, Crenothrix and Letpothrix** exert a catalytic effect to speed up the chemical reactions that are thermodynamically favourable. Different types of bacteria may live together in symbiotic relationship and greatly aggravate the problems with well performance and corrosion of iron pipes and well casing and other exposed metallic iron in water supply systems.

8.6.1 Processes for removal of iron:

1. Aeration: The process through which water is in contact with atmosphere, which is most easily achieved by using a cascade or fountain system. Apart from providing oxygen for purification and improving overall quality, it also reduces the corrosiveness of water by driving off CO_2 and rising the p^H. It also improves taste of water by stripping out the solution of hydrogen sulphide and volatile organic compounds. It also removes Fe & Mn from solution which affects taste of water and stains clothes. Iron is soluble only in water at p^H<6.5 and in the absence of oxygen. Aeration increases the p^H and converts soluble iron into insoluble hydroxide form which can be removed by other processes.

2. Coagulation: It is a process where coagulants are used to induce particle agglomeration. Selection of a suitable coagulant depends on the nature of particles, especially their affinity to adsorb water, and their electrical charge. Particles are either hydrophobic or hydrophilic. Iron oxides are hydrophobic. A wide variety of coagulants are available and the most common are Alum ($AlSiO_4$), aluminium hydroxide, ferric chloride and ferric sulphate. The coagulant is added to the water in a special vessel (coagulant rapid mixing unit) for coagulating the iron particles.

3. Filtration: A process to remove the residual material, where water is passed through a porous bed of inert medium, usually silica or quartz sand from which small particulate matter is strained. Filters are classified as either slow or rapid and can be operated either by gravity or by pressure (where the water is forced through the medium under pressure, significantly increasing the flow- through rate).

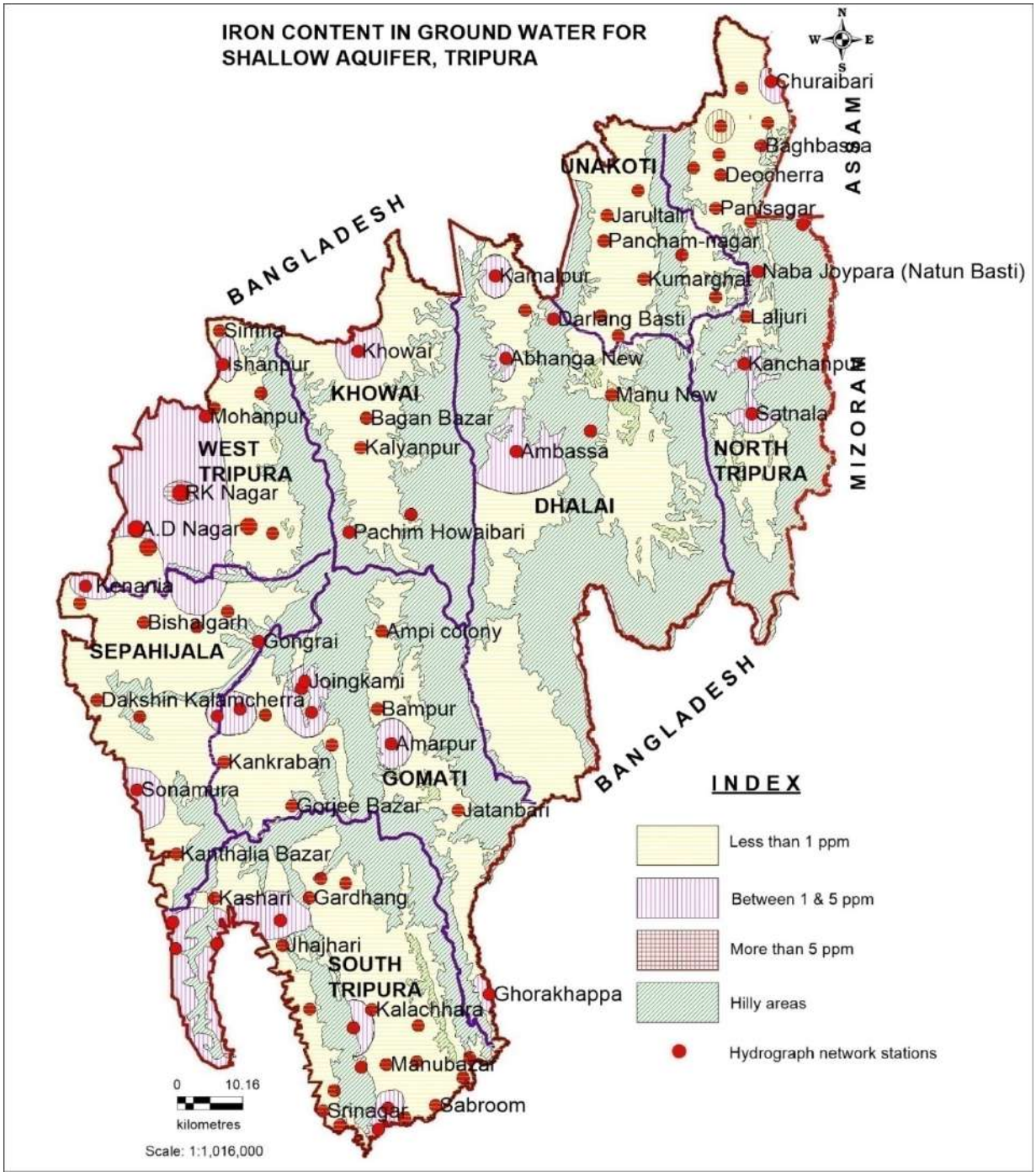

Figure 8.1: Map showing the areas and intensity of Iron contamination in shallow aquifers of Tripura

It is anticipated that in future the ever increasing unplanned urbanizing may cause pollution of ground water in the shallow aquifers. Cities like Agartala, Udaipur and Dharmanagar, a large number of tanks or small lakes also exist, some of which are nothing but chess pools. These cities have not yet been provided with proper underground sewerage system. The tanks which are used by urban people for various household uses are the foci of spread of pollution. Polluted water of such stagnant pools seeps underground and contaminates the near surface aquifers. Therefore, it is recommended that the domestic waste should be treated properly before disposal and as far as possible all major drains should be lined with brick and concrete to avoid pollution of ground water through leakage and

seepage of wastes and waste waters from the drains. There are also some kaccha latrines in the cities and open defecation is also seen in some poor slum areas, which cause a serious fecal pollution.

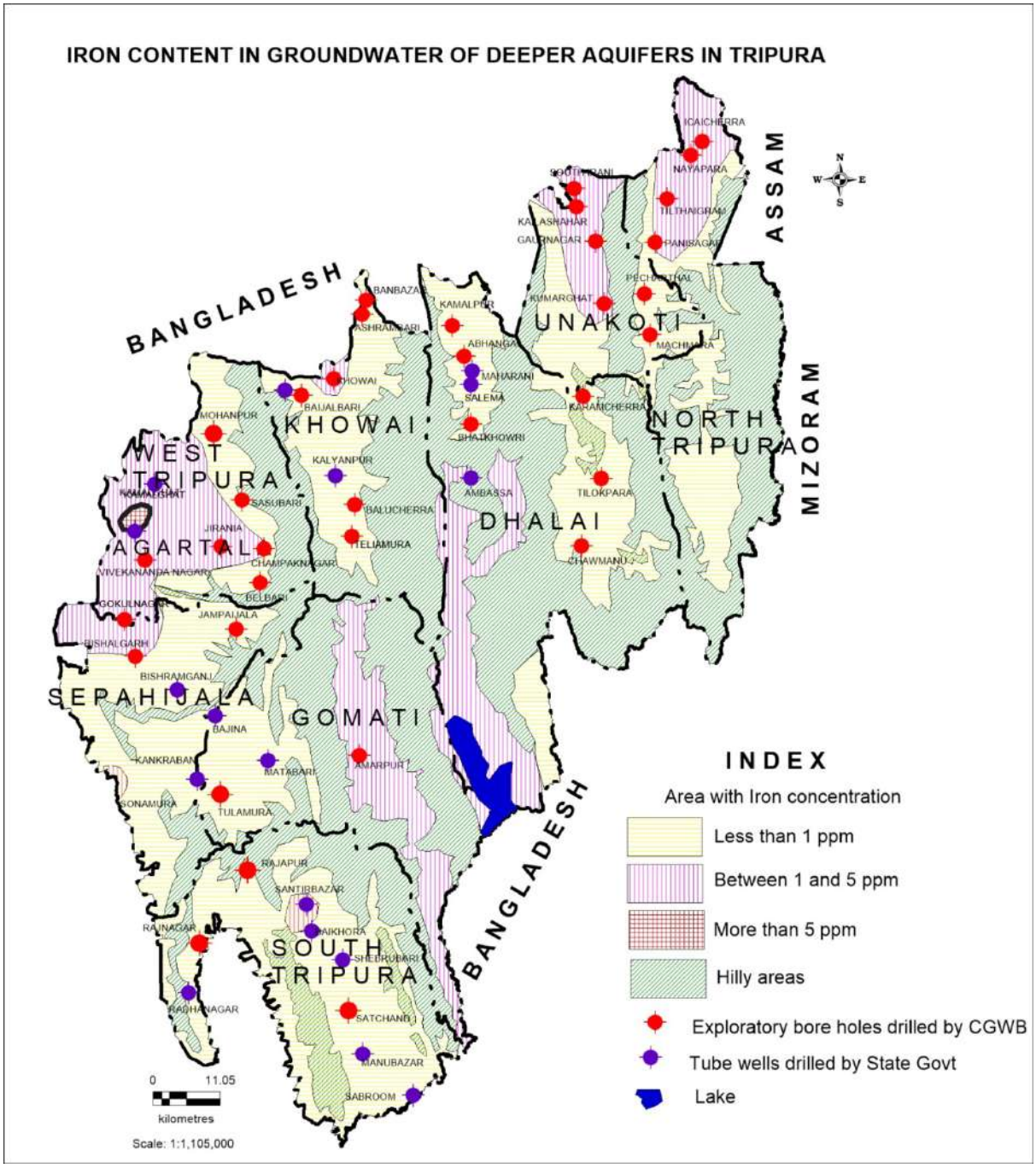

Figure 8.2: Map showing the areas and intensity of Iron contamination in deep aquifers of Tripura

Currently, pollution of ground water by arsenic has seriousluy drawn the attention of the scientific community. As reported, ground water of Tripura has not so far been affected by arsenic contamination. However, presence of arsenic below permissible limit in a sporadic manner cannot be ruled out in certain parts of the state, especially in the areas adjoining Bangladesh.

A number of ground water samples from GWMS and Aquifer Mapping monitoring wells were collected and analyzed by CGWB. According to the analysis results, arsenic content in ground water in most of the monitoring wells is below detectable limit. However, the arsenic content of ground water from shallow aquifers is found to be in the range of 1.23 ppb to 11.08 ppb in Ghoragappa area, from deeper aquifer arsenic content is 14.68 ppb at Tuichama area,South Tripura. In North Tripura the arsenic content in shallow aquiferis in the range of less than 0.34 ppb to3.71 ppb, in deeper aquifer at Kanchanpur the concentration is found to be 13.32 ppb. In other areas, water samples collected both from shallow and deeper aquifers; arsenic content is found below detectable limit. However, more rigorous studies are required to know the latest and actual status of arsenic content in ground water of Tripura. Arsenic concentration has been detected in few dug wells and tube wells and the analysis resultsis furnished in the Table below:-

Table 8.3: Location of Arsenic detection and concentration from Monitoring well in Tripura during 2017-18

Sl. No	Lab code	Location	District	Type of sample (EW or DW)	NHNS /Exploratory/Aquifer mapping/short term/Pollution	As(ppb)
1	C227	Chalengta	Unakoti	DW	NHNS	0.75
2	C232	Kamalpur	Dhalai	DW	NHNS	0.07
3	C233	Kumarghat	Unakoti	DW	NHNS	0.87
4	C238	Uttar Machmara	North Tripura	DW	NHNS	0.34
5	C239	Chandra- moni Kami	Unakoti	DW	NHNS	1.05
6	C243	Kamalpur	Dhalai	DW	NHNS	6.57
7	C244	Manu New	Dhalai	DW	NHNS	2.29
8	C248	Chandipur	North Tripura	DW	NHNS	3.71
9	C252	82 Mile	Dhalai	DW	NHNS	3.71
10	C254	Jalai	Unakoti	DW	NHNS	0.86
11	C258	Laxminagar	North Tripura	DW	NHNS	0.86
12	C260	Sonaimuri	Unakoti	DW	NHNS	5.14
13	C264	Duraicharra	Dhalai	DW	NHNS	2.29
14	C265	Saraspur	North Tripura	DW	NHNS	0.86
15	C267	Salema	Dhalai	DW	NHNS	0.86
16	C268	Rouya	North Tripura	DW	NHNS	6.57
17	C269	Durgapur	Dhalai	DW	NHNS	0.86
18	C302	Tufaniamura	Sepahijala	DW	NHNS	2.17
19	C303	Sachichandrapur	South Tripura	DW	NHNS	8.07
20	C304	Srinagar	South Tripura	DW	NHNS	8.93
21	C309	Gorjee Bazar	South Tripura	DW	NHNS	6.75
22	C698	Dukli	West Tripura	DW	NHNS	0.545
23	C704	Bagbassa	Sepahijala	DW	Aquifer Mapping	2.364
24	C716	Poangbari	South Tripura	DW	Aquifer Mapping	1.226
25	C731	Bampur	Gomati	DW	NHNS	0.02

Present and earlier studies conducted by the Tripura State Pollution Control Board and Centre for Study of Man and Environment, Kolkata have not found the presence of Arsenic above detection level. But since the NERIWALM study has revealed that Arsenic is present in considerable proportion in a few ground water samples from several places of Tripura, it has become necessary to go for a large scale study of ground water quality to ascertain the significant presence of Arsenic, if any.

However, arsenic pollution in ground water of some shallow tube well and one dug well had been detected by PWD (DWS), Govt. of Tripura at some locations in 2005-06 as furnished below :

Table 8.4: Locations of Detection and Arsenic Concentration in Tripura during 2005-06

Sl. No.	District	Block	Panchayat	Habitation	Type of Source	Land Mark	As (mg/lit)
1	West Tripura	Kathiyala	Dakkhinpaharpur	Machima	Shallow Tube well	H/O Shri Upendra Debnath	0.067
2	South Tripura	Bagafa	Santirbazar	Madhyapara	Shallow Tube well	H/O Parimal Malik	0.076
3	South Tripura	Hrishyamukh	Hrishyamukh		Shallow Tube well	Near Kanika Hotel	0.083
4	South Tripura	Hrishyamukh	Abhoynagar	Naluwabazar	Shallow Tube well	Naluwabazar	0.055
5	South Tripura	Hrishyamukh	Sonaichuri	Sonaichuri	Shallow Tube well	Near Sonaichuri Market	0.072
6	Gomati	Matabari	Phulkumari	Phulkumari	Ring Well	H/O Shri Shankar Das	0.074
7	West Tripura	Jirania	Debendranagar	Champaknagar	Shallow Tube well	infront of Hotel Sushmita	0.133
8	West Tripura	Jirania	Champaknagar	Champaknagar	Shallow Tube well	Champaknagar Market	0.12

Table 8.5: Results of Arsenic Analysis of Ground Water Samples Collected From Different Parts of Tripura By Centre For Study of Man & Environment, Kolkata

Sample No	Sampling Date	Name of Location	Type of source	Arsenic (mg/lt)
District : North Tripura				
1.	14.05.01	*Kailashahar*	Deep Tube Well	<0.003
2.	14.05.01	*Dharmanagar*	Hand Pump	<0.003
3.	14.05.01	*Kanchanpur*	Deep Tube Well	<0.003
4.	14.05.01	*Kumarghat*	Deep Tube Well	<0.003
District : Dhalai				
5.	18.05.01	*Manu*	Deep Tube Well	<0.003
District : West Tripura				
6.	10.06.01	*Dukli*	Deep Tube Well	<0.003
7.	10.06.01	*Jirania*	Deep Tube Well	<0.003
8.	11.06.01	*A.D.Nagar*	Deep Tube Well	<0.003
9.	11.06.01	*Kunjaban*	Deep Tube Well	<0.003
10.	15.06.01	*Dhanpur*	Hand Pump	<0.003
11.	23.06.01	*Dhanpur*	Deep Tube Well	<0.003
12.	16.06.01	*M/s Ramkrishna Engineering, Agartala*	Hand Pump	<0.003
13.	24.06.01	*Khowai*	Deep Tube Well	<0.003
14.	24.06.01	*Khowai*	Auto flow	<0.003
15.	25.06.01	*R. C. Nagar*	Deep Tube Well	<0.003
16.	16.06.01	*Chandrapur*	Deep Tube Well	<0.003
District : South Tripura				

17.	18.06.01	*Santirbazar*	Deep Tube Well	<0.003
18.	22.06.01	*Belonia*	Deep Tube Well	<0.003

Table 8.6: Results Of Arsenic Analysis Of Ground Water Samples Collected From Various Parts Of Tripura By North Eastern Regional Institute Of Water And Land Management, Tezpur, Assam

District	Number of Samples Analysed (% of As Contamination)	Location	Arsenic (µg/lt)		Maximum Arsenic Contaminated Area
			Non-Monsoon	Monsoon	
West Tripura	52 (22.2)	Jirania, Bishalgarh	191	144	Jirania & Bishalgarh Block
Dhalai	36 (42.1)	Salema, Hallahali, Halhooli, Kamalpur & Joynagar	65-444	77-165	Salema and Kamalpur Block
North Tripura	30 (57.1)	Sanitala, Rajbari, Kailashahar, Dharmanagar, Jampui & Kanchanpur	122-283	62-215	Dharmanagar and Kailashahar Block
South Tripura	36 (Nil)	--	6.38	5-23	--

Source: *Characterisation of Drinking Water for the Quality in NE India, Technical Report, NERIWALAM, Tezpur-784027, 2004*

Table 8.7:Iron And Arsenic Contents And P^h Of Ground Water Collected From Various Parts Of Tripura By North Eastern Regional Institute Of Water And Land Management, Tezpur, Assam

District	Number of samples analysed (% of As contamination)	Location	P^H	Iron (mg/lt)	Arsenic (µg/lt)
West Tripura	38 (22.2)	Jirania	7.1	10.98	191
Dhalai	19 (42.1)	Salema, Hallhali, Halhooli, Kamalpur, Joynagar	7.3 – 8.3	0.45 – 8.91	65 - 444
North Tripura	21 (57.14)	Sanitala, Rajbari, Dharmanagar	6.8 – 8.1	0.48 – 1.04	122 - 283

Source *: Arsenic Contamination in Ground Water of North Eastern India.* Dr. A. K. Singh, Associate Professor and Adviser (Soil and Water Testing Lab & Microbiology Lab), NERIWALAM, Tezpur-784027, Assam (India). *Published in Proceedings of National Seminar on 'Water Quality' held at National Institute of Hydrology, Roorkee during November 22 - 23, 2004.*

8.7 GEOCHEMICAL PLOT OF THE WATER SAMPLES FROM NHNS 2022 DATA

The Water Quality data from the National Hydrograph Network Stations (NHNS) as in Annexure-VI have been plotted through the Aquqchem software and are represented in the following diagrams:

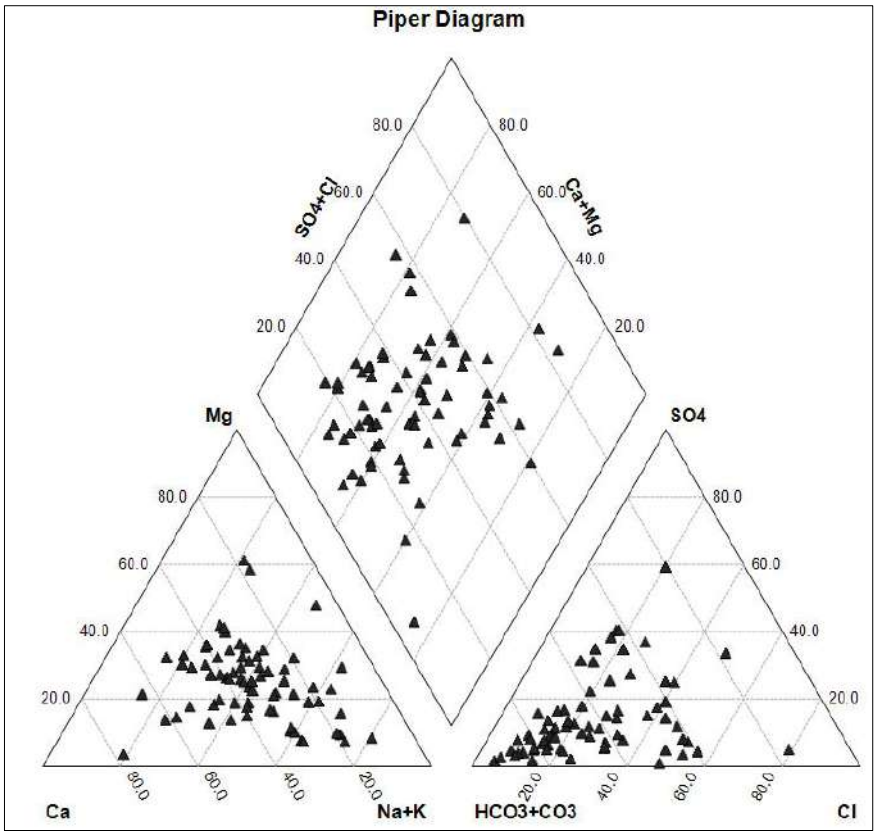

Figure 8.3: Piper plot of the NHNS 2022 Data

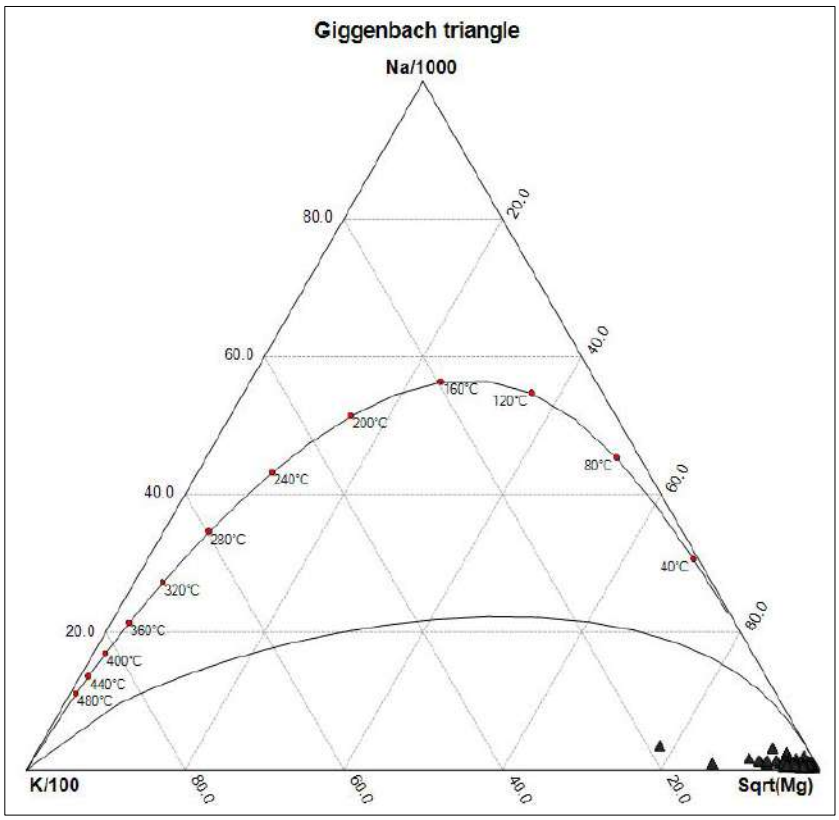

Figure 8.4: Giggenbach Triangle plot of the NHNS 2022 Data

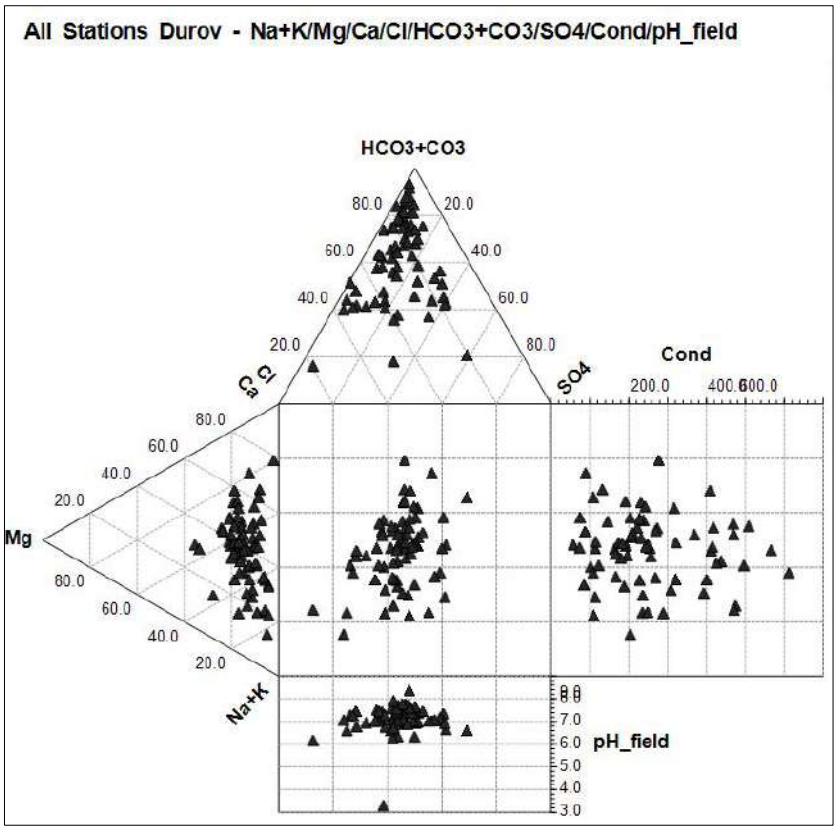

Figure 8.5: Durov plot of the NHNS 2022 Data

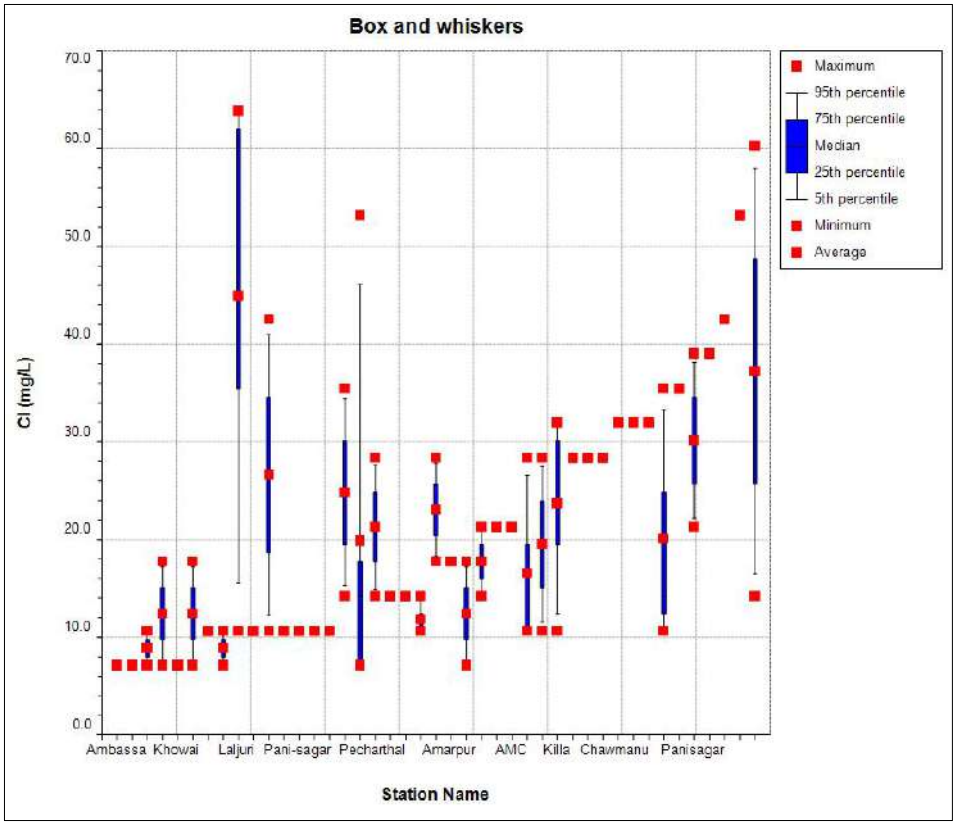

Figure 8.6: Box and whiskers plot of the NHNS 2022 Data

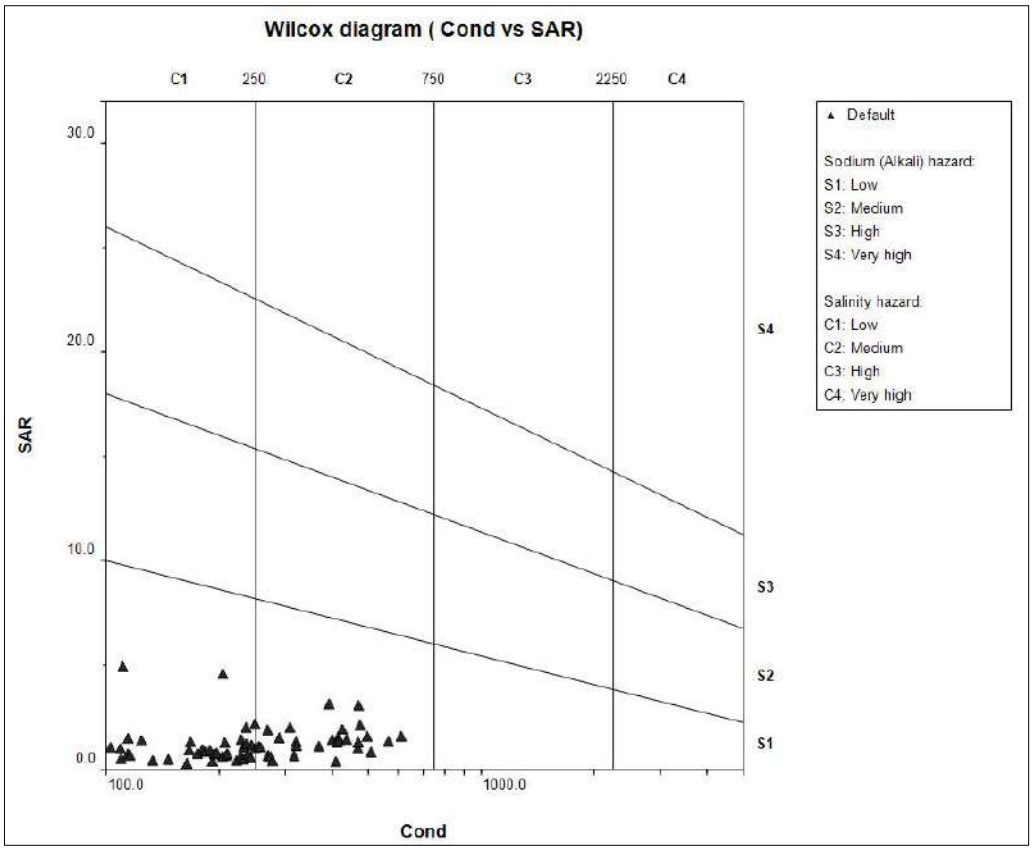

Figure 8.7: Wilcox Diagram of the NHNS 2022 Data

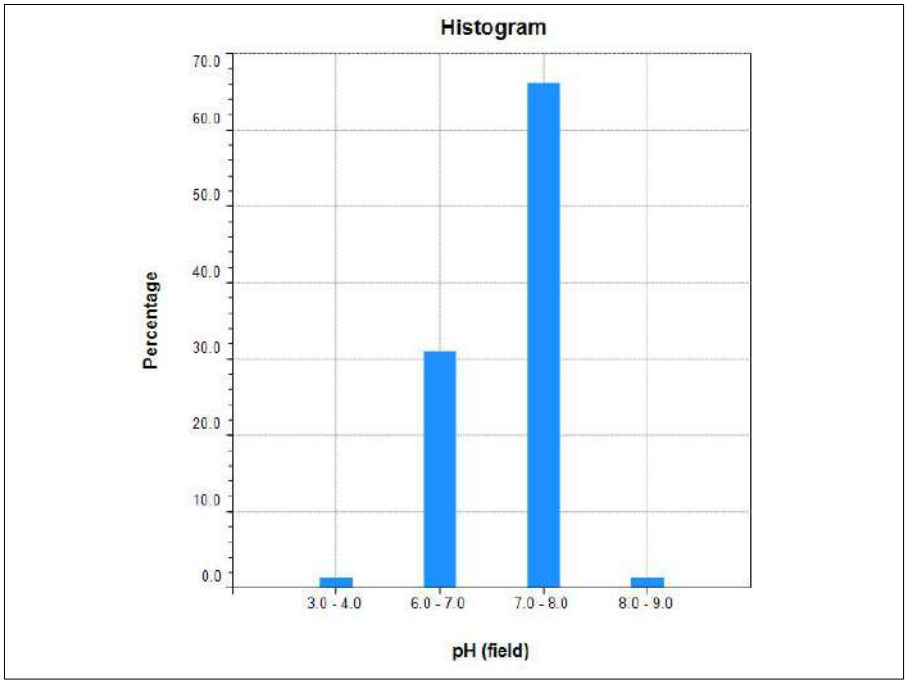

Figure 8.8: pH Histograph of the NHNS 2022 Data

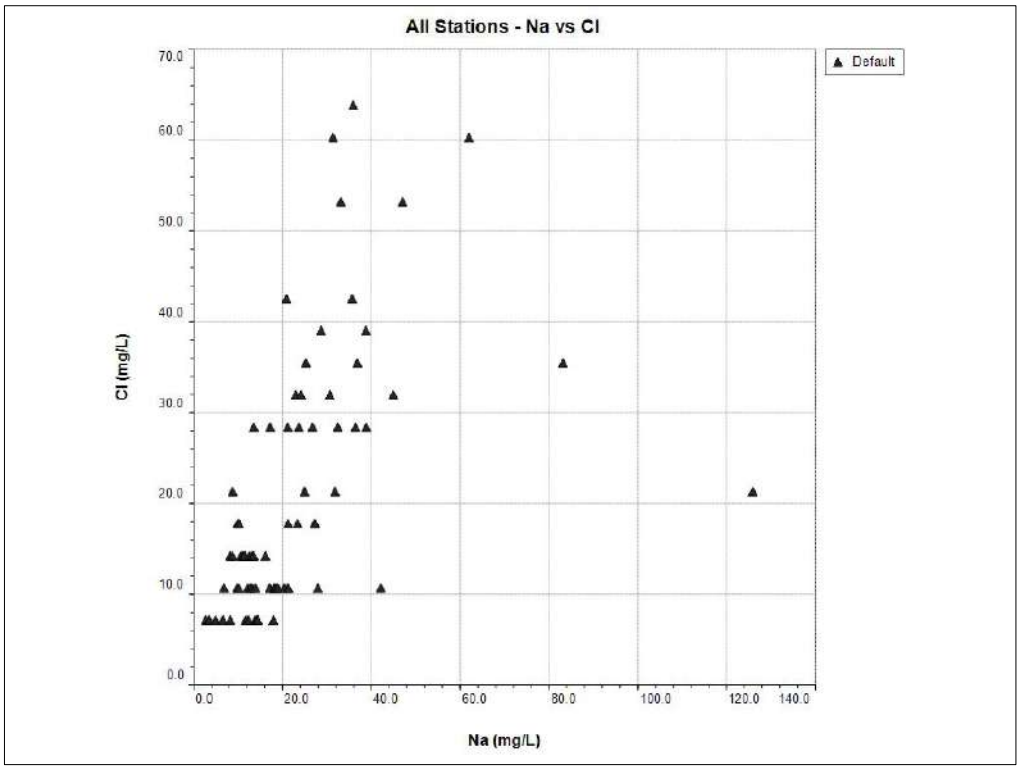

Figure 8.9: Scatter plot of Na vs Cl of NHNS 2022 Data

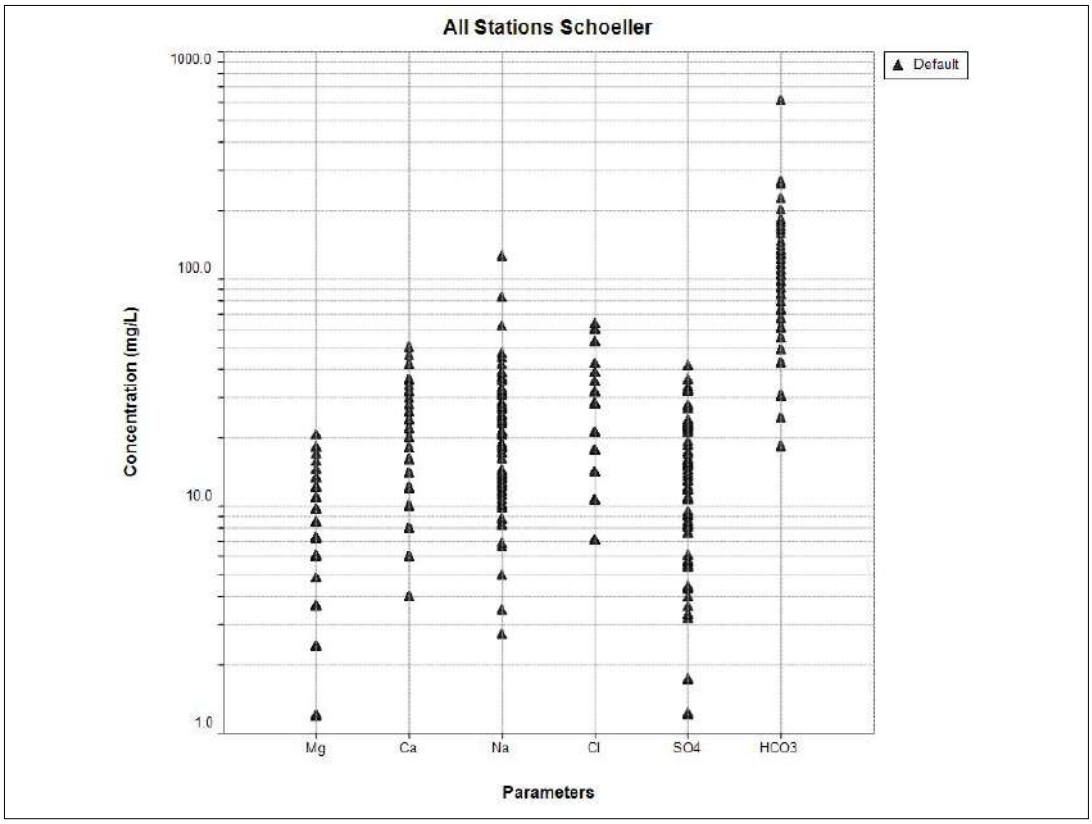

Figure 8.10: Schoeller plot of NHNS 2022 Data

9. STATUS OF AQUIFER MAPPING AND SALIENT FINDINGS

District-wise aquifer mapping and management plan of Tripura state have been completed. Under National Aquifer Mapping and Management (NAQUIM) program, combination of geologic, geophysical, hydrologic and hydro chemical information is applied to characterize the quantity, quality and sustainability of ground water aquifers. Systematic aquifer mapping will improve our understanding of the geologic framework of aquifers, their hydrogeologic characteristics, quality and also quantifying the available ground water resources potential and proposing plans appropriate to the scale of demand and the institutional arrangements for management.

In the district-wise aquifer management plan of Tripura State, it was found that stage of groundwater extraction is low and some fallow cultivable land is available. Also long term ground water trend do not show any decline. So, the groundwater utilization is proposed to increase the cropping intensityupto 200% by planning to use upto 60% of available groundwater resources.

In North Tripura and Unokoti districts 6829 ha of fallow cultivable land has been considered to bring under assured irrigation. CROPWAT 8.0 model showed that annual irrigation water requirement for this land is 1586 ham while irrigation water requirement during dry season spanning from October to March it is 874 ham. However, proportionate dynamic groundwater resources available for future irrigation use (proposed to use 60% of availability) in 6829 ha is 1495 ham. Therefore, thisfallow area can be irrigated by constructing ground water abstraction structures and can bring under double cropped area of cropping intensity upto 200%. This amount of groundwater resources can be harnessed by constructing 460 tube wells.

In Dhalai district, 2877 ha of fallow cultivable land has been considered to bring under assured irrigation. CROPWAT 8.0 model showed that annual irrigation water requirement is 872 ham while irrigation water requirement during dry season spanning from October to March it is 465 ham. Annual irrigation water requirement can be catered by constructing 460 nos. of tube wells.

In West Tripura District (Khowai, West Tripura and Siphahijala combined) 15854 ha of fallow cultivable land has been considered to bring under assured irrigation. CROPWAT 8.0 model showed that annual irrigation water requirement is 5687 ham while irrigation water requirement during dry season spanning from October to March it is 2962 ham. However, proportionate dynamic groundwater resources available for future irrigation use (proposed to use 60% of availability) in 15,854 ha in the district is 6301 ham. Therefore, this fallow area can be irrigated by constructing ground water abstraction structures and can bring under double cropped area from 181% to 200%. This amount of groundwater resources can be harnessed by constructing 1250 tube wells.

In South Tripura (South Tripura and Gomati District combined) 5911 ha of fallow cultivable land has been considered to bring under assured irrigation. CROPWAT 8.0 model showed that annual irrigation water requirement is 2109 ham while irrigation water requirement during dry season spanning from October to March it is 1088 ham.However, proportionate dynamic groundwater resources available for future irrigation use (proposed to use 60% of availability) in 5,911 ha in the district is 1875 ham. Therefore, this rice fallow area can be irrigated by constructing ground water abstraction structures and can bring under double cropped area. This amount of groundwater resources can be harnessed by constructing 880 tube wells.

10. GROUND WATER DEVELOPMENT AND MANAGEMENT

10.1 GROUND WATER DEVELOPMENT

Ground water development in Tripura is being done through dug wells and tube wells. The tube wells include low duty shallow tube wells, medium duty intermediate depth tube wells or mini deep tube wells or small bore tube well, heavy duty deep tube wells and artesian wells. The ground water from these structures is mainly used for drinking, domestic and irrigation purposes.Other ground water abstraction structures are spot sources with small yield capacity such as dug wells, Mark - II/III tube wells and ordinary hand pumps, which are mainly used in rural areas for drinking purpose. Thousands of artesian wells are also found in Tripura, which are mainly used for irrigation purpose, whereas some of them are even used for drinking and domestic purposes.

On the basis of hydrogeological conditions, the valley portions of the state may be divided into two sectors such as, 'A' and 'B'. Sector 'A' coincides with the central portions of the valleys, while sector 'B' coincides with the foothill zones. A third Sector named 'C' represents the hilly areas of the State. Shallow tube wells constructed down to the depth of 50 to 60 m bgl tapping 20 to 30 m of granular zones in sector 'A' would yield 10 to 15 m^3/hr at a draw down up to 10 m and the same kind of tube well would have a draw down up to 15 m in sector 'B'. Similarly, deep tube wells down to 200 to 300 m bgl depth tapping 36 to 42 m of granular zones in sector 'A' would be capable of yielding 50 to 150 m^3/hr for a draw down up to 20 m and the same tube well of depth 200 m in sector 'B' tapping 36 to 42 m granular zone would have a smaller yield ranging from 20 to 70 m^3/hr with a higher draw down. Keeping in view the high draw down, the length of housing is recommended to be at least 50 m for the deep tube wells in sector 'B'. The yield from the tube wells in sector 'C' comprising the hilly terrain would be less than 10 m^3/hr with an exceptionally very high drawdown.

10.1.1 Ground Water Development for Irrigation Purpose

Ground water is developed for irrigation purposes in a rather low scale in Tripura through deep tube wells, mini deep tube wells/small bore tube wells, shallow tube wells fitted with pump sets (both electric and diesel) and artesian/auto flowing wells. Now-a-days the use of dug wells for irrigation in Tripura has become very negligible. PWD (WR), RDD, Agriculture department, TTAADC, and Forest dept. had brought 117544 ha of area under irrigation out of which 80701 ha of irrigated area utilized as on March 2019 including groundwater and surface water. Out of 80701 ha of area utilized only 6416 ha (7.9%) of area is being irrigated by 275 nos. of deep tube wells. An appreciable amount of land is also irrigated by auto flowing Artesian Well under Govt. as well as private ownership.

10.1.2 Ground Water Development for Drinking Purpose

The PWD (DWS) (Drinking Water and Sanitation Department), Govt. of Tripura is mainly responsible for supplying drinking water in Tripura. DWS use to supply water mainly from Deep Tube Wells, Shallow Tube Wells (Small Bore TW, Mark – II & III and Ordinary Hand Pumps) as well as from Surface Water Treatment Plants (SWTP) installed in various streams (cherras), rivers and lakes/reservoirs depending on the local geographical and hydro-geological setup. In SWTP on the hilly or sub-hilly areas, DWS supplies water mainly by tapping streams in their upstream areas, then treating the water in settlement tanks, which is finally supplied by pipeline through gravity flow.

Due to lack of other suitable modes of drinking water facilities through treatment of surface water in most of the areas of Tripura, the people of these areas are mostly dependent on the ground water structures (spot source and community source) for drinking water throughout the year including the lean period. The required depth of tube wells is continuously increasing and has reached to 300 m and now the State Government Authorities are planning for drilling tube wells with more depths for catering the increased population.

In urban areas and many parts of rural areas piped water supply schemes through shallow/deep tube wells and spot ground water sources are the main sources of drinking water. In Urban areas supply is done majorly from surface water sources and also from ground water sources. But in rural

areas, piped water supply schemes are mainly dependent on ground water, which is tapped by shallow/intermediate depth/deep tube wells. In some rural areas, water being supplied directly from deep tube wells without any treatment, whereas in majority of areas iron removal plants (IRP) are installed. Apart from deep tube wells, other drinking water sources available are hand pumps, Mark - II/III tube wells, small bore tube wells/mini deep tube wells, artesian wells and dug wells, which are extensively used in the villages and hamlets where the deep tube wells are not possible and there is no piped water supply system in the vicinity. Water supply from mini deep tube wells has also started in some blocks like Bishalgarh, which cover only 40 – 50 families per well. Water is also being supplied from masonary wells (big diameter RCC ring wells) for a limited area and covers 10 – 15 families per well (e.g. Purba Chandigarh GP, Melaghar).Individual households also construct dug wells and ordinary hand pump fitted shallow tube wells for their drinking and domestic water needs.

At the standard rate of 40 litre/capita/day, drinking and domestic water requirement for total population of 40,23,000 (2018-19 estimated population) in this state, the water requirement comes around 160,920 m^3/day .

Table 10.1: Brief Status of Drinking Water Supply by PWD (DWS) as on 01.04.2019

Particulars	As On 01-04-2019
Deep tube well in operation (in Nos.)	Urban-174, Rural- 1811
	Total - 1985
Iron removal plant commissioned (in Nos.)	Urban-59, Rural- 864
	Total - 923
Pipeline laid (in km)	Urban- 1518.50, Rural- 10040.61
	Total- 11559.11
	Total - 39
Surface water treatment plants (in Nos.)	Urban–18, Rural – 36
	Total – 54
Small Bore Tube Well (in Nos)	Urban-84, Rural-3571
	Total- 3655
Domestic connection (in Nos.)	Urban- 93218, Rural- 32406
	Total – 125624
	Total – 51949
Functioning spot sources like asMark-II/III/OHP	Urban- 1970, Rural-16078
Ring/Massonry/Sanitary Well/ Spring water sources etc. (in Nos) in ruralareas	Total – 18048

10.1.2.1 Water Supply in Agartala Municipal Corporation Area:

Population of Agartala Municipal area was 132186 in 1981, 157358 in 1991, whereas in 2001, the population had become 189327. The decadal growth rate in the municipal area was 19.04% during 1981-1991 and 14.44% during 1991-2001. Similarly, in greater Agartala population was 256968 in 1991 and it became 333418 in 2001 with decadal growth of 29%. Finally as per the Census 2011 the total population of greater Agartala has become 3,97,622 with a decadal growth of 19%.

Although there is a regular supply of surface water (treated) from Haora river in the municipal corporation area for drinking and domestic uses, ground water (from heavy duty deep tube wells tapping 30 to 36 m granular horizons within depth range of 130 to 220 m bgl) is also being used in addition to surface water. In greater Agartala area, ground water is the only source for drinking and domestic uses. It is very clear that the population in this recently constituted municipal corporation area and greater Agartala area will be more in future decades, as a result of which, the demand for drinking and domestic water will also increase manyfold. To meet this increased upcoming demand in the urban area, use of ground water would be more in future as an alternate measure.

Considering the water requirement as 135 lpcd, the demand for present population 3,97,622 of Agartala Municipality Corporation area is 53.68 MLD. With addition of wastage of 10% (5367897 litres) the total final demand calculated to be 59.047 MLD i.e. 13 MGD (1 Imperial Gallon = 4.546 Litre). As per a report of the Urban Development Department of Govt. of Tripura in 2004-05, the

demand for drinking water for greater Agartala area in 2011 was predicted to be 17.4 MGD, which was computed on the basis of assuming same decadal growth rate of population for 2001-11 decade as that of 1991-2001 decade i.e. 29 %. But due to far less decadal growth rate of population (19%) in 2001-11 decade, the demand has come down to be only 13 MGD. During that time (2004-05), it was also expected that although some new surface water schemes will be set up for supply of drinking water by PWD (DWS), Govt. of Tripura, supply of only 13 MGD water would be possible at that point of time. Coincidentally, the demand in 2011 has become 13 MGD, which was already expected in 2004-05 to be met by both the surface and ground water sources.

To meet this demand there are 2 nos. surface water treatment plants one at college tilla and the other at Milansangha (Bordwali) with a production capacity of 3 MGD and 4 MGD respectively totalling 7 MGD, while the present daily production rate is 2.22 MGD and 3.315 MGD respectively. There are 74 nos. deep tube wells supplying 6.182 MGD. So the total present water production/supply in Agartala Municipal Corporation area is 11.717 MGD and there is a marginal gap between demand (13 MGD) and supply (11.717 MGD). In 2004-05 the total supply from surface water and ground water resources for greater Agartala was 7 MGD. There are 36 nos. of Iron Removal Plants, 13 nos. of elevated storage reservoirs, 4 nos. of ground storage reservoirs, 1801 nos. of spot sources and 511.244 km length of pipe lines to supply water to the urban populace. In all, there are 2695 nos. of hydrants and 31,540 nos. of domestic water connections in the city for supplying potable water. As on March 2014, 434 nos. of Anganwari Centres, 134 nos. of Schools and 17 nos. of Madrasas have been covered by the drinking water supply.

10.1.2.2 Rural Water Supply

In rural areas, PWD (DWS) have constructed 1811 Deep Tube Wells and 3571 Small Bore Tube Wells in the entire state of Tripura up to April 2019 for drinking water supply and 16078 intermediate depth Mark – II/III tube wells and RCC/Sanitary Wells up to 2019 to provide safe drinking water. For Shallow and Mark – II/III tube wells the approximate draft is around 0.1 ham/year and for deep tube wells the draft is 18 ham/year.

As per the census 1991, it may be stated that out of the total 4,39,137 rural households, 55% of rural population were taking drinking water from dug wells, 14% of rural people were using water from piped water supply and 17 % people residing in medium and high hill areas used water from other sources. Whereas, as per 2011 Census out of the total 6,07,779 rural households, 35.41 % of rural population is taking drinking water from dug wells, 25.15 % of rural people are using water from piped water supply and 6.47 % people residing in medium and high hill areas use water from other sources. So it can be said that the rural drinking water supply system has been improved a lot over the years in the last two decades i.e during the period from 1991 to 2011.

10.2 WATER CONSERVATION AND ARTIFICIAL RECHARGE

Scope for artificial recharge is minimal in the state because water level in the major part of Tripura lies between 2 – 5 m bgl. As the state receives more than 2000 mm of annual rainfall every year, constructions of rainwater harvesting structures are very logical. Apart from roof top rainwater harvesting structures, small and medium sized check dams, nala bunds etc. can also be constructed. However, the artificial recharge to ground water in deeper aquifers by injection of harvested rain water through abandoned or specially drilled tube wells may also be encouraged in this state with usually undulated topography, especially where larger quantity of water needs to extracted.

10.3 GROUND WATER MANAGEMENT

The balance ground water resource of **111249.36** ham for future irrigation indicates that there is a huge scope for further development of ground water. Based on the hydrogeological conditions, shallow tube wells up to 60 m depth tapping 20 to 30 m granular zones having yield of 10 to 20 m^3/hr and deep tube wells up to 300 m depth tapping 45 to 55 m cumulative thickness of granular horizons yielding 50 to 150 m^3/hr can be constructed in valleys as well as foothill portions. In valley portions, yield from the tube wells are norally more than two times the yield in the foothill portions.

The nature of the aquifer material says that tube wells should be designed with slot size 0.50 - 1.00 mm alongwith gravel packing by 2 - 4 mm size of quartzitic sub-rounded to sub-angular gravels. The design aspects of tube wells are mainly controlled by the permeability of aquifer materials. Based on pumping test results, the permeability values in the state are determined to be 15 to 30 m/day. Longer life of the tube wells depends on proper development of the wells before it is put to use. Thus it is essential to develop the tube wells by air compressor to break and clear the mud cake, if any formed by drilling mud and also to suck out the finner assorted grains from the tapped granular zones around slot/screen areas of the pipes alongwith discharged water, which in turn increases the permeability of the formation near the pipe assembly resulting higher incoming velocity of water.

The minimum spacing between two shallow tube wells should be kept at 500 m and between two deep tube wells, it should be 2000 m at the initial stage of development, which may be reviewed and revised with collection of more data generated through pumping tests and field observations of the behaviour of piezometers and the discharge-draw down relations in different parts of the state.

In the hilly areas of the state, although more than 2000 mm rainfall occurs, people residing there usually face acute scarcity of water in the lean period. Roof top rainwater harvesting may be adopted effectively to meet the drinking and domestic water demand of the people residing on hilltops particularly during non-monsoon period, when the average non-monsoon rainfall is 800 to 1000 mm. In rural areas rooftop rainwater harvesting can be adopted in a small scale for household needs. In the urban areas, housing complexes, institutional and Govt. buildings having large roof areas can be used for harvesting rainwater for preserving/conserving that water or to recharge the ground water.

In foothill portion of the state, where most of the precipitations get wasted as surface runoff, rain water can be efficiently utilized for augmentation of ground water by constructing structures like check dams, gabions and check weirs. Doing so, water level in nearby upstream areas can be raised to a considerable extent by saturating the otherwise dry part of the localized aquifers. In foothill areas, gully plugging and contour bundhs will also be helpful for augmentation of ground water level.

In the moderately hilly and foothill areas of the state, there are certain portions where fractures and lineaments occur below the surface, which can be explored for ground water development. In these areas, promising granular zones may be found sometimes within the depths of 300 m bgl. But the potential fracture zones must be confirmed by electrical resistivity surveys before deployment of a suitable drilling rig in these areas of the state. Electrical logging of the naked pilot bore holes is also mandatory for accurate delineation of the granular zones saturated with ground water. Otherwise, the identification of promising granular zones or fracture zones only from the lithological logs of pilot holes would be very difficult and sometimes, this log may be misguiding in recommendation of proper design of tube wells, which eventually may cause failure of the tube well or deterioration of performance of the tube well in the long run.

11.GROUND WATER RELATED ISSUES AND PROBLEMS

11.1 WATER LOGGED AREA

(a) North Tripura District

During pre-monsoon period isolated pockets of very shallow water level i.e., within 2 m bgl is observed in Dharmanagar and Kanchanpur valley. These pockets are located in (i) Bagbassa, Sanicherra, Lalcherra of Kadamtala block; (ii) Khedacherra of Damcherra block (iii) Satnala and Kanchanpur area of Dasda block. In these areas water level varies from 0.9 – 1.81 m bgl. Almost entire Kanchanpur area show shallow water levels.

(b) Unakoti District

During pre-monsoon water logged area is found in Jarultali of Gournagar block.

(c) Dhalai District

During pre-monsoon water logged areas are found in Durga Cherra (Damburnagar block), Nuna cherra (Ganganagar block), Chailengta and Chowmanu area in the district.

(d) Khowai District

Shallow ground water level of less the 2 mbgl during pre-monsoon season is observed in Khowai area in the district.

(e) West Tripura District

During pre-monsoon period water levels are noticed within 2 m bgl in a few isolated pockets, which varies from 1.10 to 1.94 m bgl and thus are prone to be water logged, which may create salinity hazards in future hampering the agricultural production. Water logged area is found Sadhupara of Jirania block.

(f) Sepahijala District

During pre-monsoon, water logged area is found in Dakshin Kalamcherra of Boxanagar Bock. To avoid this water logging problem, ground water can be abstracted and used in downstream areas for irrigation and in some areas, ponds /lakes can be made where fisheries can also be taken up.

(g) Gomati District

During pre-monsoon, water logged area is observed in Amarpur, Bampur area of Amarpur block and Joinkami area in Killa Block. The depth to water level in these area ranges from 0.5 to 1.72 mbgl.

(h) South Tripura District

During pre-monsoon period isolated pockets of very shallow water level i.e., within 2 m bgl is observed in the district. They are located in Amli Ghat, Srinagar area of Poangbari block; Manurmukh area of Bharat Chandra Nagar block. In these areas water level ranges from 0.5-1.93 m bgl.

11.2 GROUND WATER CONTAMINATION

Ground water is characterized by high iron content, which generally ranges from BDL to 10.20 ppm. The concentration of iron in deep tube wells ranges from 0.1 to 15.90 ppm. The highest concentration of 15.90 ppm is noticed at Harikumartilla (West Ghilatali) village in Kalyanpur block. The iron concentration in water from open dug well is comparatively less than that of tube wells. This is due to the fact that the scope of aeration is more in open wells, which causes the precipitation of ferrous iron as ferric iron. Enrichment of iron in water is due to ferruginous nature of Duptila Formation and Tipam Sandstones, which form the major aquifers. High iron content renders ground water unsuitable for drinking and also creates aesthetic problems like colour, stains, smell etc.

Bacteria like **Gallionella, Crenothrix and Letpothrix** exert a catalytic effect to speed up chemical reactions that are thermodynamically favourable. Different types of bacteria may live together in a symbiotic relationship and greatly aggravate the problems with well performance and

corrosion of iron pipe and well casing and other exposed metallic iron parts in the water supply systems.

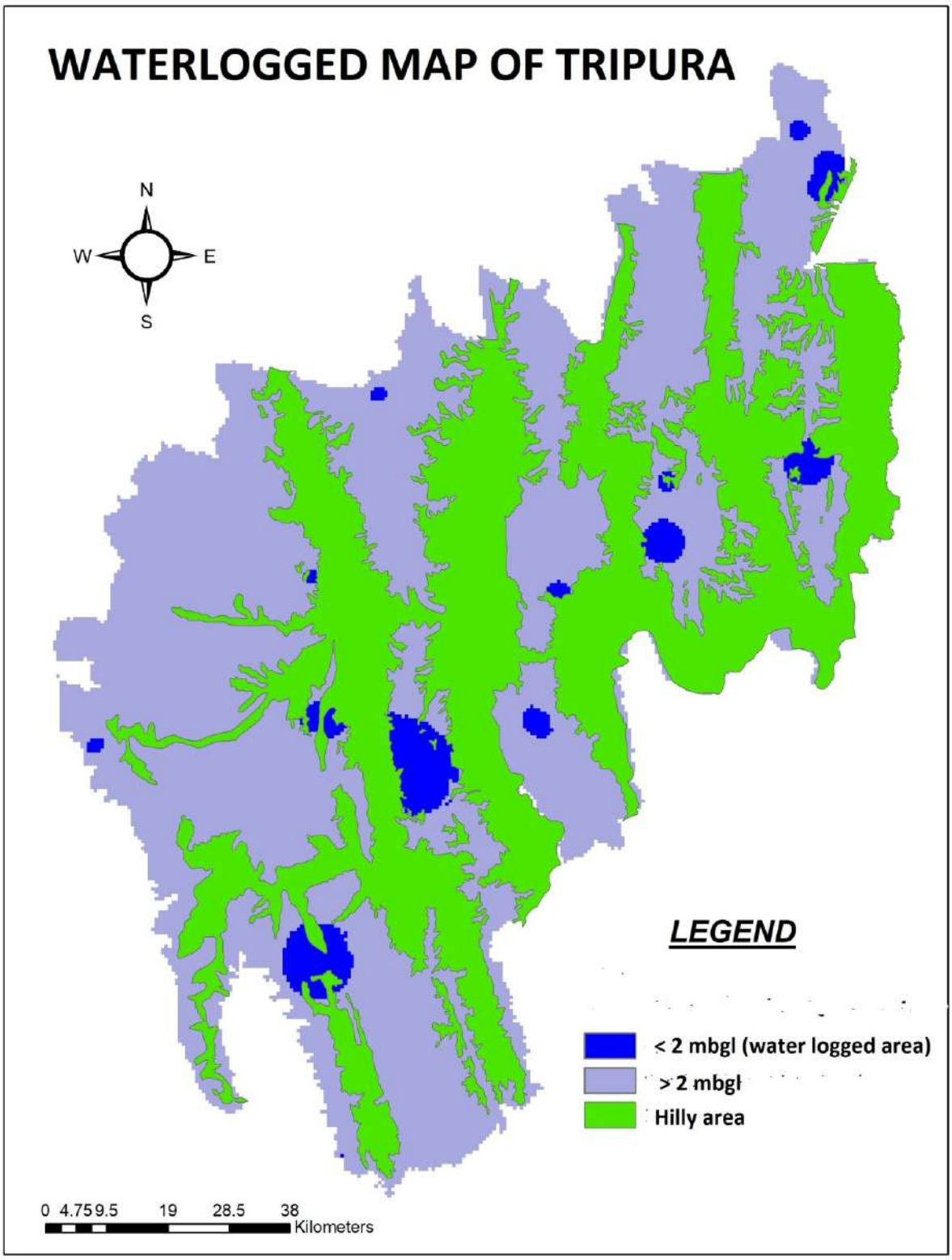

Figure 11.1 Map showing Water logged areas of Tripura

Iron concentration in deep tube wells constructed by PWD (DWS), Govt. of Tripura and CGWB was determined by spectrophotometry and found above permissible limit at many places. Various processes involved in removal of high iron are aeration, coagulation and filtration. Tripura Filter is used for domestic purpose and Modified Iron Removal Plant & Package Type Iron Removal Plant (DWS)) for community supply. Tripura filter was evaluated by All India Institute of Hygiene and Public Health, Kolkata and found capable of removing iron and bacteriological contamination effectively.

12. CONCLUSIONS AND RECOMMENDATIONS

12.1 CONCLUSIONS

The state of Tripura covers a total area of 10,491.69 sq. km. About 60 % of the area in the state is under forest cover. Very recently, the state is administratively redivided into 8 districts, 23 sub-divisions, 58 rural development blocks, 19 nos. of Nagar Panchayets and 591 nos. of Gram Panchayets. The state has an autonomous district council named Tripura Tribal Area Autonomous District Council (TTAADC), which has a total area of 7,132.56 sq. km and having 587 nos. of TTAADC villages.

The state has a total population of 36,73,917 as per census 2011 & projected (as on 2021 as 4,90,000. The growth rate of the population (decadal growth from 2001 to 2011) in the state is 14.84%. During this decade (2001 to 2011) the rural population has been decreased from 83% to 74%, whereas the urban population has increased steeply from 17% to 26%.

Physiographycally, the state consists of hilly terrain with immature topography. The major geographic features are the tighty folded anticlinal hill ranges with broad synclinal valleys in between. Five principal hill ranges namely the Jampui, the SakhanTlang, the Longtarai, the Atharomura and the Baramura, which are running parallel in N-S direction and traverse the state from east to west. The altitude of the hill ranges increases progressively from west to east attaining a maximum of 975 m above mean sea level (MSL) at Belting Sib in Jampui range.

Anticlinal hill ranges form the watersheds from which various drainage channels emerge. The common drainage patterns in the state are dendritic, parallel to sub-parallel and of rectangular type and streams are of first and second order. Major rivers are Gomti, Howrah, Khowai, Dhalai, Manu, Deo, Juri, Longai, Fenny and Muhuri. The whole drainage system forms a part of Meghna basin.

Out of the total geographical area of 10491.69 sq. km. of the state, more than 60% of the area is under forest. The net area under agriculture (net area sown/net cropped area) was 270755 ha in 2020-21. The proportion of the area under agriculture therefore is low in the state compared to that of national level.

The climate of the state is tropical, highly humid with moderate temperature. The state receives rainfall under the spell of southwest monsoon which commences in the end of May and lasts till the end of September. The average annual rainfall is 2262 mm.

The main crop of Tripura is paddy; all the three types of paddy i.e. summer paddy (Aush), monsoon paddy (Aman) and winter paddy (Boros) are being grown. Apart from paddy, sugarcane, maize, wheat, mesta, jute, cotton, potato, pulses and oilseeds are also grown. Over a limited area of the state, cashewnut, pineapple and orange are also cultivated. Rubber and tea plantations are now being taken up on small mounds and foothills over a considerable area of the state. People in the hills cultivate paddy and other viable crops on high slopes by practicing traditional ‘JHUM’ (shifting cultivation). About 51% of the population of the state is dependent on agriculture and allied activities for their livelihood as it is the single largest provider of employment to the rural people.

The soils have been classified into five broad groups, such as reddish yellow-brown sandy soils; red loam and sandy loam soils; older alluvial soils, younger alluvial soils and lateritic soils. Younger soils or river valley soils are found along all major river courses. However, on the basis of their origin, the soils of Tripura can be classified into two major groups, namely residual soil and transported soil or alluvial soil. In general, the soils in the state are naturally acidic in nature. Nitrogen and Phosphate are low, available Potash is medium to high, Calcium, Magnesium and Sulphur are deficient.

Geologically, Quaternary and Upper Tertiary groups of sediments occupy the State of Tripura. The Groups of formations occurring from bottom to top are Surma, Tipam and Dupitila of Upper Tertiary age. The state is characterized by a series of tighty folded anticlines and broad synclines trending in north-south direction. The more argillaceous rocks exposed in the cores of the anticlines are equivalent to the Surma group of Mio-Pliocene age and is about 4000 m thick. The younger arenaceous beds in the flanks of the anticlines comprise the Tipam groups of probable Upper Pliocene

age and are over 2000 m thick. The sediments in the synclinal troughs unconformably overlain by a sequence of unconsolidated to semi consolidated sediments arranged in neat terraces are Dupitilla, which has an age from Pleistocene to Recent.

Hydrogeologial surveys, aided by exploratory drilling and deposit well programmes carried out by the Central Ground Water Board, have revealed that there are three to four major granular zones with intercalation of clay within a depth of 300 m in the synclinal valleys of the state. The thickness of the aquifers varies from valley to valley and it decreases considerably in the northern parts of the state i.e. in Kamalpur, Kailasahar and Dharmanagar valleys. Formations of Tipam Group, comprising medium to fine grained, semi-consolidated and friable sandstones form the major aquifer system. Worthiness of aquifers in terms of ground water varies from valley to valley.

In western parts of the state, the aquifers are of good potential in comparison to the northeastern parts towards Dharmanagar where it is moderately potential. On the basis of drilling, aquifer zones down to explored depth of 300 m bgl can broadly be divided into two groups - **(i)** a shallow aquifer zone occurring up to 50 m bgl &**(ii)** Deeper Aquifer Zones below 50 m bgl and extended down to 300 m bgl. Study of sub-surface geology through lithological logs revealed that the aquifers are discontinuous in nature. Its thickness and disposition vary even within the same valley.

In Tripura, ground water occurs under unconfined conditions in Recent, Duputilla and Tipam Formations. Besides, it also occurs under semi-confined to confined conditions in Tipam Formation at depths. Recharge areas for the deeper aquifers lie in the adjacent anticlinal hills. In valleys wherever good thicknesses of potential and productive granular zones available and ground water remains under enormous confining pressure the auto flowing i.e. artesian conditions occur, which actually indicates the ground water discharge areas. The geology and geomorphology of Tripura is favorable for artesian conditions within the synclinal valleys. Artesian flowing conditions occur in patches both at shallow and deeper depths in all districts. Auto discharges of the free-flowing tube wells range from 100 to 6000 lph and in general, the piezometric head rises up to maximum of 2.5 m agl.

Depth to water level in GWMS during pre-monsoon (March) lies between 0.45-9.76 m bgl and the same during post-monsoon period (November) lies between 0.16-9.18 m bgl. Seasonal fluctuation of water level generally varies between 0.06 to 2.98 m. On the other hand, depth to water level in Piezometers (GWMS, all stationed in Tripura) constructed tapping intermediate to deep semi-confined to confined aquifers generally lies between 2.75 to 27.25 m bgl during pre-monsoon and between 2.87 to 26.89 m bgl during post-monsoon. From the analysis of water level data of 106 GWMS and other ground water structures, it is seen that there is no significant decline in ground water level in the state for the last decade.

The water table contours in the valley portion vary from 60 m above MSL in Amarpur Valley of South Tripura district to less than 10 m above msl in Agartala-Udaipur-Sabroom valley of West Tripura district and South Tripura district for both the pre-monsoon and post-monsoon period. The pattern of the pre-monsoon of water table contours in Agartala valley reveals that the master slope of the ground water flow in unconfined aquifers is towards west and that for the Khowai valley is towards north and for the West Tripura district as a whole it is towards WNW. In North Tripura and Dhalai districts covering Dharmanagar, Kailasahar and Kamalpur valleys, the general flow is towards north. However, ground water movement in unconfined aquifers in southern part of Dhalai district is towards south. In South Tripura district covering Udaipur-Sabroom valley, the movement is mainly towards south. In Udaipur valley, the ground water flow pattern indicates the effluent nature of Gomti River. The hydraulic gradient of ground water flow path in the major part in Udaipur valley is 1.2 m/km. The water table gradient for all the valleys of Tripura ranges from 1.08 to 1.60 m/km. In general, the gradient is steep near foothill, which becomes flatter towards the central part of the valleys along the riverine tracts. During post-monsoon period, while the ground water flow directions remain the same as that during pre-monsoon period for a particular area, a marked shifting in the position of respective water table contours is observed in that area. Moreover, these contours become flatter in post-monsoon period with a general hydraulic gradient around 0.88 m/km.

Analysis of data collected through Aquifer Performance Tests on the exploratory/deposit tube wells constructed by CGWB in the state has shown that Transmissivity ranges from 4.5 m^2/day (at Pecharthal, North Tripura) to 1689 m^2/day (at Khowai, West Tripura) and permeability ranges from

0.1 m/day to 43.90 m/day (at Abhanga, Dhalai district). The Storage Coefficient ranges from 7.5 x 10^{-4} (at Belbari, West Tripura district) to 1.775 x 10^{-3} (at Ompinagar, South Tripura) and 2.06 x 10^{-3} (at Fatikcherra & Gokulnagar BSF camps, West Tripura) showing confined nature of the deeper aquifers.

Minimum spacing between two shallow tube wells should be kept at 500 m and between two deep tube wells, it should be 2000 m at the initial stage of development which may be reconsidered later and revised with collection of more data generated through pumping tests and field observations of the behavior of piezometers and discharge-draw down relations in different parts of the state. It is seen that construction of tube wells have been sufficiently done in the central parts of the valleys, hence the foothill areas of the state may now be attempted to explore with proper scientific techniques through mobilising all available resources, infrastructures and inputs. Aquifer materials suggest that tube wells should have slot size ranging from 0.5 to 1 mm and should be packed with sufficiently thick layer of sub-rounded to sub-angular quartzitic gravel of size 2 to 4 mm.

On the basis of hydrogeological conditions, the whole area of the state has been divided into three sectors, 'A' and 'B' and 'C'. Sector 'A' coincides with the central portions of the valleys, while sector 'B' coincides with the foothill zones and Sector 'C' represents the hilly areas of the state. Shallow tube wells constructed down to the depth of 50 to 60 m bgl tapping 20 to 30 m (cumulative thickness) of granular zones in sector 'A' would yield 10 to 15 m^3/hr at a draw down up to 10 m and the same kind of tube well would have draw down up to 15 m in sector 'B'. Similarly, deep tube wells down to 200 to 300 m depth tapping 36 to 42 m of granular zones in Sector 'A' would be capable of yielding 50 to 150 m^3/hr for a draw down upto 20 m and the same tube well constructed down to the depth of 150 to 200 m in sector 'B' tapping 36 to 42 m cumulative thickness of granular zones would have a smaller yield ranging from 20 to 70 m^3/hr invariably with a higher draw down. Due to high draw down, the length of housing pipe should be at least 50 m for the deep tube wells in Sector 'B'. Yield of tube wells in sector 'C' would certainly be less than 10 m^3/hr with a very high draw down.

Results of chemical analysis of ground water show that ground water in all parts of the state is fresh and good for domestic, irrigation and industrial uses with a low total dissolved solids (TDS) as indicated by the electrical conductivity varying from 92 to 799 micromhos/cm. Ground water is mildly alkaline with p^H ranging from 6.1 to 8.4. Based on the values of cations and anions the ground water occurring in the State may be classified as Calcium Bi-Carbonate type of water. All the observed chemical characteristics of ground water indicate that it is suitable for irrigational uses.

However, the Iron content in ground water is at higher side which warrants proper treatment before its use for drinking, domestic and industrial purpose. The water is also encrustating in nature. Removal of iron is best effected by aeration process followed by sedimentation and filtration. Potassium Permanganate or Chlorine/Chloride may be employed to induce oxidization and to cause the precipitation of the dissolved ferrous iron in ground water as insoluble ferric iron, which is then filtered from the water. This process is applicable very much when bacteria is present in the water. Iron can also be removed by the addition of a mixture of Sodium Carbonate and Sodium Phosphate to precipitate iron as insoluble, followed by setting and filtrations. Open dug wells are normally free from the hazards of high concentration of iron as water in it gets much exposure to air for oxidation.

There is no saline/brackish water aquifer found yet in the state of Tripura.The ground water of Tripura from both the shallow and deep aquifers has so far not been reported categorically to be affected by any considerable arsenic contamination, although it has been detected by one or two agencies at a few places with a very less magnitude. However, the presence of arsenic above or below permissible limit in ground water from some of the scattered and restricted patch areas adjacent to the Bangladesh border, especially in North Tripura, Dhalai and West Tripura district cannot be ruled out as the adjoining localities of Bangladesh are reported to be arsenic polluted.

A number of ground water samples from GWMS and Aquifer Mapping monitoring wells were collected and analyzed by CGWB. According to the analysis results, arsenic content in ground water in most of the monitoring wells is below detectable limit. However, the arsenic content of ground water from shallow aquifers is found to be in the range of 0.07 ppb to 8.93 ppb in Srinagar area, In other areas, water samples collected from shallow aquifers; arsenic content is found below detectable limit.

The total Rechargable Ground Water Resources of Tripura have been estimated by GEC-2015 methodology as 1.18 BCM and the Annual Extractable Ground Water Resources is 1.06 BCM. The total extraction for domestic and industrial uses has been estimated as 0.08 BCM. Future Allocation of Ground Water for Domestic and Industrial Uses up to 2025 has been estimated to be 0.08 BCM. The Balance Ground Water Resource for Future Irrigational Use has been estimated as 0.95 BCM. The present stage of ground water extraction in the state is 9.7%. There is a scope for further development of ground water in the state of Tripura still exists for agricultural or industrial sector. Stage of ground water extraction in West Tripura district is highest i.e 20.20% and lowest in Gomati district, which is 5.42%. All the administrative blocks of Tripura have been categorized as "safe" from the ground water extraction point of view. Agartala Municipal Corporation of West Tripura district has attainted the highest stage of extraction i.e. 55.72% and Karbuk block of Gomati district has the lowest stage of ground water extraction i.e. 2.49%. Out of total 59 assessment units, 35 nos. of units have the stage of ground water extraction below 10%. The long-term water level trend of the blocks during pre-monsoon and post-monsoon periods shows almost stable condition.

12.2 RECOMMENDATIONS

Athough the state annually receives more than 2000 mm rainfall spread throughtout the year including non-monsoon period also, the people residing in the hilly areas or hilly forest areas faces acute scarcity of water during the lean period. As a solution to this problem, Roof Top Rainwater Harvesting may be adopted effectively on an individual or a community basis to meet the demand of people residing on hilltops particularly during non-monsoon period as the average non-monsoon rainfall in Tripura is in the tune of 800 to 1000 mm. In other rural areas of Tripura where sufficient municipal facilities are not available, home-made indigenous rooftop rainwater harvesting structure in small scale would be very useful for meeting the household water needs by utilizing rainwater.

In urban areas, urban housing complexes, institutional and Govt. buildings usually have large roof areas, where the rooftop rainwater can be collected, utilized, conserved and also may be used for recharging the ground water reservoir underneath the ground surface, which is mostly covered with concrete structures and has very less scope of rainfall recharge in a natural way.

Rainwater can be collected from the rooftops through gutters into a 1000 lt or bigger capacity PVC or concrete container. Filters can be used at the time of collection for filtration of physical impurities. The water thus collected can be used for domestic and drinking purposes after treating with bleaching powder or any other chlorinization agents for removing bacteriogenic contamination. Both rural and urban people should be encouraged for a regular rain water harvesting practice.

It has been observed that 70 to 80 percent of rainfall occurs between May to September and within a few hours most of the rainwater goes as run off and finally enters Bangladesh. In foothill portion of the state, where most of the precipitations get wasted as surface runoff can be efficiently utilized for augmentation of ground water recharge by constructing structures like small/medium check dams, gabions and check weirs by which the arrested runoff water can be stored over or under the ground. Doing so, the water level in the upstream parts can be raised to a considerable extent saturating the otherwise dry part of the aquifer for facilitating future withdrawal in lean period.

In foothill areas, gully plugging and contour bunding will be most effective for augmentation of ground water level. In many parts of the hilly areas, there are some open spaces called platforms or terraces. Platforms are raised areas and may be cemented or covered by plastic sheets spread, which will have distributors of rainwater on all the sides. These platforms should be fully protected from approaching by animals and human beings. Maintenance of platforms in hygienic ways is a must. Surface runoff should not be allowed to enter into the platforms. The rainwater collected by this method can then be used by rural people residing on hills for domestic purposes.

In hilly areas, ground water can be developed only in the intermontane valleys through dug wells and shallow tube wells for solving the regular water crisis during summer/lean period.In the hilly and foothill areas of the state, there are certain portions where fractures and lineaments occur. In these areas, potential fracture zones may be found within the depth of 300 m bgl. These fracture zones can be tapped for ground water development. But the presence of potential fracture zones and the

alignment of fractures must be confirmed by electrical resistivity surveys before deployment of a suitable drilling rig in these areas. A careful selection of suitable drilling sites is very essential especially for the foothills and hilly areas and even for the valleys in Tripura, which must be supported by the proper geophysical investigations.

While constructing deep tube wells or mini deep tube wells, appropriate gravel packing is a must because the grain size of sandstones in Tripura is fine to medium. Slot size should be 0.5 to 1 mm and the gravels should be quartzitic, sub-rounded to sub-angular in shape and 2 to 4 mm in size.

Some measures are required to be taken to maintain the good yield of artesian wells for a longer period. It has been observed that in most of these wells piezometric head is up to 1 m agl only. So, if a pipe of 1.5 m is put on top of the wells, the water will stop flowing over and whenever water would be required, it can be collected through a tap with at the height of 1 m agl.

The scope of conjunctive use of surface and ground water may be explored in minor irrigation command areas. This will help in minimizing water logging problem and in evenhanded distribution of irrigation water in the area. People's co-operation is very much required for further development of ground water, particularly in irrigation sector and adopting this conjunctive use.

Ground water quality in Tripura should be monitored periodically both during pre-monsoon and post-monsoon time for iron, fluoride and especially for arsenic content, because ground water in the neighboring Bangladesh is reported to be arsenic infested.

Ground water usually contains high iron. So, iron removal plants are required to be installed with every community drinking water supply schemes. In most of the cases the ground water is encrustating in nature, hence it is recommended that well screen should be cleaned periodically, say once in a year, even if the discharge does not decline. PVC/stainless steel stainer pipes may be used. Glassy Phosphates are known to be effective to clean the iron encrustation on the tube well pipes.

Dug wells are normally free from the hazards related to high concentration of iron as the water within open dug well gets much exposed suface area and more contact time with the air/atmosphere, which facilitates oxidation at a larger scale than that in case of a tube well. So people, especially in rural Tripura should give emphasis on construction of more and more open dug wells of suitable depths for their daily drinking water needs.

As that ground water from both the shallow and deeper aquifers is invariably contaminated by high concentration of geogenic iorn, there is an urgent need to introduce the low cost Tripura Filter in a large scale, especially in rural, hilly and tribal areas of Tripura, where piped water supply is still not available. This indigenous Tripura Filtre was evaluated by All India Institute of Hygiene and Public Health, Kolkata and found capable of removing iron and also the bacteriological contamination effectively. The various processes of iron removal such as aeration, coagulation, sedimentation and filtration may be used. Potassium Permanganate or Chlorine/Chloride may be employed to oxidize the dissolved iron for separating as precipitations, which is then filtered from the water. This process is highly applicable when bacteria are also present in the water. It is also recommended to add a mixture of Sodium Carbonate and Sodium Phosphate in water to precipitate iron as insoluble followed by settling and filtration. Tripura Filter may be used for domestic purpose in individual households and Modified Iron Removal Plant or Package Type Iron Removal Plant for community use.

The ground water of Tripura from both the shallow and deep aquifers has not so far been reported to be affected by significant arsenic contamination. However, more studies in this reagard and more and more ground water sample collection are required in the state of Tripura to know the actual status of arsenic content in ground water. It is advisable that all the newly constructed tube wells tapping shallow or deeper aquifers should undergo the testing for arsenic contamination prior to its commissioning. Periodical testing for knowing the arsenic content in the existing tube wells should also be done to check any possible arsenic presence or its mobilization in future.

No analysis of ground water samples from irrigated area has yet been carried out in Tripura for detection of pollutants from fertilizers and pesticides and so it has now become necessary to monitor the ground water quality regularly, specially in shallow aquifers in the areas covered by extensive agricultural lands in order to find out level of pollution in the irrigated fields, if any.

The overall stage of ground water extraction in the state is 9.7%, which indicates that there is an ample scope for development of ground water for drinking, domestic as well as irrigation purposes. Ground water development for drinking and irrigation purposes can be done through dug wells, shallow to medium depth and deep tube wells. Ground water extraction should be carried out in a planned manner and should be developed step by step in a phased manner. Assessment of ground water regime is also required after each step or phase of development. Initially the acceptable rate of extraction should be kept at 70 % and further development programme should be taken up only after studying actual ground water draft, long term water level trends and other related hydrogeological aspects. Keeping in view the high extraction of ground water in Agartala Municipal Corporation of West Tripura district, a close monitoring of the ground water level needs to be carried out by the state government in these blocks. If this natural resource of ground water is harnessed with this type of proper planning and management, then the economic scenario of the state can surely be uplifted to a reasonably higher scale.

Minimum Safe distance between two deep tube wells is 500 m and between two shallow tube wells, it is 150 m. While constructing tube wells this safe distance should be maintained everywhere.

In urban areas, site for solid waste disposal should be selected in a very careful manner. Disposal sites should not be in the recharge zone of ground water, otherwise ground water of the near surface aquifers will be contaminated organically as well as inorganically. Areas away from locality and with thick clay cover at the near surface zone will be a better option for waste disposal. It has been observed that there are many kachha latrines discharging directly in Howrah River near intake points of water treatment plants in Agartala. This practice should be stopped immediately to avoid health hazards related to contamination of ground water in nearby areas. Moreover, the gutters/drains in the urban areas should be lined properly with brick and concrete to avoid mixing of foul water with the aquifer water to resist pollution of ground water by harmful organic or inorganic substances.

Public awareness should also be generated at a larger scale in rural as well as urban area for proper and judicious use of ground water, stopping wastage of drinking or irrigation water and for conservation of all forms of water resources available.

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Sl. No.	Publishing Department	Year	Name or Title of the Report or Publication
1	Central Ground Water Board, GoI	2022	Dynamic Ground Water Resources of Tripura, (As on March, 2022)
2	Central Ground Water Board, GoI	2018	Hydrogeological conditions and ground water Development Prospects in Tripura.
3	Central Ground Water Board, GoI	2018	Report on Dynamic Ground Water Resources of Tripura
4	Central Ground Water Board, GoI	1990	Hydrogeological Atlas of Tripura
5	Central Ground Water Board, GoI	1992	Hydrogeology and Ground Water Potentials of South Tripura Dist. Tripura, Tech. Series-D, No18
6	Central Ground Water Board, GoI	1992	Ground Water Potentials of South Tripura Dist. Tripura, Tech. Series-D, No19
7	Central Ground Water Board, GoI	2018	Report on Aquifer Mapping and management plan of West Tripura District, Tripura
8	Central Ground Water Board, GoI	2017	Report on Aquifer Mapping and management plan of North Tripura District, Tripura
9	Central Ground Water Board, GoI	2017	Report on Aquifer Mapping and management plan of Dhalai District, Tripura
10	Central Ground Water Board, GoI	2018	Report on Aquifer Mapping and management plan of South Tripura District, Tripura
11	Laskar, et. el.	1983	Soils Of Tripura & Their Fertility Management, Research Bull NO-23, Division of Soil Sc., ICAR, Shillong
12	Prasad K.K. et. el.	1977	Hydrogeological Conditions of North East States with Scope of Ground Water Development.
13	Prasad K.K. et. el.	1978	Hydrogeology and Ground Water Potential of Tripura.
14	Saha, D.	1989	Report On Reappraisal Hydrogeological Survey of West Tripura District, TripuraState. (FSP1986-87)
15	Sharma, V.	1989	Ground Water Potential of West Tripura District, Tripura.
16	Sharma, V.	1993	Hydrogeological Conditions & Ground Water Potentials of Tripura.
17	Prasad K.K. et. el.	1982	Interim Report On Scope For Ground Water Development In Parts Of North Tripura And South Tripura
18	Agriculture Dept., Govt of Tripura	2018	Rainfall data,
19	PWD (WR), Govt of Tripura	2019	Status Report on Irrigation coverage by PWD(WR) as on 31.03.2019
20	Director General, GSI	1974	Geology and Mineral Resources of NE States of India, pt. IV, Misc, Pub. No 30
21	Directorate of Economics & Statistics, Planning (Statistics) Department, Govt of Tripura	2016	Some Basic Statistics of Tripura - 2016
22	Directorate of Economics & Statistics, Planning (Statistics) Department, Govt of Tripura	2019	Economic Review of Tripura 2018-19
23	Directorate of Economics & Statistics, Planning (Statistics) Department, Govt of Tripura	2019	Tripura At – A – Glance, 2019
24	Ganguli, S.	1983	Geology And Hydrocarbon Prospects Of Tripura–Cachar-Mizoram Region, Petroleum Asia Journal
25	Kher, B.M. & Ganju, J.L.	1984	Tectonics Of Tripura Folds-Probable Mechanics of Folding and Faulting, Petroliferous Basins of India, Himachal Times Group, Dehradun, pp. 66-70.

ANNEXURE– I (Important Location)

CO-ORDINATES OF IMPORTANT LOCALITIES

Location	North latitute	East Longitude
North Tripura		
Damcherra	$24^0\,14'\,30''$	$92^0\,17'\,00''$
Dharmanagar	$24^0\,16'\,00''$	$92^0\,16'\,00''$
Panisagar	$24^0\,14'\,30''$	$92^0\,08'\,12''$
Kanchanpur	$23^0\,56'\,00''$	$92^0\,12'\,00''$
Machmara	$24^0\,08'\,19''$	$92^0\,07'\,06''$
Unakoti		
Kailashahar	$24^0\,20'\,00''$	$92^0\,01'\,00''$
Kumarghat	$24^0\,08'\,00''$	$92^0\,03'\,00''$
Pecharthal	$24^0\,11'\,16''$	$92^0\,06'\,07''$
Dhalai		
Chhamanu	$23^0\,19'\,49''$	$91^0\,51'\,43''$
Abhanga	$24^0\,03'\,05''$	$91^0\,50'\,20''$
Ambassa	$24^0\,56'\,00''$	$91^0\,51'\,45''$
Kamalpur	$24^0\,02'\,30''$	$91^0\,50'\,00''$
Karamcherra	$24^0\,02'\,00''$	$92^0\,17'\,00''$
Manu	$24^0\,00'\,00''$	$91^0\,59'\,00''$
Khowai		
Kalyanpur	$23^0\,23'\,00''$	$91^0\,36'\,00''$
Khowai	$24^0\,03'\,45''$	$91^0\,36'\,30''$
Teliamura	$23^0\,52'\,00''$	$91^0\,38'\,45''$
Vivekanandanagar	$23^0\,47'\,30''$	$91^0\,17'\,30''$
West Tripura		
Agartala	$23^0\,49'\,00''$	$91^0\,18'\,00''$
Champaknagar	$23^0\,48'\,20''$	$91^0\,29'\,40''$
Jirania	$23^0\,40'\,30''$	$91^0\,27'\,30''$
Mohanpur	$23^0\,59'\,10''$	$91^0\,25'\,00''$
Simna	$24^0\,02'\,00''$	$91^0\,24'\,30''$
Sepahijala		
Bishalgarh	$23^0\,40'\,00''$	$91^0\,17'\,00''$
Kanthalia	$23^0\,23'\,00''$	$91^0\,19'\,00''$
Kenania	$23^0\,44'\,00''$	$91^0\,11'\,00''$
Nalchar	$23^0\,33'\,10''$	$91^0\,21'\,30''$
Sonamura	$23^0\,29'\,00''$	$91^0\,16'\,00''$
Gomati		
Amarpur	$23^0\,31'\,20''$	$91^0\,39'\,38''$
Udaipur	$23^0\,32'\,00''$	$91^0\,28'\,30''$
Bagma	$23^0\,36'\,00''$	$91^0\,25'\,00''$
Gorjee	$23^0\,25'\,30''$	$91^0\,30'\,00''$
Gaptali	$23^0\,09'\,40''$	$91^0\,23'\,20''$
South Tripura		
Belonia	$23^0\,27'\,00''$	$91^0\,15'\,00''$
Ghoshkhamar	$23^0\,11'\,27''$	$91^0\,20'\,40''$
Hrishyamukh	$23^0\,08'\,30''$	$91^0\,32'\,00''$
Jolaibari	$23^0\,12'\,30''$	$91^0\,37'\,05''$
Satchand	$23^0\,07'\,45''$	$91^0\,38'\,10''$
Sabroom	$23^0\,57'\,30''$	$91^0\,44'\,38''$
Santirbazar	$23^0\,18'\,00''$	$91^0\,33\,'00''$

ANNEXURE– II (Potential created by PWD (WR))

BLOCK AND DISTRICT WISE NOS OF STRUCTURES AND POTENTIAL CREATED BY PWD (WR) ON MARCH 2019 (latest available data)

Sl.No	Name of block /AMC	L.I (No)	Area coverage (ha)	H.P.L.I (Nos.)	Area coverage (ha)	DTW (nos)	Area coverage (ha)	Diversion (nos)	Area coverage (ha)	Low high pick up weir (nos)	Area coverage (ha)	Medium (nos)	Area coverage (ha)	Total (nos)	Area coverage (ha)
1	Mohanpur	16	911	0	0	14	407	2	265					32	1583
2	Mohanpur MC	4	120			3	60							7	180
3	Bamutia	12	390			20	400							32	790
4	Lefunga	12	467.5			2	50							14	517.5
5	Hezamara	19	795.05			2	40							21	835.05
6	Jirania	17	632			9	179							26	811
7	Jirania NP	1	30			2	40							3	70
8	Ranir bazar NP	3	90			1	20							4	110
9	Belbari	21	1109											21	1109
10	Old Agartala	17	686			4	80							21	766
11	Mandai	21	1150.94			5	140	1	240					27	1530.94
12	Dukli	21	1259.5			13	333							34	1592.5
13	AMC	13	478.7			7	139	1	70					21	687.7
WEST TRIPURA		**177**	**8119.69**	**0**	**0**	**82**	**1888**	**4**	**575**	**0**	**0**	**0**	**0**	**263**	**10582.69**
1	Khowai	36	1597			9	344	1	290					46	2231
2	Khowai M.C	6	240											6	240
3	Kalyanpur	34	1677.25			7	151	1	95				1500	42	3423.25
4	Tulashikar	20	775			1	25							21	800
5	Teliamura	25	1356.1			5	123	1	150				2900	31	4529.1
6	Padmabil	6	280			4	99	1	134					11	513

Sl.No	Name of block /AMC	L.I (No)	Area coverage (ha)	H.P.L.I (Nos.)	Area coverage (ha)	DTW (nos)	Area coverage (ha)	Diversion (nos)	Area coverage (ha)	Low high pick up weir (nos)	Area coverage (ha)	Medium (nos)	Area coverage (ha)	Total (nos)	Area coverage (ha)
7	Mungiakami	12	640.97										115	12	755.97
KHOWAI		**139**	**6566.32**	**0**	**0**	**26**	**742**	**4**	**669**	**0**	**0**	**0**	**4515**	**169**	**12492.32**
1	Bishalgarh	37	2045			19	411							56	2456
2	Bishalgarh MC	5	250			2	44							7	294
3	Charilam	14	765			6	126							20	891
4	Jampuijala	26	1049			9	189							35	1238
5	Nalchar	40	1381			9	167	1	110					50	1658
6	Mohanbhog	27	990.25			2	38							29	1028.25
7	Melaghar M.C	12	505											12	505
8	Sonamura NP	3	129											3	129
9	Boxanagar	13	549.06			13	324.6							26	873.66
10	Kathalia	19	791.89	1	300	9	174	1	80					30	1345.89
SEPAHIJALA		**196**	**8455.2**	**1**	**300**	**69**	**1473.6**	**2**	**190**	**0**	**0**	**0**	**0**	**268**	**10418.8**
1	Udaipur NP	3	100											3	100
2	Matabari	38	1573	1	120	6	125	2	220				3375	47	5413
3	Tepaniya	16	480.05			10	314							26	794.05
4	Kakraban	56	1908.12			12	267.5	1	190				1062	69	3427.62
5	Killa	26	909.5			2	64	1	52					29	1025
6	Amarpur NP	5	160											5	160
7	Amarpur	84	2539.58			3	88	4	410					91	3037.58
8	Karbook	41	1238.75			1	24							42	1262.75
9	Silachari	4	101				0							4	101
10	Ompi	49	1184.35			2	55							51	1239.35
GOMATI		**322**	**10194.4**	**1**	**120**	**36**	**937.5**	**8**	**872**	**0**	**0**	**0**	**4437**	**367**	**16560.35**

Sl.No	Name of block /AMC	L.I (No)	Area coverage (ha)	H.P.L.I (Nos.)	Area coverage (ha)	DTW (nos)	Area coverage (ha)	Diversion (nos)	Area coverage (ha)	Low high pick up weir (nos)	Area coverage (ha)	Medium (nos)	Area coverage (ha)	Total (nos)	Area coverage (ha)
1	Santir bazar NP	7	223			1	20	1	43					9	286
2	Bagafa	27	737.2			7	128.5	3	488.5					37	1354.2
3	Jolaibari	41	884.95			1	16	1	1250					43	2150.95
4	Rajnagar	10	270.58			9	186							19	456.58
5	Birchandranagar	31	816			2	40	2	90					35	946
6	Herishyamukh	24	829.77			4	90.8	6	595					34	1515.57
7	Satchand	71	1889.2			5	105.5	3	452					79	2446.7
8	Poyangbari	0	0			0	0	0	0					0	0
9	Rupaichari	20	559.4			4	94	2	177					26	830.4
SOUTH TRIPURA		**231**	**6210.1**	**0**	**0**	**33**	**680.8**	**18**	**3095.5**	**0**	**0**	**0**	**0**	**282**	**9986.4**
1	Kailasahar MC	1	25											1	25
2	Chandipur	34	1224.51			3	56							37	1280.51
3	Gournagar	27	1022.99			1	24							28	1046.99
4	Kumarghat MC	6	174											6	174
5	Kumarghat	76	2437			4	87						1759	80	4283
6	Pecharthal	31	960	1	60									32	1020
UNAKOTI		**175**	**5843.5**	**1**	**60**	**8**	**167**	**0**	**0**	**0**	**0**	**0**	**1759**	**184**	**7829.5**
1	Dharmanagar MC	6	110											6	110
2	Kadamtala	13	865					1	120					14	985
3	Kalacherra	21	597			6	159.5							27	756.5
4	Panisagar NP	7	239											7	239
5	Panisagar	42	1481			2	50							44	1531
6	Jubrajnagar	38	1308			8	195							46	1503
7	Dasda	26	599.7	1	265			1	20	4	32			32	916.7

Sl.No	Name of block /AMC	L.I (No)	Area coverage (ha)	H.P.L.I (Nos.)	Area coverage (ha)	DTW (nos)	Area coverage (ha)	Diversion (nos)	Area coverage (ha)	Low high pick up weir (nos)	Area coverage (ha)	Medium (nos)	Area coverage (ha)	Total (nos)	Area coverage (ha)
8	Laljuri	8	193.5											8	193.5
9	Damcherra	7	179.35	1	40									8	219.35
10	Jampui hill	0	0												
NORTH TRIPURA		**168**	**5572.55**	**2**	**305**	**16**	**404.5**	**2**	**140**	**4**	**32**	**0**	**0**	**192**	**6454.05**
1	Salema	37	1138			1	38	3	230					41	1406
2	Kamalpur NP	4	120					1	35					5	155
3	Durga Chowmuhani	43	1363	2	158	1	10	4	238					50	1769
4	Ambassa MC	5	184											5	184
5	Ambassa	29	959.95			1	25	1	200					31	1184.95
6	Ganganagar	0	0											0	0
7	Chawmanu	9	304											9	304
8	Manu	36	1285			1	30	1	107					38	1422
9	Dumburnagar	21	534											21	534
10	Raishyabari	2	51			1	20							3	71
DHALAI		**186**	**5938.95**	**2**	**158**	**5**	**123**	**10**	**810**	**0**	**0**	**0**	**0**	**203**	**7029.95**
TOTAL		**1594**	**56900.7**	**7**	**943**	**275**	**6416.4**	**48**	**6351.5**	**4**	**32**	**3**	**10711**	**1928**	**81354.06**

ANNEXURE– III (Depth to WL)

DEPTH TO WATER LEVEL (m bgl) OF GWMW OF TRIPURA, 2022

S.No.	Block	Site name	Well Type	Lat DD	Long DD	Pre Monsoon	Post Monsoon	Fluctuation
Dhalai								
1	Ambassa	Ambassa N	DW	23.92397	91.84708	7.91	6.23	1.68
2	Ambassa	Chawmanu	DW	23.86219	91.99900	1.16	1.04	0.12
3	Ambassa	Durga Cherra	DW	23.60889	91.82583	1.52	filled up	-
4	Ambassa	Kali Kumar Para	DW	23.10139	91.86000	3.12	2.82	0.30
5	Ambassa	Lalchari	DW	23.93417	91.85444	7.77	4.64	3.13
6	Ambassa	Nuna Cherra	DW	23.78750	91.85528	1.67	2.63	-0.96
7	Durga Chowmuhani	Durga Chowmuhani	DW	24.12167	91.86028	4.40	0.78	3.62
8	Durga Chowmuhani	Kamalpur	DW	24.16944	91.81528	1.83	1.59	0.24
9	Manu	Manu N	DW	24.00250	91.99194	5.92	4.41	1.51
10	Manu	Sindhu Kumar	DW	23.95250	91.96056	3.90	2.58	1.32
11	Salema	Abhanga N	DW	24.05389	91.83083	4.70	2.01	2.69
Gomti								
12	Amarpur	Bampur	DW	23.56222	91.63528	4.04	3.39	0.65
13	Amarpur	Jatanbari	DW	23.42000	91.75833	6.00	4.33	1.67
14	Ampi	Ompi Colony	DW	23.67181	91.64222	7.38	7.12	0.26
15	Ampi	Twidu	DW	23.73111	91.65528	4.77	Gate closed	-
16	Kankraban	Kankraban	DW	23.48750	91.40194	10.30	9.48	0.82
17	Killa	Dewanbari	DW	23.55778	91.53528	3.90	3.26	0.64
18	Killa	Joingkami	DW	23.60111	91.51750	1.04	0.92	0.12
19	Killa	Naobari-2	DW	23.59111	91.51944	1.70	1.66	0.04
20	Matabari	Dhawajnagar Udaipur	DW	23.55361	91.46500	4.14	3.49	0.65
21	Matabari	Garjee Bazar	DW	23.42667	91.50583	2.75	2.94	-0.19
Khowai								
22	Kalyanpur	Kalyanpur	DW	23.92889	91.60944	4.56	6.81	-2.25
23	Kalyanpur	Kathalbari	DW	23.97278	91.60694	7.46	5.36	2.10
97	Kalyanpur	Totabari EW	TW	23.90917	91.62028	15.42	14.36	1.06
24	Khowai	Khowai	DW	24.06389	91.60500	2.03	1.98	0.05
25	Mungiakami	45miles	DW	23.95250	91.96056	2.93	2.69	0.24
26	Mungiakami	Tuimadhu	DW	23.83500	91.68639	3.67	7.38	-3.71
27	Teliamura	Paschim Howaibari	DW	23.81000	91.59194	3.60	2.09	1.51
98	Teliamura	Chakmaghat Ew	TW	23.83500	91.67583	3.37	2.97	0.40
99	Teliamura	Chakmaghat Ow	TW	23.83500	91.67583		3.15	-

North Tripura								
28	Damcherra	Khedacherra	DW	24.09444	92.32250	1.61	1.75	-0.14
29	Damcherra	Narendra Nagar	DW	24.24155	92.28519	3.46	3.24	0.22
30	Dasda	Ananda Bazar	DW	23.84778	92.21083	5.01	1.87	3.14
31	Dasda	Dataram	DW	23.76528	92.22833	3.22	2.46	0.76
32	Dasda	Kanchanpur	DW	24.04556	92.19500	1.80	1.33	0.47
33	Dasda	Satnala	DW	23.97556	92.20583	1.05	0.68	0.37
100	Dasda	Kanchanpur Court Ow	TW	24.05667	92.20111	5.56	4.88	0.68
34	Jampui Hill	Sabual	DW	23.86556	92.26444	3.34	1.74	1.60
35	Kadamtala	Bagbasa N	DW	24.35167	92.22194	1.85	1.05	0.80
36	Kadamtala	Churaibari	DW	24.43778	92.24667	3.34	2.54	0.80
37	Kadamtala	Dharmanagar	DW	24.37889	92.15972	4.46	4.29	0.17
38	Kadamtala	Lalchhara	DW	24.43250	92.19222	2.05	0.68	1.37
39	Kadamtala	Sanicherra	DW	24.38361	92.23250	1.45	0.74	0.71
40	Laljuri	Laljuri	DW	24.11194	92.19833	6.93	6.51	0.42
41	Laljuri	Naba Joypara (natun Basti	DW	24.17500	92.21639	4.42	2.58	1.84
42	Panisagar	Deocherra	DW	24.31028	92.15972	5.49	4.48	1.01
43	Panisagar	Kunjanagar	DW	24.24556	92.20556	3.79	2.46	1.33
44	Panisagar	Panisagar	DW	24.24167	92.18333	4.45	2.34	2.11
45	Yubrajnagar	Krishnapur	DW	24.33944	92.15778	6.55	2.31	4.24
46	Yubrajnagar	Rajnagar New	DW	24.31833	92.10111	5.12	3.66	1.46
Sepahijala								
47	Bishalgarh	Konaban (replaced Kenania)	DW	23.70972	91.18222	3.24	0.54	2.70
48	Jampuijala	Gongrai	DW	23.65667	91.45389	3.60	2.83	0.77
49	Jampuijala	Tufaniamura	DW	23.69861	91.40694	4.67	3.63	1.04
50	Kanthalia	Kathalia bazar	DW	23.38333	91.31667	3.10	2.55	0.55
51	Nalchar	Lalmaibari	DW	23.55056	91.26722	2.45	3.31	-0.86
52	Nalchar	Rajib Nagar	DW	23.57118	91.39056		not approach able	-
53	Nalchar	Shivnagar	DW	23.54944	91.26806	4.77	2.18	2.59
South Tripura								
54	Bagafa	Manurmukh	DW	23.26556	91.48806	0.75	0.98	-0.23
55	Bagafa	Michara	DW	23.26639	91.51278	2.5	1.75	0.75
56	Poangbari	Poangbari	DW	23.02757	91.57010	5.84	1.33	4.51
57	Poangbari	Purba Takka	DW	23.05997	91.61148		4.08	-
58	Poangbari	Srinagar	DW	22.99885	91.55363	2.62	1.49	1.13
59	Rajnagar	Barkashari	DW	23.29583	91.38806	8.59	6.89	1.70
60	Rajnagar	Gaurnagar Bazar	DW	23.07219	91.63805	3.63	2.84	0.79
61	Rajnagar	Radhanagar	DW	23.22556	91.32944	3.32	2.70	0.62
62	Rajnagar	Rajnagar	DW	23.23222	91.39167	4.19	3.19	1.00
63	Rajnagar	Rangamura	DW	23.26306	91.32528	3.70	1.94	1.76

64	Rupaichhari	Baishnabpur	DW	23.04547	91.76608	8	3.81	4.19
65	Rupaichhari	Chatakchari	DW	23.06783	91.69493	dry	3.32	-
66	Rupaichhari	Magroom	DW	23.07297	91.77552	4.2	3.62	0.58
67	Satchand	Bijaynagar	DW	22.98963	91.67667	3.28	1.84	1.44
68	Satchand	Kalachhara	DW	23.14083	91.62722			-
69	Satchand	Kalirbazar	DW	23.11480	91.59983	2.02	2.1	-0.08
70	Satchand	Manu Bazar	DW	23.06417	91.64861	dry	3.63	-
71	Satchand	Motu Mogpara	DW	23.00283	91.65172	3.27	3.28	-0.01
72	Satchand	Sabroom	DW	23.00622	91.72381	5.99	2.46	3.53
73	Satchand	Shashi-Chandrapur	DW	22.97315	91.63747	2.69	3.97	-1.28
101	Satchand	PaschimJalefa EW	TW	23.03333	91.68694	autoflow	blocked	-
102	Satchand	PaschimJalefa OW	TW	23.03336	91.68701	autoflow	autoflow	-
103	Satchand	Rajib Nagar Ew	TW	23.05696	91.65660	8.17	7.74	0.43
104	Satchand	Tuichama Ew	TW	23.15667	91.66168	15.22	12.27	2.95
105	Satchand	Tuichama OW	TW	23.03336	91.68701		14.84	-
74	Silachhari	Ananda Bandhu Para	DW	23.21398	91.77908	5.58	4.22	1.36
75	Silachhari	Ghorakhappa	DW	23.16210	91.80502	4.65	3.15	1.50
Unakoti								
76	Chandipur	Panchamnagar	DW	24.21806	91.98111	6.95	4.25	2.70
77	Gaurnagar	Gauranagar N	DW	24.28917	92.03333	5.56	3.21	2.35
78	Gaurnagar	Jarutali	DW	24.25417	91.98583	2.43	1.35	1.08
79	Kumarghat	Chandramanikami	DW	24.11194	92.19833	4.4	3.36	1.04
80	Kumarghat	Demdum	DW	24.12954	91.9452	4.10	2.48	1.62
81	Kumarghat	Kanchanbari	DW	24.11361	91.97667	2.51	2.17	0.34
82	Kumarghat	Kanchanchhera	DW	24.08528	92.00250	6.30	3.84	2.46
83	Kumarghat	Kumarghat	DW	24.16500	92.04194	7.12	6.71	0.41
84	Pecharthal	Karaicherra	DW	24.14000	92.15139	4.85	4.49	0.36
85	Pecharthal	Pecharthal	DW	24.19861	92.09972	7.55	4.42	3.13
86	Agartala M.C.	Chandmari	DW	23.86852	91.29827		3.39	-
West Tripura								
106	Agartala M.C.	Badharghat DTW	TW	23.80278	91.27139	4.54	3.37	1.17
87	Belbari	Khumulwng	DW	23.81806	91.43889	6.98	5.39	1.59
88	Dukli	A D Nagar	DW	23.80139	91.26750		3.99	-
89	Dukli	Madhuban	DW	23.78861	91.28583	3.40	2.62	0.78
90	Heza-mara	Pukua bari	DW	24.01167	91.45000	dry	1.97	-
91	Jirania	R.K Nagar	DW	23.86500	91.33528	2.79	1.87	0.92
92	Jirania	Sadhupara	DW	23.81028	91.50972	1.93	0.55	1.38
107	Jirania	Nagicherra1	TW	23.00361	91.33028	28.35	26.38	1.97
108	Jirania	Nagicherra2	TW	23.80361	91.33028		overgrowth	-
93	Lefunga	Gamcha kobra Market	DW	23.90361	91.35000	3.52	2.77	0.75

94	Mohanpur	Ishanpur	DW	24.04528	91.39917	3.02	1.30	1.72
95	Mohanpur	Simna	DW	24.09222	91.39333	5.81	4.70	1.11
96	Mohanpur	Tarapur	DW			2.64	1.99	0.65
109	Mohanpur	Bodhjanagar Dtw	TW	23.88250	91.36528	21.30	19.25	2.05
110	Mohanpur	Bodhjanagar Stw	TW	23.88278	91.36528		13.35	-
111	Mohanpur	Narsinghgarh DTW	TW	23.90417	91.24694	10.60	8.20	2.40

ANNEXURE– IV (Pre-Post WL, Long Term)

LONG TERM PRE-MONSOON & POST-MONSOON WATER LEVEL DATA OF GROUND WATER MONITORIN WELLS IN TRIPURA

S.No.	Block	Site name	Pre Monsoon												Post Monsoon										
			Well Type	Mar-22	Mar-21	Mar-20	Mar-19	Mar-18	Mar-17	Mar-16	Mar-15	Mar-14	Mar-13	Mean	22-Nov	Nov-21	Nov-20	Nov-19	Nov-18	Nov-17	Nov-16	Nov-15	Nov-14	Nov-13	Mean
Dhalai																									
1	Ambassa	Ambassa N	DW	7.91	7.30	7.78	7.33	6.75						7.41	6.23	6.56	7.96	6.38	6.03						6.63
2	Ambassa	Chawmanu	DW	1.16	1.33	1.478	1.29							1.31	1.04	1.08	1.06	1.31							1.12
3	Ambassa	Durga Cherra	DW	1.52	1.72	2.99	1.97							2.05	-	0.58	0.52	1.88							0.99
4	Ambassa	Kali Kumar Para	DW	3.12	3.02	3.04	2.99							3.04	2.82	2.74	2.70								2.75
5	Ambassa	Lalchari	DW	7.77	7.50	7.55	7.08							7.48	4.64	6.17	5.26	4.98							5.26
6	Ambassa	Nuna Cherra	DW	1.67	1.54	2.02	1.77							1.75	2.63	0.95	1.13	1.02							1.43
7	Durga Chowmuhani	Durga Chowmuhani	DW	4.40	5.54	3.82	3.77	4.33	5.05	4.93	5			4.61	0.78	4.48	3.38	3.60	2.98	2.74	3.06	3.14			3.02
8	Durga Chowmuhani	Kamalpur	DW	1.83	2.08	2.37	2.02	2.2	2.08	2.04	1.97	3.59	2.38	2.26	1.59	2.62	1.71	1.90	1.80	1.77	1.84		1.54	2	1.86
9	Manu	Manu N	DW	5.92	5.60	5.72	4.97	5.05	5.23	5.5		5.55		5.44	4.41	4.91	4.05	4.55	3.79	2.75	4.85		4.27	5.18	4.31
10	Manu	Sindhu Kumar	DW	3.90	3.07	4.5	2.80	3.93	3.38	3.82				3.63	2.58	2.58	2.65	2.98	2.06	1.3	2.53				2.38
11	Salema	Abhanga N	DW	4.70	4.65	5.03	4.54	4.51	4.1	3.15	2.12	5.43		4.25	2.01	2.19	1.95	3.03	1.80		2.64	1.85	2.12	2.66	2.25
Gomti																									
12	Amarpur	Bampur	DW	4.04	3.84	4.14	1.54	1.56	4.06	3.94	4.16	4.14		3.49	3.39	3.30	2.67	3.64	3.50	2.67	2.65	2.27	3.29	3.25	3.06
13	Amarpur	Jatanbari	DW	6.00	5.53	5.63	2.65	1.62	5.94	6.02				4.77	4.33	4.77	3.47	3.88	4.30	3.33	3.35				3.92
14	Ampi	Ompi Colony	DW	7.38	7.10									7.24	7.12	5.60	6.20								6.31
15	Ampi	Twidu	DW	4.77	4.65	4.70								4.71	-	3.76	3.27								3.52
16	Kankraban	Kankraban	DW	10.30	9.48	10.41	9.76	9.69	10.3	10.25	10.4	10.33		10.10	9.48	9.39	9.03	9.18	9.59	9.33	8.75	8.33	9.52	9.48	9.21
17	Killa	Dewanbari	DW	3.90	2.84	3.57	3.32							3.41	3.26	3.48	2.49	3.02	1.07						2.66
18	Killa	Joingkami	DW	1.04	1.06	0.74								0.95	0.92	1.05	0.30	0.44	0.25						0.59
19	Killa	Naobari-2	DW	1.70	1.90	2.07	2.19							1.97	1.66	1.36	1.25	1.30	2.06						1.53

20	Matabari	Dhawajnagar Udaipur	DW	4.14	4.44	4.64	3.31	3.27	3.89	3.84	4.6	4.54	4.44	4.11	3.49	2.70	2.44	3.18	2.69	2.17	2.16	1.92	3.54	3.46	2.78
21	Matabari	Garjee Bazar	DW	2.75	2.50	2.60	2.57	1.89	3.46	3.41	3.38	3.4	3.59	2.96	2.94	0.86	0.52	1.10		0.64	1.18	0.69	2.09	2.74	1.42
Khowai																									
22	Kalyanpur	Kalyanpur	DW	4.56	4.26	4.34	4.34	4.22	4.28	4.28	4.47	4.38	4.47	4.36	6.81	4.14	3.76	3.93	3.97	3.85	3.96	3.64	4.09	4.18	4.23
23	Kalyanpur	Kathalbari	DW	7.46	7.51	7.36								7.44	5.36	6.62	5.22								5.73
97	Kalyanpur	Totabari EW	TW	15.42	15.12	15.25	15.22							15.25	14.36	14.34	14.36	14.72	14.71						14.50
24	Khowai	Khowai	DW	2.03	2.08	2.06	1.88	1.91	1.99	2.02	2.17	2.08	1.96	2.02	1.98	1.94	1.78	1.93	1.88	1.68	1.37	1.38	2.16	1.69	1.78
25	Mungiakami	45miles	DW	2.93	2.75	7.70	4.97	5.91	3.83	1.94				4.29	2.69	2.09	0.99	2.70	2.16	3.65	3.63				2.56
26	Mungiakami	Tuimadhu	DW	3.67	3.78	4.17	4.46	3.64		4.2	4.15	3.94		4.00	7.38	4.70	2.06	4.19	4.41	4.11	4.1	4.04	4.7	4.54	4.42
27	Teliamura	Paschim Howaibari	DW	3.60	3.98	3.99	3.90	3.06	2.74	4	5.76	4.35		3.93	2.09	2.51	1.80	3.10	2.57	1.76	2.42	1.8	3.06	2.87	2.40
98	Teliamura	Chakmaghat Ew	TW	3.37	2.88	2.99	3.11	2.99						3.07	2.97	3.25	2.61	2.95	2.78						2.91
99	Teliamura	Chakmaghat Ow	TW		2.98	3.37	2.75	2.85						2.99	3.15	3.21	2.73	3.05	2.86						3.00
North Tripura																									
28	Damcherra	Khedacherra	DW	1.61	1.75	1.63	1.81							1.70	1.75	1.03	1.11	1.44							1.33
29	Damcherra	Narendra Nagar	DW	3.46	4.24	3.96	3.81							3.87	3.24	3.33	3.14	3.27							3.25
30	Dasda	Ananda Bazar	DW	5.01	2.89	2.53	2.69							3.28	1.87	1.85	1.49	1.58							1.70
31	Dasda	Dataram	DW	3.22	3.36	3.67	3.72							3.49	2.46	1.35	1.09	2.55							1.86
32	Dasda	Kanchanpur	DW	1.80	2.22	2.47	1.72	3.3	4.6	1.66	2.06			2.48	1.33	0.76	0.82	1.22	1.23	0.9	1.61	1.46	2.01		1.26
33	Dasda	Satnala	DW	1.05	1.17	1.05	0.90	0.68	0.05	1.2	0.72			0.85	0.68	0.46	0.45	0.55	0.48	0.19	0.7	0.32			0.48
100	Dasda	Kanchanpur Court Ow	TW	5.56	5.56	5.56	5.05	4.5						5.17	4.88	4.92	4.42	4.42	3.55						4.44
34	Jampui Hill	Sabual	DW	3.34	dry	5.27	3.14							3.92	1.74	2.45	1.64	1.40							1.81
35	Kadamtala	Bagbasa N	DW	1.85	1.05	1.78	1.23		1.1	1.3	0.48	1.45		1.28	1.05	1.41	0.52	1.05	1.20	0.45	0.39	0.68	1.1	0.94	0.88
36	Kadamtala	Churaibari	DW	3.34	2.84	2.24	2.40	1.18	1.88	2.81				2.38	2.54	2.00	1.69	2.74	0.93	0.74	2.1				1.82
37	Kadamtala	Dharmanagar	DW	4.46	4.53	4.56	4.39	4.32	4.43	4.45	4.26	4.98	4.69	4.51	4.29	4.35	4.09	4.23	4.36	4.19	4.4	4.1	4.12	4.46	4.26
38	Kadamtala	Lalchhara	DW	2.05	2.48	3.33	1.76	1.56	2.08	2.37				2.23	0.68	0.84	0.98	2.08	1.69	0.95					1.20
39	Kadamtala	Sanicherra	DW	1.45	2.03	2.06	1.53	1.9	2.01	1.87				1.84	0.74	0.91	0.58	0.98	0.96	0.85	1.31				0.90
40	Laljuri	Laljuri	DW	6.93	7.03	6.89	6.68	6.9	7.05	7.06	7			6.94	6.51	6.29	6.00	6.53	6.83	5.24	4.87	6.15	6.18		6.07

41	Laljuri	Naba Joypara (natun Basti	DW	4.42	3.87	4.68	4.64	4.72	4.76	4.64				4.53	2.58	3.21	2.22	2.60	3.43	2.54	3.03				2.80
42	Panisagar	Deocherra	DW	5.49	5.22	5.22	5.56	5.42	6.17	5.07				5.45	4.48	5.08	4.66	4.29	4.60	3.79	4.94				4.55
43	Panisagar	Kunjanagar	DW	3.79	3.73	3.50	3.48	3.37	3.53	3.48				3.55	2.46	2.99	2.96	3.12	3.53	3.07	3.13				3.04
44	Panisagar	Panisagar	DW	4.45	4.16	3.78	4.02	3.9	4.12	4.35	4.15	3.72	5.13	4.18	2.34	3.28	2.25	2.42	2.66	1.79	2.42	2.18	2.77	2.04	2.42
45	Yubrajnagar	Krishnapur	DW	6.55	2.95	3.33	2.57	2.09	2.35	2.23				3.15	2.31	2.71	1.59	1.02	1.96	1.25					1.81
46	Yubrajnagar	Rajnagar New	DW	5.12	3.38	3.66								4.05	3.66	4.19	2.53	2.70							3.27
Sepahijala																									
47	Bishalgarh	Konaban (replaced Kenania)	DW	3.24		nm	NM							3.24	0.54	1.94	0.54		1.34						1.09
48	Jampuijala	Gongrai	DW	3.60	3.27	3.89	3.73	2.74	5.45	3.33	3.63	3.55		3.69	2.83		1.73	2.50	2.32	1.14	2.02	2.83	2.75	2.71	2.31
49	Jampuijala	Tufaniamura	DW	4.67	4.38	4.68	4.68	4.23	6.31	4.22	4.57	4.62		4.71	3.63	3.54	3.08	3.98	3.98	2.32	2.69	3.33	3.95	3.93	3.44
50	Kanthalia	Kathalia bazar	DW	3.10	3.03	3.25	2.93	2.89	4.32	3.78	2.79	2.75	3.04	3.19	2.55	2.85	2.35	2.83	2.70	2.66	2.67	1.86	2.92	2.27	2.57
51	Nalchar	Lalmaibari	DW	2.45	2.73	2.86	4.50							3.14	3.31	4.04	3.31	3.84	3.28						3.56
52	Nalchar	Rajib Nagar	DW		1.39									1.39	-	0.78	0.67								0.73
53	Nalchar	Shivnagar	DW	4.77	5.09	4.57	2.82							4.31	2.18	2.30	1.95	2.22	1.80						2.09
South Tripura																									
54	Bagafa	Manurmukh	DW	0.75	0.80	0.77	0.50	0.17	1.05	1.31	1.2	1.15	1.21	0.89	0.98	0.31	0.24	0.55	1.17	0.82	0.85		1.07	0.88	0.76
55	Bagafa	Michara	DW	2.5	3.04	1.06								2.20	1.75	0.82	1.46								1.34
56	Poangbari	Poangbari	DW	5.84	5.18	5.34	4.68	1.61						4.53	1.33	3.34	3.13	3.68	1.39	1.33					2.37
57	Poangbari	Purba Takka	DW		6.13	4.76	4.89	2.84						4.66	4.08	3.87	3.83	3.88	2.65	2.68					3.50
58	Poangbari	Srinagar	DW	2.62	2.92	2.43	1.93	2.18						2.42	1.49	1.51	1.35	1.39	1.99	2.01					1.62
59	Rajnagar	Barkashari	DW	8.59	8.57	8.56								8.57	6.89	7.55	6.63								7.02
60	Rajnagar	Gaurnagar Bazar	DW	3.63	3.9	3.70								3.74	2.84	2.96	2.5								2.77
61	Rajnagar	Radhanagar	DW	3.32	3.47	3.76	3.58	3.15	2.94	3.57	4.04	4.02		3.54	2.70		2.05	3.67	2.61	2.62	2.64	2.63	3.18		2.76
62	Rajnagar	Rajnagar	DW	4.19	4.25	4.55	4.58	3.41	3.38	4.33	4.75	4.75	5.04	4.32	3.19	3.25	3.02	3.25	3.18	3.24	3.22	4.22	3.96	3.51	3.40
63	Rajnagar	Rangamura	DW	3.70	3.75			5.9	5.46	4.37				4.64	1.94	1.16	2.30								1.80
64	Rupaichhari	Baishnabpur	DW	8	6.7	7.4	6	5.25						6.67	3.81	4.34	4.35	5.35	4.95	2.11					4.15
65	Rupaichhari	Chatakchari	DW	dry		Dry		6.02						6.02	3.32	5.06	5	5.6		N.M.					4.75

66	Rupaichhari	Magroom	DW	4.2	3.75	3.6	2.34	2.32						3.24	3.62	2.31	1.65	2.17	2.84	2.1					2.45
67	Satchand	Bijaynagar	DW	3.28	3.28	3.4	2.96	2.93						3.17	1.84		1.38	2.03	1.45	1.42					1.62
68	Satchand	Kalachhara	DW						5.82	5.73	5.55	5.77		5.72			NA		4.73	4.77	4.78	3.94	5.14	4.98	4.72
69	Satchand	Kalirbazar	DW	2.02	2.03	1.88	2.62	2.61						2.23	2.1	2.36	1.58	2.15	1.96	2					2.03
70	Satchand	Manu Bazar	DW	dry	4.44	4.58		3.96	4.43	4.39	4.42	4.34		4.37	3.63	-	3.28	3.74	3.32	3.16	3.18	3.23	3.74	3.5	3.42
71	Satchand	Motu Mogpara	DW	3.27	3.3	3.05		3.25						3.22	3.28	3.06	3.1	3.2	2.96	2.94					3.09
72	Satchand	Sabroom	DW	5.99	5.87	5.97	6.17	5.8	5.95	5.82	6.33	6.17	6.21	6.03	2.46	4.03	4.92	5.25	4.73	4.67	4.97	4.12	5.61	5.42	4.62
73	Satchand	Shashi-Chandrapur	DW	2.69	2.68	4.06		3.09						3.13	3.97	2.79			3.04	2.97					3.19
101	Satchand	PaschimJalefa EW	TW	Auto flow	Auto flow	Auto flow									-	Auto flow	Auto flow								
102	Satchand	PaschimJalefa OW	TW	Auto flow	Auto flow	Auto flow									Auto flow	Auto flow	Auto flow								
103	Satchand	Rajib Nagar Ew	TW	8.17	8.10	8.28	9.22	8.86						8.53	7.74	7.38	7.46	7.60	7.47						7.53
104	Satchand	Tuichama Ew	TW	15.22	15.72	15.60	15.15	15.01						15.34	12.27	14.08	14.52	12.42	13.85						13.43
105	Satchand	Tuichama OW	TW		13.13	13.01	12.33	12.7						12.79	14.84	12.22	11.67	12.23	11.53						12.50
74	Silachhari	Ananda Bandhu Para	DW	5.58	5.37	5.58	4.03	4.06						4.92	4.22	0.77	5	3.93	3.87	3.85					3.61
75	Silachhari	Ghorakhappa	DW	4.65	4.7	4.27	3.87	3.85						4.27	3.15	3.51	2.78	3.45	2.91	2.93					3.12
Unakoti																									
76	Chandipur	Panchamnagar	DW	6.95	6.30	6.02	6.55	6.37	0.85	5.85	7.17			5.76	4.25	4.84	4.05	4.34	4.65	3.81	4.15				4.30
77	Gaurnagar	Gauranagar N	DW	5.56	5.63	5.73	5.51	5.36	5.05	5.09	6.1	5.56	5.98	5.56	3.21	2.77	1.87	2.53	2.50	1.29	2.26	1.96	2.62	3.93	2.49
78	Gaurnagar	Jarutali	DW	2.43	1.97	2.05	1.99	1.97	2.21					2.10	1.35	1.97	1.55	1.55	1.66	1.26	1.45				1.54
79	Kumarghat	Chandramanikami	DW	4.4	4.27	4.48	4.25	4.5	4.22	4.25	6.24			4.58	3.36	3.52	2.76	3.2	2.86	2.05	2.91	2.45			2.89
80	Kumarghat	Demdum	DW	4.10	3.58	3.34	3.41							3.61	2.48	2.64	2.30	2.43	2.18						2.41
81	Kumarghat	Kanchanbari	DW	2.51	2.67	2.47	2.44							2.52	2.17	2.23	2.00								2.13
82	Kumarghat	Kanchanchhera	DW	6.30	6.10	5.99	6.15	5.85	5.5	5.38	5.83	7.76		6.10	3.84	4.51	4.68	4.05	3.56	2.19	4.13		2.98	6.08	4.00
83	Kumarghat	Kumarghat	DW	7.12	7.30	5.22	1.63	5.26	5.36	5.4	5.75	5.38	5.63	5.41	6.71	6.16	5.64	3.68	3.88	2.53	3.82	3.62	4.01	4.48	4.45
84	Pecharthal	Karaicherra	DW	4.85	3.55	5.15	5.69	4.09	4.78	2.38	8.69			4.90	4.49	3.41	4.15	4.38	4.28	5.67	1.78	1.35	1.61		3.46
85	Pecharthal	Pecharthal	DW	7.55	7.48	6.69	6.26	6.24	6.17	7.18	7.13	6.7	6.58	6.80	4.42	6.58	6.12	4.82	2.50	2.08	4.5	3.24	3.84	3.82	4.19
West Tripura																									

86	Agartala M.C.	Chandmari	DW	4.29	5.89									5.09	3.39	4.90									4.15
106	Agartala M.C.	Badharghat DTW	TW	4.54	4.27	4.57	4.41			4.95	5.22	4.09	4.92	4.62	3.37	-	2.43	3.26	3.44		2.1		3.55	3.44	3.08
87	Belbari	Khumulwng	DW	6.98	6.96	7.09	7.11							7.04	5.39	6.57	6.01	6.64							6.15
88	Dukli	A D Nagar	DW		6.34	6.94								6.64	3.99	3.88	3.61								3.83
89	Dukli	Madhuban	DW	3.40	4.64									4.02	2.62	2.48	3.66								2.92
90	Heza-mara	Pukua bari	DW	dry	3.88									3.88	1.97	4.18	2.12								2.76
91	Jirania	R.K Nagar	DW	2.79	2.43									2.61	1.87	0.81	2.27								1.65
92	Jirania	Sadhupara	DW	1.93										1.93	0.55	0.81									0.68
107	Jirania	Nagicherra1	TW	28.35	27.32	28.09	27.25			29.78	29.45	27.75	29.68	28.46	26.38	27.21	25.91	26.89	25.94		25.6	25.9	24.73	28.45	26.33
108	Jirania	Nagicherra2	TW		22.75	23.49	22.55			28.63	25.55	21.95	25.78	24.39	-	-	21.80	22.37	20.61		24.56	24.75	28.56	25.47	24.02
93	Lefunga	Gamcha kobra Market	DW	3.52	3.17									3.35	2.77	3.01	2.68								2.82
94	Mohanpur	Ishanpur	DW	3.02	3.50	3.24	3.04	3.36	3.91	3.85	4.14	3.96		3.56	1.30	2.76	2.35	2.11	0.95	2.38	1.25		0.82		1.74
95	Mohanpur	Simna	DW	5.81	5.43	5.71	5.17	4.81	5.95	5.42	6.15	6.19	5.49	5.61	4.70	4.61	4.67	4.71	4.68	4.82	4.71	4.58	5.61	5.28	4.84
96	Mohanpur	Tarapur	DW	2.64	2.77	2.99	2.70							2.78	1.99	1.82	1.66	2.01							1.87
109	Mohanpur	Bodhjanagar Dtw	TW	21.30	20.74	21.08	20.61	19.9		20.87	21.46	21.85	21.91	21.08	19.25	20.17	19.25	19.83	15.48		18.23	16.84	20.42	20.55	18.89
110	Mohanpur	Bodhjanagar Stw	TW		18.90	18.41	17.56	16.6		18.33	19.45	21	19.97	18.78	13.35	17.61	16.15	16.79	18.77		15.93		18.04	18.65	16.91
111	Mohanpur	Narsinghgarh DTW	TW	10.60	10.40	10.72	10.27	9.88	6	10.81	8.55	11.07	10.79	9.91	8.20	8.21	8.30	8.68	9.12		3.16	8.35	8.82	8.9	7.97

ANNEXURE– V (Long Term Trend in WL)

LONG TERM (2011-2021) TREND WITH RISE AND FALL OF DEPTH TO WATER LEVEL IN GWMWs OF TRIPURA

Sl.No	Block	Location	Type of well	Pre monsoon				Post Monsoon			
				Data no.	Rise (m/yr)	Fall (m/yr)	Intercept	Data no.	Rise (m/yr)	Fall (m/yr)	Intercept
KHOWAI											
1	Mungia-kami	45 Miles	DUG	4		1.12	-4.22	3	0.74		8.29
2		Tuimadhu	DUG	5		0.03	3.90	6	0.07		4.69
3	Khowai	Khowai	DUG	10	0.01		2.02	8	0.02		1.80
4		Pachim Howaibari	DUG	6	0.33		6.12	6	0.14		3.16
5	Kalyanpur	Kalyanpur	DUG	10	0.07		4.82	8	0.04		4.17
WEST TRIPURA											
6	Mohanpur	Mohanpur	DUG	6	0.38		4.06	6		0.1	1.1
7		Narsinghgarh DTW	PZ	10	0.20		10.81	7	0.22		8.8
8		Simna	DUG	10	0.01		5.52	8	0.01		4.9
9		Bodhjung-nagar DTW	PZ	9	0.01		20.84	8	0.24		18.8
10		Bodhjung-nagar STW	PZ	8	0.26		20.07	5	0.37		20.0
11		Ishanpur	DUG	6	0.20		4.99	4		0.1	0.4
12		Nagicherra EW - I	PZ	8		0.30	26.64	7		0.4	23.7
13		Nagicherra EW - II	PZ	8	0.07		25.18	7	0.70		28.2
14	Heza-mara	Subalsingh	DUG	6	0.14		8.83	6		0.1	5.7
15		Badharghat DTW	PZ	8		0.06	4.32	6	0.02		3.2
UNAKOTI											
16	Gaurnagar	Gaurnagar	DUG	10.00	0.15		6.45	8	0.14		3.08
17		Jarultali	DUG	3.00	0.11		2.94	3		0.11	0.72
18	Pecharthal	Pecharthal	DUG	10.00		0.07	5.90	8	0.22		4.50
19		Karaicherra	DUG	5.00	0.43		8.13	5.00		0.97	-2.86
20	Kumarghat	Kanchan-cherra	DUG	6.00	0.23		7.54	5.00	0.43		6.17
21		Chandra- moni Kami	DUG	5.00	0.37		7.30	4.00		0.04	2.33
22		Kumarghat	DUG	10.00	0.18		5.80	8.00	0.11		4.27
23	Chandipur	Pancham-nagar	DUG	5.00	0.07		5.86	3.00		0.25	2.45
SOUTH TRIPURA											
24	Sabroom	Manubazar	DUG	5.00	0.08		4.76	6.00	0.08		3.78
25		Sabroom	Dug	10.00	0.03		6.25	8.00	0.09		5.41
26	Bagafa	(Santir Bazar)	DUG	4.00		0.00	4.35	3.00	0.87		6.52
27		Gardhang	DUG	6.00	0.05		1.23	5.00		0.05	0.66
28		Manur Mukh	DUG	9.00	0.10		1.52	7.00		0.01	0.93
29	Rajnagar	Radhanagar	DUG	6.00	0.16		4.57	5.00	0.12		3.43
30		Rajnagar	DUG	7.00	0.19		5.48	6.00	0.14		4.31
SEPAHIJALA											
31	Boxnagar	Dakshin Kalamcherra	DUG	10.00		0.11	1.52	7.00	0.04		1.18
32	Bishalgarh	Bishalgarh	DUG	7.00		0.48	1.65	6.00		0.11	3.04
33		Golaghati	DUG	4.00		0.27	0.35	3.00		0.19	0.08
34	Jampui-jala	Tufaniamura	DUG	6.00		0.04	4.52	6.00	0.15		4.20
35		Gongrai	DUG	6.00		0.01	3.67	6.00	0.22		3.49
36	Kanthalia	Kanthalia Bazar	DUG	9.00		0.09	2.80	8.00	0.02		2.65
NORTH TRIPURA											
37	Kadamtala	Baghbasa	DUG	8.00	0.11		1.84	8.00	0.06		1.15
38		Dharmanagar	DUG	10.00	0.06		4.83	8.00	0.02		4.41
39		Lalchhara	DUG	4.00	0.24		3.71	2.00		0.74	-4.23
40		Sanicherra	DUG	4.00	0.11		2.68	3.00	0.18		2.27
41	Panisagar	Deocherra	DUG	4.00		0.07	5.02	3.00	0.17		5.63
42		Panisagar	DUG	10.00	0.03		4.25	8.00	0.06		2.68
43		Kunjanagar	DUG	4.00	0.02		3.59	3.00		0.20	1.84
44	Dasda	Satnala	DUG	5.00	0.02		0.82	4.00	0.00		1.15
45		Kanchanpur	DUG	5.00		0.10	2.00	5.00	0.21		2.71
46	Yubaraj-nagar	Krishnapur	DUG	4.00		0.08	1.74	2.00		0.71	-3.72
47		Rajnagar	DUG	6.00	0.06		4.89	6.00	0.40		5.45
48	Laljuri	Laljuri	DUG	5.00	0.08		7.50	5.00		0.04	5.62
49		Naba Joypara (Natun Basti)	DUG	4.00	0.00		4.72	3.00		0.20	1.60
GOMATI											
50	Amarpur	Amarpur	DUG	6.00	0.09		2.54	5.00	0.03		1.29
51		Bampur	DUG	6.00	0.59		7.07	6.00	0.01		2.97
52		Jatanbari	DUG	4.00	1.44		14.88	3.00		0.48	0.34
53	Matabari	Dhawajnagar	DUG	10.00	0.15		4.78	8.00	0.12		3.24
54		Gorjee Bazar	DUG	10.00	0.14		3.88	7.00	0.15		2.06
55	Killa	Noabari	DUG	4.00	0.40		4.89	4.00	0.29		3.93
56	Kankra-ban	Kankraban	DUG	6.00	0.14		11.04	6.00		0.01	9.10
DHALAI											
57	Salema	Abhanga New	DUG	9.00	0.12		4.89	8.00	0.13		2.69
58		Ambasa	DUG	5.00		0.24	2.76	6.00		0.60	-1.62
59	Durga Chowmuhani	Darlang Basti	DUG	5.00		0.05	2.95	4.00	0.02		1.78
60		Durga Chowmuhani	DUG	5.00	0.31		6.76	4.00	0.08		3.50
61		Kamalpur	DUG	10.00	0.15		3.22	7.00	0.02		1.92

62	Manu	Manu New	DUG	8.00	0.04		5.47	7.00	0.18		5.07
63		Sindhu Kumar	DUG	4.00	0.25		5.37	3.00	0.24		2.69

ANNEXURE– VI (WQ Pre-M)

(A) PHYSICO-CHEMICAL PROPERTIES AND CHEMICAL CONSTITUENTS IN GROUND WATER OF SHALLOW UNCONFINED AQUIFERS TAPPED BY GROUND WATER MONITORING WELLs FOR PRE MONSOON-2022

Sl.no	Lab code	District	Block	Location	Longitude	Latitude	Date of Collection of Sample	Temp°C	pH	EC (µs/cm) 25C	Turbidity (NTU)	TDS (mg/L)	CO_3^{-2} (mg/L)	HCO_3^{-1} mg/L)	TA (as $CaCO_3$) (mg/L)	Cl- (mg/L)	SO_4^{-2} (mg/L)	NO_3^{-1} (mg/L)	F^- (mg/L)	Ca^{+2} (mg/L)	Mg^{+2} (mg/L)	TH (as $CaCO^3$) (mg/L)	Na (mg/L)	K (mg/L)	Fe (mg/L)	Ur (ppb)
1	N213	Dhalai	Ambassa	Ambassa	91.84694	23.92397	26.02.2022	28.00	7.44	210.8	0	139.128	0	97.67808	97.67808	7.09	15.8605	0.993	0.25	18.0144	7.272816	75	14.45	6.05	0.252	0.1696
2	N214	Dhalai	Ambassa	Lalchari	91.85444	23.93416	26.02.2022	27.00	6.59	74.9	0.21	49.434	0	30.5244	30.5244	7.09	3.2109	6.7867	0.12	8.0064	2.423301	30	6.63	6.91	0.234	BDL
3	N248	Dhalai	Chawmanu	Chawmanu	91.99889	23.86222	8.03.2022	25.30	7.876	426.8	0	281.688	0	201.461	201.461	31.905	10.6914	3.6329	0.36	28.0224	8.481553	105	45	6.54		BDL
4	N251	Dhalai	Dumburnagar	Durga Cherra	91.82583	23.60889	09.03.2022	26.00	7.182	232.5	0.16	153.45	0	128.2025	128.2025	14.18	8.5509	1.2574	0.42	26.0208	10.90971	110	11.2	2.44		BDL
5	N218	Dhalai	Durga Chomuhani	Durga Chowmuhani	91.86028	24.12167	26.02.2022	24.30	6.73	309.5	0	204.27	0	61.0488	61.0488	35.45	22.5239	22.0646	0.09	14.0112	7.274757	65	36.9	10.6	0.16	BDL
6	N216	Dhalai	Durga Chomuhani	Kamalpur	91.815	24.16964	26.02.2022	32.00	6.96	194.1	0	128.106	0	54.94392	54.94392	14.18	21.1683	4.1568	0.13	12.0096	8.48932	65	13.28	4.41	1.553	0.0797
7	N217	Dhalai	Durga Chowmuhani	Kali Kumar Para	91.86	24.10889	26.02.2022	22.40	6.59	109.7	0	72.402	0	18.31464	18.31464	10.635	41.5862	18.2505	0.1	24.0192	3.629126	75	9.86	5.15	0.271	0.0264
8	N250	Dhalai	Ganganagar	Nuna Cherra	91.85528	23.78722	9.03.2022	20.50	6.867	133.3	0.03	87.978	0	61.0488	61.0488	10.635	9.0137	5.3187	0.26	18.0144	2.418447	55	6.87	2.48		0.2561
9	N247	Dhalai	Manu	Manu New	91.99194	24.0025	8.03.2022	26.20	7.675	369.8	0.02	244.068	0	225.8806	225.8806	28.36	11.0038	13.2867	0.3	34.0272	20.61456	170	32.51	4.32		BDL
10	N249	Dhalai	Manu	Sindhu Kumar	91.96056	23.9525	8.03.2022	24.90	7.004	250.3	0.03	165.198	0	146.5171	146.5171	10.635	13.0105	4.5616	0.33	20.016	8.485437	85	21.3	6.97		0.1235
11	N215	Dhalai	Salema	Abhanga New	91.83083	24.05414	26.02.2022	27.00	7.04	232.9	0	153.714	0	109.8878	109.8878	10.635	5.5484	2.0004	0.14	22.0176	6.057282	80	21.29	5.74	1.652	BDL
12	N269	Gomti	Amarpur	Jatanbari	91.75833	23.42	16.03.22	26.00	6.32	189.3	0.08	124.938	0	30.5244	30.5244	17.725	16.0882	17.8555	0.11	8.0064	1.209709	25	10.26	16.73		BDL
13	N267	Gomti	Kankra-ban	Kankraban	91.40194	23.4875	15.03.2022	27.30	6.924	192.5	0.24	127.05	0	91.5732	91.5732	14.18	11.8078	5.242	0.43	26.0208	9.696117	105	8.78	6.81		BDL
14	N266	Gomti	Killa	Dewanbari	91.53528	23.55778	15.03.2022	27.30	6.905	204.8	0.26	135.168	0	79.36344	79.36344	10.635	15.2181	7.1557	0.3	20.016	8.485437	85	12.75	2.76		0.0124
15	N265	Gomti	Killa	Joingkami	91.525	23.60117	15.03.2022	25.90	6.988	438.6	0.03	289.476	0	115.9927	115.9927	31.905	23.4691	16.7994	0.29	18.0144	10.91359	90	30.71	3.1		0.0356
16	N264	Gomti	Killa	Noabari-2	91.51944	23.59111	15.03.2022	24.70	6.855	470.6	0.09	310.596	0	183.1464	183.1464	28.36	27.7367	10.1668	0.22	42.0336	16.9699	175	38.9	8.12		BDL
17	N273	Gomti	Matabari	Gorjee Bazar	91.50583	23.42667	17.03.2022	25.00	6.916	197.5	0.3	130.35	0	42.73416	42.73416	28.36	9.4991	25.1605	0.15	12.0096	7.275728	60	13.57	9.78		BDL
18	N268	Gomti	Ompi	Ompi colony	91.64222	23.67181	16.03.22	27.00	7.054	270.4	0.14	178.464	0	109.8878	109.8878	28.36	15.5433	15.8668	0.26	24.0192	18.19223	135	17.27	8.28		0.0112
19	N263	Gomti	Tepania	Dhawajnagar	91.465	23.55375	15.03.2022	24.10	6.296	86.03	0.08	56.7798	0	30.5244	30.5244	10.635	14.4533	9.506	0.12	8.0064	1.209709	25	17.16	3.936		BDL
20	N256	Khowai	Kalyanpur	Kathalbari	91.60694	23.97295	10.03.2022	25.70	6.999	223.1	0.09	147.246	0	103.783	103.783	21.27	11.7392	3.667	0.68	16.0128	12.12816	90	8.81	8.27		BDL
21	N257	Khowai	Khowai	Khowai	91.605	24.06389	10.03.2022	25.00	7.379	228.8	0.28	151.008	0	134.3074	134.3074	7.09	5.3951	0.7264	0.54	22.0176	12.12524	105	13.89	2.9		BDL
22	N212	Khowai	Mungia-kami	45 Miles	91.76389	23.90119	26.02.2022	29.00	8.35	110.8	0	73.128	21	610.488	631.488	21.27	7.5927	0.986	0.44	36.0288	8.47767	125	125.96	68.6	0.588	0.0836
23	N255	Khowai	Mungia-kami	Tuimadhu	91.68639	23.835	10.03.2022		6.968	317.5	0.07	209.55	0	122.0976	122.0976	14.18	22.4891	9.1811	0.87	32.0256	12.12039	130	16.21	4.14		BDL
24	N254	Khowai	Telia-mura	Pachim Howaibari	91.59194	23.81	10.03.2022	24.30	7.001	401.2	0.02	264.792	0	67.15368	67.15368	38.995	17.4016	20.4252	0.24	12.0096	12.1301	80	28.75	10.37		0.0548
25	N235	North Tripura	Yubaraj-nagar	Baghbassa	92.22194	24.35183	28.02.2022	22.70	7.145	175.3	0.08	115.698	0	85.46832	85.46832	10.635	5.3917	3.1969	0.23	14.0112	6.061165	60	13.14	6.65	0.419	0.037
26	N243	North Tripura	Yubaraj-nagar	Dharmanagar	92.15972	24.37894	02.03.2022	22.50	7.358	209	0.11	137.94	0	73.25856	73.25856	14.18	21.9084	4.4758	0.34	16.0128	7.273786	70	12.61	8.38	0.234	0.1712
27	N229	North Tripura	Yubaraj-nagar	Krishnapur	92.15778	24.33944	28.02.2022	24.10	7.432	469.7	0.24	310.002	0	122.0976	122.0976	35.45	8.561	16.4595	0.2	36.0288	8.47767	125	25.34	9.65	3.17	0.3325
28	N232	North Tripura	Damcherra	Khedacherra	92.32261	24.09452	28.02.2022	24.60	7.575	418.6	0.09	276.276	0	268.6147	268.6147	10.635	5.776	0.6357	0.24	50.04	13.32524	180	42.17	6.56	0.892	0.1095
29	N231	North Tripura	Damcherra	Narendra Nagar	92.28517	24.24139	28.02.2022	23.50	7.426	180.8	0.15	119.328	0	103.783	103.783	7.09	3.6165	0.9206	0.25	12.0096	9.702913	70	18.01	5.2	0.682	0.0214
30	N244	North Tripura	Dasda	Ananda Bazar	92.21083	23.84806	03.03.2022	22.50	7.367	229.3	0.09	151.338	0	103.783	103.783	10.635	1.7087	11.7904	0.27	12.0096	2.421359	40	20.43	11.96	1.239	0.0753
31	N245	North Tripura	Dasda	Dataram	92.22806	23.76278	03.03.2022	21.00	7.745	322.1	0.17	212.586	0	164.8318	164.8318	10.635	4.4214	1.8807	0.55	26.0208	13.33689	120	28	6.32	0.105	0.2143

32	N239	North Tripura	Dasda	Satnala	92.20583	23.97556	01.03.2022	23.20	7.562	509.5	0.13	336.27	0	170.9366	170.9366	28.36	8.0364	3.4061	0.24	36.0288	18.18641	165	23.75	12.15	0.626	0.0103
33	N241	North Tripura	Kadam-tala	Churaibari	92.24667	24.43778	01.03.2022	23.00	7.361	244.4	0.16	161.304	0	97.67808	97.67808	17.725	21.7223	8.1565	0.37	22.0176	6.057282	80	23.45	9.06	0.271	0.3477
34	N242	North Tripura	Kadam-tala	Lalchhara	92.19222	24.4325	1.03.2022	23.00	7.53	416.1	0.08	274.626	0	128.2025	128.2025	28.36	18.5432	7.7027	0.3	32.0256	7.266019	110	36.48	8.85	0.682	0.3985
35	N240	North Tripura	Kalacherra	Sanicherra	92.2325	24.38361	01.03.2022	23.80	7.526	567.2	0.06	374.352	0	134.3074	134.3074	42.54	32.1419	5.552	0.23	32.0256	14.54757	140	35.72	16.28	0.419	0.1084
36	N238	North Tripura	Laljuri	Kanchanpur	92.195	24.04556	01.03.2022	22.00	7.254	612.7	0.08	404.382	0	85.46832	85.46832	63.81	11.806	8.2228	0.18	18.0144	13.34078	100	35.96	11.02	0.664	0.0174
37	N237	North Tripura	Laljuri	Laljuri	92.19833	24.11194	01.03.2022	24.50	7.036	205	0.12	135.3	0	73.25856	73.25856	60.265	6.0894	34.9486	0.16	8.0064	3.636893	35	62.04	9.08	0.123	0.0444
38	N236	North Tripura	Laljuri	Naba Joypara (Natun Basti)	92.21639	24.175	01.03.2022	21.50	7.039	167.9	0.13	110.814	0	61.0488	61.0488	10.635	27.9243	7.8581	0.2	12.0096	2.421359	40	18.99	11.8	0.345	0.0068
39	N234	North Tripura	Panisagar	Deocherra	92.15972	24.31028	28.02.2022	24.20	6.578	236.6	0.09	156.156	0	30.5244	30.5244	21.27	1.7429	33.5655	0.29	6.0048	3.637864	30	25.03	9.87	0.16	0.0169
40	N233	North Tripura	Panisagar	Panisagar	92.15222	24.26422	28.02.2022	24.00	6.68	476.1	0.11	314.226	0	24.41952	24.41952	38.995	36.2027	42.892	0.45	10.008	9.703883	65	38.82	20.06	0.234	0.1165
41	N230	North Tripura	Pani-sagar	Kunjanagar	92.20556	24.24556	28.02.2022	24.70	7.254	102.9	0.18	67.914	0	54.94392	54.94392	10.635	1.2078	0.5055	0.21	8.0064	3.636893	35	13.95	2.77	0.363	0.0014
42	N219	North Tripura	Yubraj-naga	Rajnagar	92.11361	24.31847	27.02.2022	24.50	7.18	164.4	0	108.504	0	91.5732	91.5732	7.09	3.3317	1.7725	0.14	6.0048	12.13301	65	4.97	7.94	0.326	0.0629
43	N281	Sepahijala	Bishalgarh	Konaban SC Colony	91.18222	23.70981	19.03.2025	26.00	7.39	207.4	0.08	136.884	0	85.46832	85.46832	28.36	10.8153	2.7963	0.37	26.0208	4.841748	85	26.8	1.88		BDL
44	N262	Sepahijala	Jampui-jala	Gongrai	91.45389	23.65667	15.03.2022	28.50	6.629	58.43	0.11	38.5638	0	30.5244	30.5244	7.09	22.6618	1.0377	0.18	4.0032	8.493204	45	3.49	3.6		BDL
45	N282	Sepahijala	Jampui-jala	Tufaniamura	91.40694	23.69861	19.03.2022	24.00	7.708	237.1	0.11	156.486	0	140.4122	140.4122	17.725	16.9565	6.4056	0.35	4.0032	20.62913	95	27.35	18.16		0.0141
46	N280	Sepahijala	Nalchar	Shivnagar	91.2825	23.54944	18.03.2024	24.00	7.248	289.8	0.09	191.268	0	61.0488	61.0488	31.905	19.2723	0	0.66	4.0032	8.493204	45	23	19.38		BDL
47	N274	South Tripura	Bagafa	Michara	91.50694	23.26444	17.03.2022	26.40	7.762	393.8	0.24	259.908	0	262.5098	262.5098	35.45	23.4128	0.7993	0.65	24.0192	18.19223	135	83.22	4.5		0.0288
48	N275	South Tripura	Poangbari	Poangbari	91.56667	23.01667	17.03.2022	27.00	7.615	184.3	0.24	121.638	0	103.783	103.783	10.635	15.0099	13.0558	0.26	18.0144	10.91359	90	18.24	7.29		BDL
49	N276	South Tripura	Poangbari	Srinagar	91.555	23	17.03.2022	25.00	7.437	258	0.25	170.28	0	73.25856	73.25856	42.54	5.6873	0	0.2	16.0128	8.487379	75	20.94	8.26		BDL
50	N279	South Tripura	Rajnagar	Rajnagar	91.39167	23.23244	18.03.2023	28.00	7.331	76.12	0.06	50.2392	0	48.83904	48.83904	10.635	32.5462	11.4037	0.12	16.0128	8.487379	75	10.14	1.52		BDL
51	N271	South Tripura	Rupaichhari	Baishnabpur	91.75	23.03333	16.03.22	24.00	7.02	114.4	0.2	75.504	0	42.73416	42.73416	7.09	22.9651	4.8437	0.21	10.008	6.063107	50	11.75	3.61		BDL
52	N270	South Tripura	Rupaichhari	Magroom	91.77444	23.07306	16.03.22	27.00	6.989	124.3	0.1	82.038	0	61.0488	61.0488	17.725	3.9865	0	0.13	12.0096	3.634951	45	21.32	0.96		BDL
53	N278	South Tripura	Satchand	Kalirbazar	91.59889	23.11333	18.03.2022	24.00	7.618	115.9	0.1	76.494	0	85.46832	85.46832	10.635	8.2671	0.8379	0.32	12.0096	8.48932	65	12.15	4.03		BDL
54	N272	South Tripura	Satchand	Sabroom	91.72361	23.00622	17.03.2022	25.00	7.022	88.78	0.24	58.5948	0	48.83904	48.83904	14.18	4.3002	15.4031	0.16	10.008	7.276699	55	8.26	1.98		BDL
55	N277	South Tripura	Satchand	Shashi-Chandrapur	91.63333	22.96667	17.03.2022	26.00	7.516	166.6	0.25	109.956	0	103.783	103.783	10.635	11.7771	5.15	0.27	14.0112	9.701942	75	18.22	6.46		BDL
56	N221	Unakoti	Chandipur	Jarultali	91.98583	24.25417	27.02.2022	21.80	6.904	114.6	0.15	75.636	0	42.73416	42.73416	10.635	32.342	3.0596	0.11	6.0048	3.637864	30	18.57	5.99	0.178	BDL
57	N222	Unakoti	Chandipur	Pancham-nagar	91.98111	24.21825	27.02.2022	23.70	7.041	146.7	0.08	96.822	0	73.25856	73.25856	7.09	3.3271	12.1167	0.09	16.0128	6.060194	65	8.29	7.55	0.271	0.0407
58	N220	Unakoti	Gaurnagar	Gaurnagar	92.03333	24.28928	27.02.2022	24.70	6.82	321.8	0.16	212.388	0	48.83904	48.83904	31.905	26.9226	25.7048	0.09	14.0112	7.274757	65	24.24	18.57	0.141	0.0217
59	N223	Unakoti	Kumarghat	Chandra-moni Kami	92.19833	24.11194	27.02.2022	23.90	7.375	274.2	0.17	180.972	0	115.9927	115.9927	14.18	10.7469	5.175	0.16	24.0192	9.697087	100	13.54	14.22	0.739	0.1653
60	N224	Unakoti	Kumarghat	Dumdum	91.945197°	24.129543°	27.02.2022	22.40	7.14	109.3	0.13	72.138	0	54.94392	54.94392	7.09	24.0463	10.3819	0.16	8.0064	4.850485	40	14.28	6.52	0.873	BDL
61	N225	Unakoti	Kumarghat	Kanchanbari	91.97667	24.11361	27.02.2022	23.00	7.262	497.2	0.21	328.152	0	97.67808	97.67808	53.175	1.2257	3.3869	0.14	20.016	8.485437	85	33.2	7.52	0.178	BDL
62	N226	Unakoti	Kumarghat	Kanchan-cherra	92.0025	24.08553	27.02.2022	24.20	7.006	249.8	0.17	164.868	0	42.73416	42.73416	17.725	33.5663	35.0807	0.15	8.0064	2.423301	30	27.3	13.89	0.16	0.0053
63	N227	Unakoti	Kumarghat	Kumarghat New	92.04194	24.16525	27.02.2022	21.50	7.408	243.4	0.16	160.644	0	128.2025	128.2025	7.09	9.2178	5.4663	0.15	30.024	6.053398	100	12.35	11.03	0.382	BDL
64	N246	Unakoti	Pecharthal	Karaicherra	92.15139	24.14	08.03.2022	25.60	7.494	255.6	0.07	168.696	0	79.36344	79.36344	28.36	8.2684	4.4876	0.23	18.0144	7.272816	75	21.23	5.36	In process	BDL
65	N228	Unakoti	Pecharthal	Pecharthal	92.09972	24.19883	27.02.2022	22.70	7.555	410.3	0.35	270.798	0	177.0415	177.0415	14.18	13.9544	9.2331	0.12	42.0336	15.75631	170	10.7	6.82	0.215	0.6479
66	N252	West Tripura	Jirania	Khumulwng	91.43333	23.81831	10.03.2022	26.40	7.013	89.99	0	59.3934	0	24.41952	24.41952	7.09	15.2481	1.1911	0.21	12.0096	2.421359	40	2.73	0.9		BDL
67	N260	West Tripura	AMC	Chandmari			14.03.2022	26.8	6.234	269.7	0.22	178.002	0	67.15368	67.15368	21.27	13.5608	14.6983	0.21	16.0128	3.63301	55	31.89	6.01		BDL
68	N261	West Tripura	Dukli	Madhuban	91.28583	23.78861	14.03.2022	26.00	6.141	471.5	0.11	311.19	0	18.31464	18.31464	53.175	4.4195	40.8502	0.13	12.0096	3.634951	45	47.11	6		BDL
69	N253	West Tripura	Jirania	Sadhupara	91.50972	23.81028	10.03.2022	23.00	7.041	278.3	0.02	183.678	0	158.7269	158.7269	17.725	12.2078	1.8568	0.26	46.0368	1.191262	120	9.95	5.38		BDL

70	N258	West Tripura	Mohanpur	Ishanpur	91.39917	24.04528	10.03.2022	23.00	6.749	413.1	0.15	272.646	0	85.46832	85.46832	60.265	12.8875	35.8266	0.25	28.0224	10.90874	115	31.43	14.13		BDL
71	N259	West Tripura	Mohanpur	Simna	91.39333	24.09222	10.03.2022	26.00	3.268	239.1	0.14	157.806	0	30.5244	30.5244	14.18	7.6063	42.2917	0	16.0128	2.419417	50	11.53	2.93		0.0061

(B) PHYSICO-CHEMICAL PROPERTIES AND CHEMICAL CONSTITUENTS IN GROUND WATER OF SHALLOW UNCONFINED AQUIFERS TAPPED BY GROUND WATER MONITORING WELLs FOR PRE MONSOON-2018

Sl.no	Lab code	Location	District	Type of sample (EW or DW)	NHNS/ Exploratory/ Aquifer mapping/ short term/ Pollution	Date of collection	Temp°C	pH	EC (µs/cm) 25C	Turbidity (NTU)	TDS	CO3-2	HCO3-1	TA (as CaCO3)	Cl-	SO4-2	NO3-1	F-	Ca+2	Mg+2	TH (as CaCO3)	Na	K	Fe
											mg/L													
1	C296	Abhanga New	Dhalai	DUG	NHNS	21.04.2018	27.1	7.3	195.5	0.1	108	0	75.1	75.1	24.8	13.8	0	0.2	20.0	4.8	70	15.2	2.7	0.0
2	C297	Ambassa	Dhalai	DUG	NHNS	16.04.2018	27	7.7	181.6	0.2	99.4	0	75.1	75.1	28.4	15.9	0	0.2	20.0	6.1	75	10.1	13.7	0.0
3	C298	Durga Chowmuhani	Dhalai	DUG	NHNS	20.04.2018	25.1	8.1	285.5	0	155.8	0	125.1	125.1	85.1	22.7	0	0.4	20.0	4.8	70	50.8	33.8	0.1
4	C299	Darlang Basti	Dhalai	DUG	NHNS	20.04.2018	22.9	6.7	298.3	0.1	163.5	0	55.0	55.0	24.8	9.4	17.7	0.6	34.0	6.1	110	1.6	2.3	0.0
5	C300	Kamalpur	Dhalai	DUG	NHNS	21.04.2018	25.5	6.7	165.3	0	92.3	0	45.0	45.0	35.5	15.7	0	0.7	26.0	7.3	95	7.0	2.3	0.0
6	C301	Manu New	Dhalai	DUG	NHNS	17.04.2018	27.4	8.5	514.6	0.2	289.9	20	160.1	180.1	78.0	39.5	0.3	0.6	28.0	15.8	135	48.0	37.7	0.0
7	C302	Sindhu Kumar	Dhalai	DUG	NHNS	17.04.2018	26.5	7.5	380.6	0	215.9	0	145.1	145.1	31.9	53.1	0	0.2	34.0	4.8	105	26.1	33.2	0.0
8	C303	Baghbassa	North Tripura	DUG	NHNS	18.04.2018	26.5	7.0	144	0	82.2	0	65.1	65.1	21.3	14.5	0	0.9	14.0	7.3	65	10.9	2.9	
9	C304	Dharmanagar	North Tripura	DUG	NHNS	19.04.2018	24.8	7.0	136.2	0	77.51	0	50.0	50.0	28.4	23.7	0	1.1	14.0	1.2	40	13.1	23.8	0.0
10	C305	Panisagar	North Tripura	DUG	NHNS	19.04.2018	26.5	6.1	396.6	0	221.8	0	20.0	20.0	99.3	14.8	7.5	0.2	10.0	7.3	55	35.6	26.9	0.0
11	C306	Rajnagar	North Tripura	DUG	NHNS	20.04.2018	25.8	8.2	419	0	232.6	0	5.0	5.0	99.3	18.2	0	0.3	20.0	6.1	75	46.2	3.4	0.0
12	C307	Krishnapur	North Tripura	DUG	NHNS	19.04.2018	26.5	7.9	203.7	0.1	112.7	0	95.1	95.1	24.8	28.5	0	1.3	10.0	6.1	50	28.0	16.9	0.0
13	C308	Naba Joypara (Natun Basti)	North Tripura	DUG	NHNS	19.04.2018	24.2	7.9	148.5	0	83.4	0	75.1	75.1	24.8	12.0	0	0.4	8.0	3.6	35	24.5	13.6	0.0
14	C309	Kunjanagar	North Tripura	DUG	NHNS	19.04.2018	25.3	7.7	97.31	0	54.3	0	60.0	60.0	17.7	6.0	0	1.4	10.0	2.4	35	8.3	18.7	0.0
15	C310	Lalchhara	North Tripura	DUG	NHNS	18.04.2018	24.3	7.8	343.2	0.2	190.6	0	50.0	50.0	78.0	15.8	0.3	0.3	22.0	3.6	70	34.9	12.0	0.0
16	C311	Churaibari	North Tripura	DUG	NHNS	18.04.2018	25.5	8.2	298.3	0	163.1	0	65.1	65.1	63.8	12.6	0	0.2	28.0	2.4	80	28.7	4.4	0.0
17	C312	Sanicherra	North Tripura	DUG	NHNS	18.04.2018	25.1	7.0	424.6	0	237.6	0	95.1	95.1	109.9	42.6	0	1.0	16.0	13.3	95	55.8	29.0	0.0
18	C313	Deocherra	North Tripura	DUG	NHNS	18.04.2018	25.2	7.7	160.7	0	88.8	0	80.1	80.1	31.9	8.9	0	1.1	10.0	3.6	40	26.0	12.2	0.0
19	C314	Laljuri	North Tripura	DUG	NHNS	19.04.2018	25.5	7.8	526.4	0	286.7	0	50.0	50.0	163.1	15.6	5.5	0.2	36.0	10.9	135	45.8	26.8	0.0
20	C315	Kanchanpu	North	DUG	NHNS	19.04.2018	24.5	7.0	711.7	0	385.2	0	65.1	65.1	262.3	27.8	0.0	1.4	26.0	15.8	130	46.8	37.5	1.0

		r	Tripura																				
21	C316	Satnala	North Tripura	DUG	NHNS	19.04.2018	24.2	8.1	288.4	0	156.8	0	75.1	75.1	42.5	51.3	0.0	0.4	20.0	9.7	90	26.6	15.0	0.2
22	C317	Gaurnagar	Unakoti	DUG	NHNS	20.04.2018	24.8	7.6	233.9	0	127.2	0	85.1	85.1	28.4	21.5	0.0	0.2	30.0	1.2	80	10.6	17.6	0.0
23	C318	Jarultali	Unakoti	DUG	NHNS	20.04.2018	23.5	6.9	94.63	0	51.46	0	95.1	95.1	28.4	5.7	0.0	1.1	6.0	4.9	35	34.4	5.2	0.0
24	C319	Pancham-nagar	Unakoti	DUG	NHNS	20.04.2018	24.5	8.1	191.5	0	105.1	0	30.0	30.0	17.7	6.0	0.0	0.2	28.0	2.4	80	4.6	2.9	0.0
25	C320	Chandra-moni Kami	Unakoti	DUG	NHNS	20.04.2018	25.1	8.1	280.8	0	153.9	0	90.1	90.1	31.9	39.8	0.0	0.2	30.0	4.8	95	15.6	24.3	0.0
26	C321	Kumarghat	Unakoti	DUG	NHNS	18.04.2018	25.2	7.0	92.9	0	51.19	0	40.0	40.0	95.7	9.7	0.0	0.6	24.0	6.1	85	28.3	13.4	0.0
27	C322	Kanchan-cherra	Unakoti	DUG	NHNS	17.04.2018	25.3	6.4	158.6	0	81.33	0	30.0	30.0	39.0	11.2	0.0	0.6	4.0	19.4	90	4.0	2.8	0.0
28	C323	Pecharthal	Unakoti	DUG	NHNS	18.04.2018	26.2	7.9	315.1	0.1	171.6	0	105.1	105.1	31.9	58.6	0.0	0.3	38.0	6.0	120	27.5	2.6	0.1
29	C324	Karaicherra	Unakoti	DUG	NHNS	19.04.2018	25.3	8.1	313.4	0.1	171	0	85.1	85.1	70.9	27.4	0	0.4	24.0	3.6	75	39.5	36.5	0.0
30	C325	Amarpur	Gomti	DUG	NHNS	21.04.2018	27	8.2	327.4	0	179.2	0	95.1	95.1	56.7	37.7	0	0.3	28.0	7.3	100	31.0	17.5	0.2
31	C326	Ampi colony	Gomti	DUG	NHNS	21.04.2018	26.7	7.5	194.5	0.2	103.9	0	70.1	70.1	17.7	24.1	0	0.4	16.0	3.6	55	9.0	18.8	0.1
32	C327	Bampur	Gomti	DUG	NHNS	21.04.2018	26	8.0	340.4	0	182.5	0	95.1	95.1	60.3	45.3	0	0.5	24.0	1.2	65	47.9	18.4	0.2
33	C328	Dhawajnagar	Gomti	DUG	NHNS	21.04.2018	27.5	7.9	198.6	0.4	106.3	0	70.1	70.1	21.3	18.8	0	0.5	20.0	8.5	85	12.5	3.6	0.1
34	C329	Gorjee Bazar	Gomti	DUG	NHNS	24.04.2018	27.2	8.0	464.2	0.1	249.7	0	70.1	70.1	124.1	36.0	3.3	0.5	28.0	7.3	100	48.9	37.7	0.2
35	C330	Kankraban	Gomti	DUG	NHNS	20.04.2018	26.3	7.8	183.8	0.4	98.78	0	65.1	65.1	21.3	20.7	0.0	0.5	16.0	7.3	70	11.0	3.6	0.1
36	C331	Jatanbari	Gomti	DUG	NHNS	21.04.2018	26.7	7.8	190.8	0.1	101.7	0	70.1	70.1	21.3	22.0	0.0	0.5	18.0	1.2	50	19.9	7.7	0.1
37	C332	Kenania	Sipahi-jala	DUG	NHNS	18.04.2018	23	8.1	33.79	0	181.8	0	95.1	95.1	53.2	43.2	0.0	0.5	28.0	4.8	90	29.9	19.9	0.2
38	C333	Golaghati	Sipahi-jala	DUG	NHNS	21.04.2018	24	8.1	339	0	182.3	0	95.1	95.1	56.7	41.2	0.0	0.6	20.0	8.5	85	35.5	16.7	0.2
39	C334	Tufaniamura	Sipahi-jala	DUG	NHNS	21.04.2018	25	8.1	335.8	0.1	176.8	0	90.1	90.1	56.7	41.6	0.0	0.6	28.0	6.1	95	33.8	8.8	0.4
40	C335	Gongrai	Sipahi-jala	DUG	NHNS	21.04.2018	26.9	8.0	195.6	0.3	103	0	70.1	70.1	21.3	20.1	0.0	0.5	18.0	3.6	60	15.8	4.1	0.2
41	C336	Dakshin Kalamchera	Sipahi-jala	DUG	NHNS	19.04.2018	26	8.0	488.5	0	256.6	0	65.1	65.1	120.5	38.3	4.0	0.6	24.0	9.7	100	48.6	28.7	0.3
42	C337	Sonamura	Sipahi-jala	DUG	NHNS	19.04.2018	26.1	8.0	498.3	0.5	258.1	0	75.1	75.1	120.5	37.8	4.3	0.7	28.0	7.3	100	48.7	36.4	0.4
43	C338	Kanthalia Bazar	Sipahi-jala	DUG	NHNS	19.04.2018	26.4	8.0	478.4	0.5	248.9	0	70.1	70.1	124.1	37.2	4.3	1.1	26.0	8.5	100	34.5	28.2	0.3
44	C340	Pachim Howaibari	Khowai	DUG	NHNS	16.04.2018	26.1	7.2	537.6	0.4	283.3	0	50.0	50.0	212.7	24.0	4.6	0.9	16.0	37.6	195	48.1	32.0	0.0
45	C341	Tuimadhu	Khowai	DUG	NHNS	16.04.2018	26.5	7.9	520.6	0.3	276.1	0	100.1	100.1	159.5	23.5	4.8	1.1	16.0	10.9	85	48.4	41.9	0.0
46	C342	45 Miles	Khowai	DUG	NHNS	16.04.2018	27	8.9	954	0	509.5	90	310.3	400.3	156.0	36.8	0.0	1.3	14.0	9.7	75	11.8	3.3	0.0
47	C343	Mohanpur	West Tripura	DUG	NHNS	23.04.20181 8	24	7.0	182.9	0	96.62	0	35.0	35.0	88.6	7.4	0.7	1.1	8.0	21.8	110	17.2	3.1	0.0
48	C344	Ishanpur	West Tripura	DUG	NHNS	23.04.2018	24.6	7.2	259.8	0.5	136.6	0	70.1	70.1	53.2	13.5	0.0	0.6	8.0	3.6	35	24.5	37.0	0.0
49	C345	Simna	West Tripura	DUG	NHNS	23.04.2018	27.1	6.7	173.2	0	90.72	0	25.0	25.0	53.2	4.4	0.5	1.1	14.0	8.5	70	16.2	3.1	0.0
50	C346	Subalsingh	West Tripura	DUG	NHNS	23.04.2018	24.4	8.4	508.5	0.2	270.3	20	130.1	150.1	46.1	29.6	5.6	0.2	8.0	3.6	35	36.1	39.4	0.0
51	C347	Gardhang	South Tripura	DUG	NHNS	-	30	8.0	192.9	0	102.2	0	95.1	95.1	60.3	8.9	0.0	0.2	38.0	23.0	190	1.4	1.8	
52	C348	Manur Mukh	South Tripura	DUG	NHNS	20.04.2018	29	8.0	138.4	0	72.92	0	70.1	70.1	10.6	11.7	0.0	1.3	14.0	9.7	75	7.0	2.5	2.2
53	C350	Radhanagar	South Tripura	DUG	NHNS	19.04.2018	26.1	7.7	132.2	0.5	68.79	0	60.0	60.0	10.6	9.1	0.0	1.4	8.0	7.3	50	8.1	2.5	1.4
54	C351	Rangamura	South Tripura	DUG	NHNS	26.04.2018	26.5	7.4	129.6	0	67.54	0	25.0	25.0	24.8	7.5	2.0	0.7	8.0	3.6	35	9.1	4.8	0.2
55	C352	Manubazar	South Tripura	DUG	NHNS	28.04.2018	25.5	8.0	140.5	0.7	74.63	0	65.1	65.1	10.6	13.1	0.0	0.2	6.0	6.1	40	11.7	9.9	0.1

56	C353	Sabroom	South Tripura	DUG	NHNS	24.04.2018	25	7.7	96.39	0	51.3	0	50.0	50.0	24.8	2.0	0.0	1.2	8.0	1.2	25	4.8	2.8	
57	C354	Paschim Jalefa EW	South Tripura	DTW	NHNS	27.04.2018	26.5	6.7	112.8	0	59.45	0	30.0	30.0	7.1	19.6	3.6	0.6	8.0	7.3	50	3.2	1.9	1.4
58	C356	KALIRBAZAR	South Tripura	DUG	Aquifer Mapping	27.04.2018	25	8.0	468.8	0.4	247.4	0	45.0	45.0	10.6	28.3	0.0	1.1	8.0	2.4	30	22.0	7.9	2.8
59	C357	Baishnabpur	South Tripura	DUG	do	28.04.2018	24.5	7.7	133	0.8	70.22	0	45.0	45.0	17.7	13.1	0.0	1.2	6.0	6.1	40	9.0	9.8	0.1
60	C358	Magroom	South Tripura	DUG	do	28.04.2018	24.7	7.7	136.4	0	70.37	0	65.1	65.1	134.7	11.5	0.0	1.1	20.0	15.8	115	38.7	27.1	0.1
61	C359	Bijaynagar	South Tripura	DUG	do	26.04.2018	29	8.1	429.3	0.2	224.5	0	75.1	75.1	14.2	14.2	0.0	1.0	8.0	3.6	35	24.8	7.9	0.2
62	C360	Motu Mogpara	South Tripura	DUG	do	28.04.2018	25.7	8.2	428.1	0.3	224	0	25.0	25.0	10.6	17.9	0.0	1.0	8.0	4.9	40	4.8	5.6	2.6
63	C361	Shashi-Chandrapur	South Tripura	DUG	do	28.04.2018	25.9	7.5	135.1	0	70.58	0	25.0	25.0	131.2	9.9	2.3	0.7	20.0	14.6	110	27.9	18.4	2.6
64	C362	Amli Ghat	South Tripura	DUG	do	26.04.2018	26	7.4	145.2	0	76.51	0	40.0	40.0	131.2	10.5	2.6	0.8	24.0	14.6	120	28.0	23.5	0.2
65	C363	Srinagar	South Tripura	DUG	do	26.04.2018	26.3	7.5	134.9	0.2	70.23	0	25.0	25.0	17.7	23.2	0.0	1.2	6.0	2.4	25	11.2	13.1	0.2
66	C364	Poangbari	South Tripura	DUG	do	28.04.2018	25.9	7.4	208.5	0.2	105.5	0	45.0	45.0	31.9	63.7	0.3	0.2	6.0	3.6	30	28.7	34.2	0.2
67	C365	Purba Takka	South Tripura	DUG	do	28.04.2018	25.9	7.4	136.5	0	67.88	0	30.0	30.0	14.2	26.5	0.0	0.2	8.0	3.6	35	14.6	2.2	0.1
68	C366	Bankul Mahamuni	South Tripura	DUG	do	27.04.2018	26.5	7.5	136.5	0.1	69.21	0	65.1	65.1	14.2		0.0	0.1	12.0	4.8	50	8.5	2.1	0.1
69	C367	Chatakchari	South Tripura	DUG	do	25.04.2018	26.5	8.1	475.1	0.6	240.1	0	65.1	65.1	17.7	24.3	0.0	0.4	8.0	2.4	30	25.4	8.9	0.1
70	C368	Ghorakhappa	South Tripura	DUG	do	25.04.2018	26.7	8.1	490.1	0.2	248	0	45.0	45.0	14.2	101.6	0.0	0.5	6.0	3.6	30	24.6	7.1	
71	C369	Ananda Bandhu Para	South Tripura	DUG	do	25.04.2018	27	8.0	799.7	0	406	0	95.1	95.1	67.4	102.0	0.0	0.7	30.0	12.1	125	43.4	28.8	0.1
72	C370	Shivnagar	Sepahijala	DUG	do	18.04.2018	24.2	8.2	283.1	0	144.2	0	100.1	100.1	63.8	27.5	0.0	0.6	14.0	15.8	100	20.8	29.2	0.5
73	C371	Lalmaibari	Sepahijala	DUG	do	18.04.2018	24.1	8.1	278.2	0	140.7	0	100.1	100.1	131.2	21.3	0.0	0.6	10.0	41.3	195	16.9	24.1	0.4
74	C372	Bagabassa	Sepahijala	DUG	do	18.04.2018	24.3	8.1	280.3	0	140.9	0	95.1	95.1	24.8	22.4	0.0	0.5	16.0	10.9	85	16.8	2.0	0.3
75	C373	Noabari-2	Gomati	DUG	do	18.04.2018	27.5	7.9	289.1	0	145.9	0	25.0	25.0	21.3	35.8	0.0	0.5	16.0	7.3	70	6.8	2.2	1.2
76	C374	Joingkami	Gomati	DUG	do	18.04.2018	27	7.6	139.4	0	69.69	0	40.0	40.0	21.3	14.4	0.0	0.1	16.0	8.5	75	3.2	1.5	1.0
77	C375	Dewanbari	Gomati	DUG	do	18.04.2018	27	7.7	129.1	0.1	65.2	0	25.0	25.0	21.3	34.8	0.0	0.3	16.0	8.5	75	2.6	4.4	1.0
78	C376	Bagmabazar	Gomati	DUG	do	18.04.2018	27	7.6	357	0.7	179.1	0	25.0	25.0	39.0	9.4	4.5	0.1	6.0	4.9	35	21.8	3.5	1.0
79	C377	A. D. Nagar	West Tripura	DUG	NHNS	23.04.2018	34.2	7.3	137.3	0.3	68.72	0	35.0	35.0	14.2	5.0	1.6	0.2	10.0	3.6	40	4.2	2.9	0.3
80	C378	Radhakishore Nagar	West Tripura	DUG	NHNS	23.04.2018	26.2	7.7	135	0.9	68.05	0	20.0	20.0	88.6	30.6	0.0	0.3	10.0	6.1	50	37.4	20.7	0.3
81	C379	MADHUBAN DUKLI DW	West Tripura	DUG	NHNS	23.04.2018	25.3	7.5	340.7	0	170.8	0	40.0	40.0	42.5	9.4	5.0	0.1	8.0	3.6	35	32.2	3.6	0.0

ANNEXURE- VII (GWRE)

(A): Assessment of Dynamic Ground Water Resources of the Tripura State (2021-2022)

Sl. No	Assessment Unit Name (Block)	Monsoon		Non Monsoon		Total Annual Ground Water Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Current Annual Groundwater Extraction				Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)
		Recharge from Rainfall	Recharge from Other Sources	Recharge from Rainfall	Recharge from Other Sources				Irrigation	Industrial	Domestic	Total			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	AMBASA	2268.34	122.63	839.23	192.84	3423.04	171.15	3110.35	18.60	1.19	94.43	114.22	103.48	2987.08	3.67
2	CHAWMANU	1833.47	27.36	494.14	136.65	2491.62	249.16	1772.28	0.00	0.00	82.07	82.07	89.94	1682.34	4.63
3	DUMBURNAGAR	1715.75	49.15	303.99	138.30	2207.19	110.36	1791.05	3.15	0.00	90.45	93.60	99.12	1688.77	5.23
4	DURGA CHOWMOHANI	716.11	179.53	373.01	354.68	1623.33	162.33	1081.26	51.81	1.43	121.84	175.07	133.52	894.5	16.19
5	GANGANAGAR	482.76	0	112.09	28.36	623.21	31.16	482.02	0.00	0.00	79.19	79.19	86.78	395.25	16.43
6	MANU	2983.20	131.42	804.00	330.18	4248.80	424.88	2939.08	13.23	0.00	205.37	218.60	225.05	2700.8	7.44
7	RAISHYABARI	1161.00	4.93	195.33	34.26	1395.52	139.55	1226.87	3.78	0.00	54.48	58.26	59.7	1163.39	4.75
8	SALEMA	2291.63	126.24	830.00	274.17	3522.04	176.10	3232.81	34.65	0.00	195.84	230.49	214.61	2983.55	7.13
9	AMARPUR	4273.54	281.73	782.46	942.39	6280.12	314.00	5408.59	20.79	0.00	129.41	150.20	137.21	5250.59	2.78
10	KAKRABAN	781.66	189.48	32.82	747.13	1751.09	175.12	1558.00	7.20	0.00	172.24	179.44	182.63	1368.17	11.52
11	KARBOOK	2395.84	111.66	8.73	368.08	2884.31	288.43	2555.54	1.89	0.00	61.66	63.55	65.38	2488.27	2.49
12	KILLA	1935.07	92.26	524.00	415.41	2966.74	296.67	2247.45	63.12	0.00	93.59	156.71	99.23	2085.1	6.97
13	MATABARI	2120.42	182.14	574.19	760.57	3637.32	363.74	2567.48	10.80	1.06	233.51	245.37	247.58	2308.04	9.56
14	OMPI	1869.14	107.16	451.70	370.92	2798.92	279.89	2485.07	6.30	0.00	88.38	94.68	93.71	2385.06	3.81
15	SILACHHARI	540.83	9.2	130.70	63.21	743.94	74.39	652.89	1.26	0.00	42.08	43.34	44.62	607.01	6.64
16	TEPANIA	710.12	43.69	181.83	224.64	1160.28	116.03	958.52	5.40	0.00	61.31	66.71	65	888.12	6.96
17	KALYANPUR	1000.53	169.49	275.61	629.83	2075.46	207.54	1867.92	111.00	0.00	104.53	215.53	109.9	1647.02	11.54
18	KHOWAI	1404.20	196.61	473.51	797.05	2871.37	287.14	2372.76	57.60	0.00	145.87	203.47	153.35	2161.82	8.57
19	MUNGIAKAMI	1828.52	58.88	424.95	142.06	2454.41	122.72	2327.69	13.20	0.00	65.46	78.66	68.81	2245.68	3.38
20	PADMABIL	870.11	38.18	309.62	126.40	1344.31	67.21	1267.36	10.20	0.00	79.74	89.94	83.84	1173.31	7.10
21	TELIAMURA	678.59	144.84	233.66	474.58	1531.67	153.16	1342.10	103.20	2.38	153.21	258.78	161.07	1075.46	19.28

Sl. No	Assessment Unit Name (Block)	Monsoon		Non Monsoon		Total Annual Ground Water Recharge	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Current Annual Groundwater Extraction				Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)
		Recharge from Rainfall	Recharge from Other Sources	Recharge from Rainfall	Recharge from Other Sources				Irrigation	Industrial	Domestic	Total			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
22	TULASIKHAR	1427.86	70.78	401.24	178.43	2078.31	207.83	1841.26	11.40	0.00	97.53	108.93	102.54	1727.32	5.92
23	DAMCHHERA	199.21	20.01	49.28	100.54	369.04	36.90	307.32	3.00	0.00	64.20	67.20	68.94	235.38	21.87
24	DASDA	1175.35	82.66	363.46	187.88	1809.35	180.93	827.77	1.80	0.00	128.45	130.25	137.92	688.04	15.74
25	JAMPUI HILL	629.41	0	155.71	0.00	785.12	78.51	640.24	0.00	0.00	27.99	27.99	30.06	610.18	4.37
26	JUBARAJNAGAR	1268.48	117.72	448.13	274.12	2108.45	210.85	1608.78	0.00	1.46	158.10	159.56	169.76	1437.57	9.92
27	KADAMTALA	1376.76	100.49	486.39	167.25	2130.89	213.08	1363.04	21.60	0.00	216.69	238.29	232.66	1108.78	17.48
28	KALACHERRA	886.41	53.95	391.44	43.79	1375.59	137.56	826.17	2.40	0.36	167.62	170.38	179.97	643.44	20.62
29	LALJURI	807.45	17.41	249.69	174.88	1249.43	124.95	929.77	0.00	0.00	109.36	109.36	117.42	812.35	11.76
30	PANISAGAR	589.20	155.12	260.19	335.11	1339.62	133.96	1122.74	3.60	0.00	104.68	108.28	112.39	1006.75	9.64
31	BISHALGARH	1482.04	228.26	494.52	1122.69	3327.51	332.75	2701.46	241.20	0.48	178.64	420.31	187.8	2271.98	15.56
32	BOXANAGAR	1399.90	55.41	379.13	236.22	2070.66	207.07	1468.23	66.60	0.00	116.04	182.64	122	1279.63	12.44
33	CHARILAM	1238.23	74.84	413.16	420.07	2146.30	214.63	1653.03	66.60	1.04	194.46	262.10	204.45	1380.93	15.86
34	JAMPUIJALA	2760.42	96.84	921.08	367.26	4145.60	414.56	3108.03	27.00	0.59	102.52	130.11	107.78	2972.65	4.19
35	KANTHALIA	1498.45	132.25	405.82	661.15	2697.67	269.77	2330.30	297.60	0.00	140.24	437.84	147.43	1885.28	18.79
36	MOHANBHOG	775.57	146.29	210.04	619.65	1751.55	175.16	1565.29	1.20	0.00	106.98	108.18	112.47	1451.62	6.91
37	NALCHAR	935.17	134.51	253.27	625.90	1948.85	194.89	1537.24	3.60	0.00	165.63	169.23	174.13	1359.51	11.01
38	BAGAFA	2260.86	138.05	647.11	746.77	3792.79	379.28	2567.03	22.20	0.00	169.39	191.59	179.6	2365.23	7.46
39	BHARAT CH NAGAR	1014.12	82.96	290.26	470.22	1857.56	185.76	1167.99	15.75	0.95	75.37	92.07	79.91	1071.39	7.88
40	HRISHYAMUKH	1754.74	129.89	326.51	697.71	2908.85	290.88	2089.89	18.45	0.00	120.64	139.09	127.91	1943.53	6.66
41	JOLAIBARI	1505.65	197.28	430.95	853.71	2987.59	298.76	2493.15	27.00	0.00	117.60	144.60	124.69	2341.47	5.80
42	POANGBARI	712.09	0.27	125.85	42.86	881.07	88.11	688.17	3.00	0.00	60.96	63.96	64.63	620.54	9.29
43	RAJNAGAR	2705.55	33.8	439.94	289.56	3468.85	173.45	3115.13	105.00	0.00	140.14	245.14	148.59	2861.53	7.87
44	RUPAICHARI	1395.80	66.71	246.68	295.46	2004.65	200.46	1680.12	4.80	0.00	109.68	114.48	116.29	1559.04	6.81
45	SATCHAND	2853.20	211.05	504.25	827.36	4395.86	439.59	3781.34	3.75	0.89	138.87	143.51	147.24	3629.46	3.80

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		Recharge from Rainfall	Recharge from Other Sources	Recharge from Rainfall	Recharge from Other Sources				Irrigation	Industrial	Domestic	Total			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
46	CHANDIPUR	943.30	112.46	349.36	303.63	1708.75	170.88	1305.54	0.00	0.00	151.14	151.14	162.28	1143.26	11.58
47	GOURNAGAR	1507.49	92.5	372.21	340.34	2312.54	231.25	1940.89	4.80	0.08	157.30	162.18	168.9	1767.1	8.36
48	KUMARGHAT	2009.30	234.99	744.17	609.13	3597.59	359.76	3097.38	0.00	0.00	240.58	240.58	258.31	2839.06	7.77
49	PENCHARTHAL	959.35	91.8	355.31	292.51	1698.97	169.90	1513.72	0.00	1.37	102.47	103.84	110.02	1402.34	6.86
50	AMC	1312.89	49.38	288.98	263.54	1914.79	191.48	1723.31	0.00	0.24	960.02	960.26	1017.9	705.17	55.72
51	BAMUTIA	625.95	36.94	206.67	140.78	1010.34	101.03	806.61	20.40	0.24	107.62	128.26	114.11	671.86	15.90
52	BELBARI	729.16	100.08	207.12	380.51	1416.87	141.68	1099.36	3.00	1.19	175.78	179.97	186.38	908.79	16.37
53	DUKLI	1138.18	134.95	375.79	541.55	2190.47	219.04	1902.84	240.00	16.05	216.15	472.20	229.18	1417.62	24.82
54	HEZAMARA	1347.89	71.77	410.47	224.55	2054.68	102.73	1916.75	2.40	0.00	81.50	83.90	86.41	1827.94	4.38
55	JIRANIA	493.45	76.97	140.17	501.01	1211.60	121.16	1000.95	103.20	0.72	85.50	189.42	90.65	806.38	18.92
56	LEFUNGA	403.42	42.07	133.20	202.07	780.76	78.08	684.15	0.00	12.15	107.62	119.77	114.11	557.89	17.51
57	MANDWI	1247.41	125.18	354.33	412.50	2139.42	213.94	1760.46	0.00	21.96	102.18	124.14	108.35	1630.15	7.05
58	MOHANPUR	1245.50	131.65	411.22	545.26	2333.63	233.37	1927.39	166.80	0.62	159.09	326.51	168.68	1591.28	16.94
59	OLD AGARTALA	688.33	69.68	195.52	361.18	1314.71	131.47	1016.78	88.20	2.30	119.97	210.47	127.21	799.07	20.70
	Total	**81164.37**	**5983.55**	**21794.19**	**22408.86**	**131350.97**	**11866.19**	**106356.71**	**2113.53**	**68.73**	**8133.36**	**10315.62**	**8663.60**	**95510.84**	**9.70**

(B): Comparison of Ground Water Resources (2019-2020) and (2021-2022)

S.No	Block / Assessment Unit	Total Annual Ground Water Recharge (ham)			Annual Extractable Ground Water Resource (ham)			Total Current Annual Ground Water Extraction (ham)			Stage of Ground Water Extraction (%)		
		2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff
1	AMBASA	3576.76	3423.04	-153.72	3217.55	3110.35	-107.20	98.53	114.22	15.69	3.06	3.67	0.61
2	CHAWMANU	3272.09	2491.62	-780.47	1932.46	1772.28	-160.18	79.16	82.07	2.91	4.1	4.63	0.53
3	DUMBURNAGAR	2852.16	2207.19	-644.97	1653.66	1791.05	137.39	87.25	93.60	6.35	5.28	5.23	-0.05
4	DURGA CHOWMOHANI	2107.96	1623.33	-484.63	1632.9	1081.26	-551.64	153.77	175.07	21.30	9.42	16.19	6.77
5	GANGANAGAR	866.73	623.21	-243.52	780.06	482.02	-298.04	76.39	79.19	2.80	9.79	16.43	6.64
6	MANU	5630.54	4248.80	-1381.74	4625.72	2939.08	-1686.64	198.1	218.60	20.50	4.28	7.44	3.16
7	RAISHYABARI	1800.9	1395.52	-405.38	1088.06	1226.87	138.81	52.55	58.26	5.71	4.83	4.75	-0.08
8	SALEMA	3523.05	3522.04	-1.01	3166.03	3232.81	66.78	188.91	230.49	41.58	5.97	7.13	1.16
9	AMARPUR	5886	6280.12	394.12	4843.97	5408.59	564.62	126.1	150.20	24.10	2.6	2.78	0.18
10	KAKRABAN	2209.94	1751.09	-458.85	1988.94	1558.00	-430.94	175.05	179.44	4.39	8.8	11.52	2.72
11	KARBOOK	3105.71	2884.31	-221.40	2739.56	2555.54	-184.02	60.08	63.55	3.47	2.19	2.49	0.30
12	KILLA	3458.77	2966.74	-492.03	3101.05	2247.45	-853.60	151.8	156.71	4.91	4.9	6.97	2.07
13	MATABARI	4625.42	3637.32	-988.10	4223.23	2567.48	-1655.75	238.46	245.37	6.91	5.65	9.56	3.91
14	OMPI	3137.71	2798.92	-338.79	2685.78	2485.07	-200.71	86.12	94.68	8.56	3.21	3.81	0.60
15	SILACHHARI	948.9	743.94	-204.96	854.01	652.89	-201.12	41.01	43.34	2.33	4.8	6.64	1.84
16	TEPANIA	1357.82	1160.28	-197.54	1215.35	958.52	-256.83	65.14	66.71	1.57	5.36	6.96	1.60
17	KALYANPUR	2001.79	2075.46	73.67	1801.61	1867.92	66.31	213.2	215.53	2.33	11.83	11.54	-0.29
18	KHOWAI	2592.16	2871.37	279.21	2184.2	2372.76	188.56	200.21	203.47	3.26	9.17	8.57	-0.60
19	MUNGIAKAMI	2482.72	2454.41	-28.31	2358.59	2327.69	-30.90	77.19	78.66	1.47	3.27	3.38	0.11
20	PADMABIL	1702.1	1344.31	-357.79	1617	1267.36	-349.64	88.16	89.94	1.78	5.45	7.10	1.65
21	TELIAMURA	1698.5	1531.67	-166.83	1528.65	1342.10	-186.55	255.35	258.78	3.43	16.7	19.28	2.58
22	TULASIKHAR	2043.96	2078.31	34.35	1941.76	1841.26	-100.50	106.75	108.93	2.18	5.5	5.92	0.42
23	DAMCHHERA	432.63	369.04	-63.59	386.64	307.32	-79.32	65.33	67.20	1.87	16.9	21.87	4.97
24	DASDA	2580.42	1809.35	-771.07	1545.39	827.77	-717.62	126.49	130.25	3.76	8.18	15.74	7.56
25	JAMPUI HILL	1066.51	785.12	-281.39	959.86	640.24	-319.62	27.17	27.99	0.82	2.83	4.37	1.54

S.No	Block / Assessment Unit	Total Annual Ground Water Recharge (ham)			Annual Extractable Ground Water Resource (ham)			Total Current Annual Ground Water Extraction (ham)			Stage of Ground Water Extraction (%)		
		2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff
26	JUBARAJNAGAR	2372.05	2108.45	-263.60	1796.28	1608.78	-187.50	154.92	159.56	4.64	8.62	9.92	1.30
27	KADAMTALA	2439.23	2130.89	-308.34	1799.59	1363.04	-436.55	232	238.29	6.29	12.89	17.48	4.59
28	KALACHERRA	1851.27	1375.59	-475.68	1304.89	826.17	-478.72	165.48	170.38	4.90	12.68	20.62	7.94
29	LALJURI	1548.3	1249.43	-298.87	1295.71	929.77	-365.94	106.16	109.36	3.20	8.19	11.76	3.57
30	PANISAGAR	1739.47	1339.62	-399.85	1462.66	1122.74	-339.92	105.21	108.28	3.07	7.19	9.64	2.45
31	BISHALGARH	3328.87	3327.51	-1.36	2980.72	2701.46	-279.26	416.31	420.31	4.00	13.97	15.56	1.59
32	BOXANAGAR	2183.17	2070.66	-112.51	1606.4	1468.23	-138.17	180.04	182.64	2.60	11.21	12.44	1.23
33	CHARILAM	2271.77	2146.30	-125.47	2024.41	1653.03	-371.38	257.75	262.10	4.35	12.73	15.86	3.13
34	JAMPUIJALA	4774.08	4145.60	-628.48	4243.65	3108.03	-1135.62	127.22	130.11	2.89	3	4.19	1.19
35	KANTHALIA	2654.62	2697.67	43.05	2329.34	2330.30	0.96	434.7	437.84	3.14	18.66	18.79	0.13
36	MOHANBHOG	1707.15	1751.55	44.40	1532	1565.29	33.29	105.79	108.18	2.39	6.91	6.91	0.00
37	NALCHAR	1980.06	1948.85	-31.21	1782.05	1537.24	-244.81	165.52	169.23	3.71	9.29	11.01	1.72
38	BAGAFA	4090.82	3792.79	-298.03	3266.47	2567.03	-699.44	187.26	191.59	4.33	5.73	7.46	1.73
39	BHARAT CH NAGAR	1907.01	1857.56	-49.45	790.6	1167.99	377.39	74.4	92.07	17.67	9.41	7.88	-1.53
40	HRISHYAMUKH	2701.85	2908.85	207.00	2431.67	2089.89	-341.78	126.56	139.09	12.53	5.2	6.66	1.46
41	JOLAIBARI	3158.45	2987.59	-170.86	2791.63	2493.15	-298.48	141.59	144.60	3.01	5.07	5.80	0.73
42	POANGBARI	1029.96	881.07	-148.89	921.59	688.17	-233.42	62.4	63.96	1.56	6.77	9.29	2.52
43	RAJNAGAR	3098.48	3468.85	370.37	2658.29	3115.13	456.84	241.56	245.14	3.58	9.09	7.87	-1.22
44	RUPAICHARI	2300.23	2004.65	-295.58	2028.7	1680.12	-348.58	111.68	114.48	2.80	5.51	6.81	1.30
45	SATCHAND	5014.37	4395.86	-618.51	4502.27	3781.34	-720.93	135.93	143.51	7.58	3.02	3.80	0.78
46	CHANDIPUR	2130.36	1708.75	-421.61	1717.05	1305.54	-411.51	146.71	151.14	4.43	8.54	11.58	3.04
47	GOURNAGAR	2527.3	2312.54	-214.76	2365.03	1940.89	-424.14	157.55	162.18	4.63	6.66	8.36	1.70
48	KUMARGHAT	4556.67	3597.59	-959.08	3978.81	3097.38	-881.43	233.55	240.58	7.03	5.87	7.77	1.90
49	PENCHARTHAL	2353.24	1698.97	-654.27	2203.17	1513.72	-689.45	99.46	103.84	4.38	4.51	6.86	2.35
50	AMC	1973.14	1914.79	-58.35	1775.83	1723.31	-52.52	935.91	960.26	24.35	52.7	55.72	3.02
51	BAMUTIA	1095.63	1010.34	-85.29	986.06	806.61	-179.45	123.86	128.26	4.40	12.56	15.90	3.34
52	BELBARI	1540.03	1416.87	-123.16	1386.02	1099.36	-286.66	172.8	179.97	7.17	12.47	16.37	3.90

S.No	Block / Assessment Unit	Total Annual Ground Water Recharge (ham)			Annual Extractable Ground Water Resource (ham)			Total Current Annual Ground Water Extraction (ham)			Stage of Ground Water Extraction (%)		
		2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff	2019-2020	2021-2022	Diff
53	DUKLI	2283.8	2190.47	-93.33	2055.42	1902.84	-152.58	449.61	472.20	22.59	21.87	24.82	2.95
54	HEZAMARA	2802.92	2054.68	-748.24	2521.3	1916.75	-604.55	80.57	83.90	3.33	3.2	4.38	1.18
55	JIRANIA	1081.54	1211.60	130.06	973.38	1000.95	27.57	185.26	189.42	4.16	19.03	18.92	-0.11
56	LEFUNGA	786.59	780.76	-5.83	707.93	684.15	-23.78	103.22	119.77	16.55	14.58	17.51	2.93
57	MANDWI	2934.67	2139.42	-795.25	2787.94	1760.46	-1027.48	98	124.14	26.14	3.52	7.05	3.53
58	MOHANPUR	2426.36	2333.63	-92.73	2164.96	1927.39	-237.57	320.83	326.51	5.68	14.82	16.94	2.12
59	OLD AGARTALA	1345.08	1314.71	-30.37	1210.58	1016.78	-193.80	203.26	210.47	7.21	16.79	20.70	3.91
	TRIPURA	**146949.79**	**131350.97**	**-15598.82**	**124454.43**	**106356.71**	**-18097.72**	**9881.34**	**10315.62**	**434.28**	**8**	**9.70**	**1.70**

(C): District Wise Dynamic Ground Water Resource of Tripura (As on March 2022)

District	Total Area of Assessment Unit (Ha)	Recharge Worthy Area (Ha)	Total Annual Ground Water Recharge (Ham)	Total Natural Discharges (Ham)	Annual Extractable Ground Water Resource (Ham)	Total Groundwater Extraction (Ham)	Allocation for Domestic use as on 2025 (Ham)	Net Groundwater Availability for future use (Ham)	Stage of Groundwater Extraction (%)
DHALAI	231489	99581	17100	1464.69	15636	1051.51	1012	14496	6.73
GOMATI	161705	109828	20342	1908.27	18434	1000	935	17380	5.42
KHOWAI	101245	49560	12065	1045.6	11019	955.31	680	10031	8.67
NORTH TRIPURA	135792	54382	8742.6	1116.74	7625.8	1011.31	1049	6542.5	13.3
SEPAHIJALA	104392	87170	16172	1808.83	14364	1710.43	1056	12602	11.9
SOUTH TRIPURA	151201	98103	19639	2056.29	17583	1134.42	989	16392	6.45
UNAKOTI	65703	42878	8789.3	931.79	7857.5	657.75	700	7151.8	8.37
WEST TRIPURA	97642	78282	15373	1533.98	13839	2794.9	2243	10916	20.2
TOTAL	1049169	619784	118223	11866.2	106357	10315.6	8664	95511	9.7
TOTAL(bcm)			**1.18223**	**0.11866**	**1.06357**	**0.10315**	**0.08664**	**0.95511**	**9.7**

(D): CATEGORIZATION OF BLOCKS/ MANDALS/ TALUKAS IN INDIA (2021-2022)

S.No	District	Total No. of Assessed Units	Safe		Semi-Critical		Critical		Over - Exploited		Saline	
			Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
1	NORTH TRIPURA	8	8	100	-	-	-	-	-	-	-	-
2	UNAKOTI	4	4	100	-	-	-	-	-	-	-	-
3	DHALAI	8	8	100	-	-	-	-	-	-	-	-
4	KHOWAI	6	6	100	-	-	-	-	-	-	-	-
5	WEST TRIPURA	10	10	100	-	-	-	-	-	-	-	-
6	SEPAHIJALA	7	7	100	-	-	-	-	-	-	-	-
7	GOMATI	8	8	100	-	-	-	-	-	-	-	-
8	SOUTH TRIPURA	8	8	100	-	-	-	-	-	-	-	-
	Total States	59	59	100	-	-	-	-	-	-	-	-

(E): Comparison between Groundwater Resources Estimation of TRIPURA State for the year of 2020 and 2022

Sl. No.	ITEM	GEC'15 (2020)	GEC'15 (2022)	COMPARISON
1	Total annual ground water recharge (HAM)	138215.93	118223	Decrease by 19,992.93 Ham
2	Annual extractable ground water resource (HAM)	124454.43	106356.71	Decrease by 18,097.72 Ham
3	Current annual gross Ground Water extraction for all uses (HAM)	9881.34	10315.61	Increase by 434.27 Ham
4	Annual allocation of ground water for domestic water supply as on 2025 (HAM)	8626.55	8663.6	Increase by 37.05 Ham
5	Net Ground water availability for future use (HAM)	113844.41	95510.84	Decrease by 18333.57 Ham
6	Stage of Ground Water extraction (HAM)	8%	9.7%	Increase by 1.7%

ANNEXURE-VIII (Locations)

LOCATIONS OF DEEP TUBE WELLS CONSTRUCTED BY CGWB IN TRIPURA

NORTH TRIPURA

1. **Panisagar (2005 well**)- Within BSF campus. Site is about 5oom from the main gate towards SSW. Opposite to DIG quarter.
2. **Panisagar (1977 well)** opposite to type IV Quarters
3. **Kanchanpur** – in the premises of Kanchanpur Court

UNAKOTI

1. **Kumarghat**- 2 km from Kumarghat to Kailashar Road.300m N 30 W of Tripura Industrial Estate Kumarghat . In paddy land belong to sri Jatindra Mohan Pal.
2. **Machmara**- NW side of Trijunction of Pecharthal-Kanchanpur-Kumarghat 15m away in paddy field of Sri Kantamani Chakma. 7km south of Pechartal
3. **Pechartal -**11 kms from Kumarghat.West of NH 44.In the play ground of high school.
4. **South Irani**- 11km from Kailasahar town and 3 km North from Babur bazaar from tinali of ailasahar-Hirachrra road. In the land of Sri Asaddar ali of Khowarabil.

DHALAI

1. **Kamalpur** - At Harerkola village, about 2km south of Kamalpur town and about 50 m east of 2km stone on the Ambassa - Kamalpur road
2. **Bhatkhowr**i - On Ambassa - Kamalpur road. 100m west of road near the village in the land of sri Satish ch. Das .About 200 m west of Bhatkhowri Junior Basic school
3. **Durai- Sib-bari** - (Halahali village) - on Ambassa Kamalpur road. In Halahali field, about 2km north of Halhali Market, in the land of Sri Mano mohan Pal
4. **Abhanga** - In the Fish Seeding office compound.
5. **Karamcherra -** Between Ambassa and Kumarghat. 125km from Agartala-50m NW of village market. In the land of Sri Tippam Raja.
6. **Tilokpara** - On Chhamanu-Manu Road. Site is located at about a km. SSE of Chalingta village. In the land of Sri Mohindar Kumar Debnath (Survey No - 80).
7. **Chawmanu** - 23 km from Manu. In Govt. land opposite to PWD quarters- forest range office and 60 m SW of health centre Chhaumanu.

KHOWAI

1. **Khowai**- East of TRTC Khowai bus stand which is about 60 m due south of the Tri-junction of Teliamura- Khowai road-Khowai office tilla road.
2. **Ashrambari -** North of Tehsil office about 30 m NE of the inspection Banglow.
3. **Baijalbari**- 20m west of Khowai-Subalsingh road and ½ km south 20 west of Baijalbari High school in the land of Sri Sivach Deb barma.

WEST TRIPURA DISTRICT

1. **Lichubagan**:- On Agartala airport road within the premises of Municipality Sector office. Greater Agartala, 50 m North of Sector office.
2. **Badarghat**- Off Agartala-Sabroom road. The site as within PHE sub- division-X office campus.
3. **Tripura University**-Suryamaninagar- On Agartala Udaipur Road within University campus, and in front of Boys hostel, 1 km from main gate.
4. **Bodhjungnagar**- On Kherpur-Neepco road, within the Premises of Industrial growth centre. 50 m east of administrative building.

5. **Nagichera**- SE of Agartala by pass road at a distance of 10 km and within the premises of Horticulture Research centre. Other 10 m west of staff quarter and 50m west of TSR office.
6. **Narsingarh**- On Airport road and within the premises of Polytechnic Institute.
7. **GPA Agartala**- Eastern side of road from the bifurcation from Lichubagan at about 4 km. In the air force land for GPA.
8. **Salbagan 96 BSF camp** (1979) - 13km NNE of Agartala. Site is 600 yards due north of Agartala - Mohanpur State Highway and due west of 96 BSF family lines quarters.
9. **Salbagan** - (New, 2004) Within TC & M frontier headquarter, 1.2 km from main entrance near hospital.
10. **Fatikchera**- within the BSF campus on Agartala-Mohanpur road, 25 km from Agartala. Site is about 750m from main gate towards SSE side between Jawans Barack and training ground.
11. **Belbari** – 30 km from Agartala. Approachable from Champaknagar lies in the field by Sri Debendra Deb Burma. 10 m east of Champaknagar -Jampuijala road.
12. **Jirania Coconut Farm**- 25 km from Agartala, 500 m SE of Jirania engineering college.
13. **P & T Colony**-(Arundhati nagar) - 7km south of Agartala in the west of Sabroom road

GOMATI

1. **Amarpu**r- 20m from the northern banks Amarpur tank, in the children's park, which is about 100 to 150m NW of the office of SDO (Civil).
2. **Ompinagar**- 40 m due NE of forest Dak Bunglow about ½ km S10 ^{0} w of Primary Health Centre.
3. **Rajapu**r- West of Birchandra manu on NH for about 2 kms. Site is located of 100 m away from village market and VLW godown. It lies south 60^{o} E of VLws office.
4. **Dhupthali** -North of Dhupthali Bazar 12 km gorjee on Garjee – Tulamura – Borpathari road.
5. **Tulamura** - In open land of Sri Rashamoy Pal. 15m west of the house of Sri Sudhir Ch. Ghosh. 30m south of Garji, Tulamura Mirza road.
6. **Dhuptali** - North of Duptali Bazar in Matabari block of Udaipur Sub Division.

SEPAHIJALA

1. **Gakulnagar 78 BSF Camp** -16km south of Agartala 3km North of Bishalgarh -100 m due east of Agartala Udaipur road and NE of 78 BSF Family welfare centre.
2. **Konaban**- On Agartala Udaipur road, 9.5km from Gokul Nagar, 200m west of kali temple of the Ramakrishna Ashram and 30m south of Konaban Gokulnagar Road : 51 cm Madhupur.
3. **Golaghati** - 9.5km from Bishalgarh 50m SE of panchayat office and 10m south of fish market.
4. **Gokulnagar BSF camp**- 22km from Agartala on Udaipur road. East of NH 1km from gate No-1.

SOUTH TRIPURA

1. **Rajnagar :** 11 m west of Rajnagar market and N 35 W of Rajnagar Block office.
2. **Satchand** - on SE of Udaipur- Subroom road in front of the Junior Basic School No. - II
3. **Haripur** - Near hospital of Hrishyamukh at the Junction of road leading to the Forest Rest House.
4. **Bagafa**- Within Bagafa BSF campus. 330m from main gate towards SSE on the end point of officers quarter. 81 kms from Agartala.

ANNEXURE-IX (Lithologs)

LITHOLOGICAL LOG OF EXPLORATORY WELLS CONSTRUCTED IN TRIPURA

District – North Tripura

PANISAGAR BSF CAMPUS (EW, 1977) (PANISAGAR BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Shale, brown, intercalation with sandstone	00.00 – 9.60	9.60
Sandstone, fine to medium, brown, with shale intercalation	9.60– 25.74	16.14
Shale, brown mixed with sandstone.	25.74 – 32.12	6.38
Sandstone, fine to medium grained, brown, with little shale	32.12 – 47.86	15.74
Shale, brownish mixed with sandstone	47.86 – 51.26	3.40
Sandstone, medium grained, brown	51.26 – 67.02	15.76
Shale, greyish mixed with sandstone	67.02 – 79.70	12.68
sandstone, fine to medium grained, greyish, mixed with shale	79.70 – 143.58	63.88
Sandstone, fine to medium grained, greyish	143.58 – 149.96	6.38
Sandstone, fine to medium grained, greyish mixed with shale	149.96 – 169.10	19.14
Shale, greyish hard	169.10 – 198.00	28.90

PANISAGAR BSF CAMP (EW, 2005) (PANISAGAR BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface Soil, Brownish, sandy.	00.00-6.80	6.80
Shale, Brownish, mixed with fine grained sandstone.	6.80-22.25	15.45
Shale, Brownish.	22.25-25.25	3.00
Sandstone, Fine grained, brownish, with little shale.	25.25-31.40	6.15
Sandstone, Fine to medium grained, brownish.	31.40-65.30	33.90
Sandstone, Brownish, fine to medium grained mixed with little shale.	65.30-68.30	3.00
Sandstone, Brownish, fine to medium grained mixed with gray shale.	68.30-80.60	12.30
Sandstone, Whitish, fine to medium grained.	80.60-99.05	18.45
Sandstome, Light brownish, fine gramned.	99.05-105.20	6.15
Sandstone, Whitish, fine to medium grained.	105.20-139.10	33.20
Sandstone, Whitish, fine to medium grained, mixed with gray shale.	139.10-142.10	3.00
Sandstone, Whitish, fine to medium grained.	142.10-148.25	6.15
Sandstone, Light brownish, fine grained.	148.25-151.40	3.15
Sandstone, Whitish, fine grained.	151.40-191.30	39.90
Shale, Gray	191.30-197.45	6.15

RATACHERRA (KADAMTALA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface clay with fine grained sandstone, brownish	0 – 24.4	24.4
Sandstone, fine grained, greyish	24.4 – 61.0	36.6
Sandstone, fine to medium grained, brownish	61.0 – 67.1	6.1
Sandstone, medium grained, greyish	67.1 – 149.4	82.3
Sandstone, medium grained, greyish	149.4 – 155.4	6.0
Shale, greyish, mixed with sandstone, fine grained	155.4 – 182.9	27.5
Shale, grey	182.9 – 195.1	12.2

KANCHANPUR COURT (LALJURI BLOCK)

Lithology	Depth Range (mbgl)	Thickness
Topsoil, Yellowish in Colour	0-3	3
Shale mixed with Sand, Yellowish in Colour	3-12	9
Shale, Grey in Colour	12-27	15
Hard Shale, Grey in Colour	27-30	3
Shale, Grey in Colour	30-39	9
Plastic Shale, Sticky in Nature and Blakish Grey in Colour	39-51	12
Sand mixed With Shale, Greyish Yellow in Colour	51-57	6
Shale, Grey in Colour	57-63	6
Sand mixed With Shale, Greyish Yellow in Colour	63-66	3
Coarse sand Mixed With Shale, Greyish Yellow in Colour	66-72	6
Fine Sand Mixed With Shale, Greyish Yellow in Colour	72-75	3
Coarse sand With Shale, Greyish Yellow in Colour	75-87	12
Sand with Shale, Greyish Yellow in Colour	87-90	3

District – Unakoti

PECHARTHAL EW (BLOCK- PECHARTHAL)

Lithology	Depth range (mbgl)	Thickness (m)
Shale, yellowish brown	0.00-3.80	3.80
Shale, yellowish with silty sandstone	3.80-6.80	3.00
Sandstone, dirty white, friable fine grained consists of sub rounded grains of quartz, dirty minerals and iron nodules.	6.80-10.5	3.25
Sandstones, gray, fine to medium grey with little shale	10.5-13.5	3.00
Shale, grey to ash grey with silty sand stone	13.5-16.30	3.25
Sandstones, gray fine with grains of quartz micas etc.	16.30-25.55	9.25
Sandstone, grey fine grained with grey shale	25.55-28.80	3.25
Shale, grey with silt and fine grained and sandstone	28.80-41.30	12.50
Sandstone, grey fine grained	41.30-44.30	3.00
Silty sandstone, grey moderately compact	44.30-47.55	3.25
Shale, grey, brittle	47.55-85.05	37.50
Shale, grey, with fine grained sandstone	85.05-110.05	25.00
Sandstone, grey fine grained with little shale	110.05-113.05	3.00
Sandstone, grey fine grained	113.05-116.30	3.25
Shale, grey, with silty sandstone	116.30-144.30	28.00
Sandstone, grey fine to medium with wood fragments & coal	144.30-160.05	15.75
Shale, grey, with silty sandstone	160.05-172.55	12.50
Sandstone, grey with shale	172.55-175.55	3.00
Sandstone, grey fine to medium grained.	175.55-200.68	25.13
Shale, grey, with fine to medium grained sandstone	200.68-209.88	9.20
Sandstone, grey with little shale	209.88-212.88	3.00
Shale, grey, with fine to medium grained sandstone	212.88-215.98	3.10
Sandstone, grey fine to medium grained	215.98-246.48	30.50
Sandstone, grey fine to medium grained with shale	246.48-249.48	3.00
Sandstone, grey fine to medium grained	249.48-255.58	6.10
Sandstone, grey fine to medium grained with shale	255.58-264.78	9.20
Shale, grey, with fine to medium grained sandstone	264.78-276.98	12.20
Sandstone, grey fine to medium grained with shale	276.98-279.98	3.00
Shale, with fine to medium grained sandstone	279.98-286.08	6.10
Sandstone, grey fine to medium grained	286.08-292.93	6.85

MACHMARA EW (PECHARTHAL BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Shale, brownish	00.00-10.30	10.30
Sandstone, medium grained, brownish	10.30-25.70	15.40
Shale, grayish mixed with sandstone	25.70 –59.30	33.60
Sandstone, fine to medium grained, grayish	59.30 -68.40	18.10
Shale, grayish.	68.40 –86.70	18.30
Sandstone, fine grained, grayish mixed with shale	86.70 –89.80	3.10
Sandstone, fine grained, grayish	89.80 –95.90	6.10
Shale, grayish.	95.90 –102.00	6.10
Sandstone, fine grained, grayish mixed with shale	102.00 –105.00	3.00
Shale, grayish	105.00 –111.10	6.10
Sandstone, grayish, mixed with shale	111.10 -114.20	3.10
Sandstone, fine to medium grained grayish	114.20 –138.60	24.40
Sandstone, grayish mixed with shale	138.60 –141.60	3.00
Sandstone, fine to medium grained, grayish	141.60 –166.00	24.40
Sandstone, grayish mixed with shale	166.00 –172.10	6.10

Sandstone, fine to medium grained, grayish	172.10 –181.30	9.20
Sandstone, grayish, mixed with shale	181.30 –196.50	15.20
Shale, grayish	196.50 –205.70	9.20
Sandstone, fine to medium grained, grayish	205.70 –245.30	39.60
Shale, fine grained sandstone, grayish	245.30 –300.30	55.00

KUMARGHAT EW (KUMARGHAT BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandstone, fine grained, greyish,	00.00 – 12.50	12.50
Sandstone, medium grained, brownish	12.50 – 15.60	3.10
Sandstone,	15.60 – 110.00	94.40
Sandstone, fine grained, greyish mixed with shale	110.00 – 125.40	15.40
Shale, greyish	125.40 – 143.70	18.30
Sandstone, fine to medium grained, greyish mixed with shale	143.70 – 165.00	21.30
Sandstone, fine to medium grained, greyish	165.00 – 168.10	3.10
Sandstone, fine grained, greyish, mixed with shale	168.10 – 174.20	6.10
Shale, greyish	174.20 – 183.30	9.10
Sandstone, fine grained, greyish	183.30 – 189.40	6.10
sandstone, fine grained, greyish, mixed with shale	189.40 – 213.80	24.40
Shale, greyish sticky	213.80 – 235.00	21.20
Sandstone, fine to medium grained, greyish mixed with shale	235.00 – 250.40	15.40

KAILASHAHAR URBAN (GAURNAGAR BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Shale, grey mixed with sandstone fine grained	0 – 18.30	18.30
Shale, brownish	18.3 – 36.6	18.3
Sandstone, brownish mixed with shale	36.6 – 42.7	6.1
Shale, brownish	42.7 – 57.9	15.2
Sandstone, light grey, mixed with shale	57.9 – 67.1	9.2
Sandstone, fine to medium grained greyish	67.1 – 79.2	12.1
Sandstone, light grey, mixed with shale	79.2 – 88.4	9.2
Sandstone, fine to medium grained greyish	88.4 – 97.5	9.1
Sandstone, light grey, mixed with shale	97.5 – 109.7	12.2
Sandstone, fine to medium grained greyish	109.7 – 115.8	6.1
Shale, greyish	115.8 – 176.8	61.0
Sandstone, fine grained greyish	176.8 – 207.3	30.80
Sandstone, light grey, mixed with shale	207.3 – 225.6	18.3
Shale, greyish	225.6 – 231.6	6.0
Sandstone, light grey, mixed with shale	231.6 – 253.0	21.4
Shale, brownish	253.0 – 262.1	9.1

SOUTH IRANI EW (GAURNAGAR BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandstone, weathered, yellow fine rounded to sub rounded quartz with little shale	Gl-3.00	3.00
Shale, yellow, with thin intercalations of sandstone	3.00-6.80	3.80
Sandstone, yellow, fine to medium with intercalation of shale	6.80-12.90	6.10
Shale, yellow, with thin intercalations of sandstone	12.90-15.90	3.00
Sandstone, yellow, fine with thin intercalated shale	15.90-22.00	6.10
Sandstone, yellow to reddish grey with sandstone, intercalations	22.00-34.20	12.20
Sandstone, yellow to reddish yellow fine	34.20-40.30	6.10

Shale , grey to greenish grey	40.30-43.40	3.10
Sandstone, yellow to reddish yellow fine	43.40-49.50	6.10
Shale, grey to yellowish and reddish grey with thin sandstone intercalations	49.50-73.90	24.40
Sandstone, grey, fine	73.90-77.00	3.10
Shale, grey to greenish grey with thin sandstone intercalations	77.00-141.00	64.00
Sandstone, yellow, fine	141.00-144.00	3.00
Shale, grey to yellowish grey with intercalations of sandstone	144.00-195.00	51.90
Sandstone with shale	195.00-217.20	21.30
Shale with sandstone	217.20-235.50	18.30
Sandstone with thin shale intercalations shale	235.50-247.70	12.20
Shale	247.70-253.80	6.10
Sandstone with shale	253.80-256.90	3.10
Shale, grey	256.90-259.90	3.00
Sandstone, grey, fine	259.90-263.00	3.10
Shale	263.00-278.20	15.20
Sandstone, grey, fine with thin intercalations of shale.	278.20-287.40	9.20
Shale with thin intercalations of sandstone	287.40-290.40	3.00
Sandstone, grey, fine with shale	290.40-296.50	3.80
Shale, grey, with thin intercalation of sandstone	296.50-300.30	3.80

KARAICHERRA (PECHARTHAL BLOCK)

Lithology	Depth Range (mbgl)	Thickness
Topsoil, Yellowish in Colour	0-3	3
Shale mixed with Sand, Yellowish in Colour	3-18	15
Shale, Grey in Colour	18-60	42
Hard Shale, Grey in Colour	60-90	30
Very Hard Shale, Grey in Colour	90-116.60	26.6

District – Dhalai

CHAWMANU (EW) (CHAWMANU BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Shale, brownish	0.00 -4.57	4.57
Sandstone, fine grained, brownish	4.57 –7.52	3.05
Shale, greyish	7.62 –118.87	111.25
Sand stone, fine to medium grained, greyish	118.87 –158.49	39.62
Shale, greyish mixed with sandstone	158.49 –170.07	11.58
Sand stone, fine to medium grained greyish, mixed with shale	170.07 –173.73	3.66
Shale, greyish	173.73 –181.35	7.62
Sand stone, fine to medium grained, greyish mixed with shale	181.35 –185.93	4.58
Sand stone, fine to medium grained greyish	185.93 –192.80	6.87
Shale, greyish	192.80 –211.22	18.42
Sand stone, fine to medium grained, greyish	211.22 –256.03	44.81
Shale, greyish mixed with fine grained sandstone	256.03 –268.22	12.19
Sandstone, fine to medium grained, greyish	268.22 –274.32	6.10
Shale, greyish mixed with fine grained sandstone	274.32 –300.80	26.48

BHATKHOWRI (EW) (SALEMA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandy soil, yellowish brown coloured with fine brown sand.	0.00-5.35	5.45
Clay, greyish brown clay with fine grains of sub-rounded sand	5.45-7.70	2.25
Sand, yellowish brown, fine, sub rounded micaceous sand.	7.70-10.70	3.00
Sandy gravel, brown fine coarse grained sand with rounded gravels of ferruginous sandstones and balls of grey clay	10.70-16.72	6.02
Sand light brown to dark brown brownish and brownish grey fine to medium sub-rounded, micaceous and with mafic minerals.	16.72-46.54	29.82
Gravely sand, Brown to yellowish brown compact with fine to coarse grained quartz (2 to 5mm) with weathered pieces of feldsper and ferruginous materials	46.54-58.45	11.91
Sand light gray to grey, fine to medium grained sub-rounded sand, micaceous with very little clay	58.45-67.48	9.03
Sand clayey, grey coloured fine to medium grained sub-rounded, micaceous sand with grey clay	67.48-94.53	27.05
Clay, greyish brown clay, loose with little admixture of fine grey sand	94.53-97.59	3.06
Sand, Grey coloured, mostly medium grained rounded, micaceous sand with mafic minerals	97.59-118.53	20.94
Sand, grey coloured fine to medium grained sand sub-rounded with little gray clay sticky and pieces of shale	118.53-136.56	18.03
Sand, grey, fine to medium micaceous sub rounded sand with mafic minerals	136.56-178.87	42.31
Sand, fine to medium grained grey coloured micaceous, subrounded sand with little sticky grey clay	178.87-209.03	30.16
Sand. Grey, fine to medium, sub-rounded, micaceous sand, occasionally coarse grained	209.03-227.16	18.16
Sand, grey mostly fine grained sub-rounded, micaceous sand with mafic minerals.	227.16-272.12	44.96
Sand clayey, grey fine grained with grey clay.	272.12-284.07	11.95
Sand grey fine to very fine sub-rounded, micaceous sand (maffic)	284.07-305.24	21.17

ABHANGA (EW) (SALEMA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, brown with fine grains of sand	00.00 – 4.00	4.00
Sandstone, fine to medium grained, brownish	4.00 – 14.48	10.48
Sandstone, fine to medium grained, greyish mixed with shale	14.48 – 20.50	6.02
Shale, greyish	20.50 – 27.43	6.93
Shale, greyish mixed with fine to medium grained sandstone	27.43 – 32.00	4.57
Shale, greyish	32.00 – 44.64	12.64
Shale, greyish mixed with fine to medium grained sandstone	44.64 – 53.62	9.98
Sandstone, fine grained, greyish, mixed with shale	53.62 – 59.67	6.05
Shale, greyish mixed with fine grained sandstone	59.67 – 63.00	3.33
Sandstone, fine to medium grained, brownish	63.00 – 68.58	5.58
Shale, greyish mixed with sandstone	68.58 – 157.32	88.74
Sandstone, fine to medium grained, greyish mixed with shale	157.32 – 180.42	23.10
Sandstone, fine to medium grained, greyish	180.42 – 195.40	14.98
Sandstone, fine to medium grained, greyish mixed with shale	195.40 – 201.30	5.90
Sandstone, fine to medium grained, greyish	201.30 – 204.20	2.90
Sandstone, fine to medium grained, greyish mixed with shale	204.20 – 205.72	1.52
Sandstone, fine to medium grained, greyish	205.72 – 219.33	13.61
Sandstone, fine to medium grained, greyish mixed with shale	219.33 – 222.33	3.00
Sandstone, fine to medium grained, greyish	222.33 – 231.27	8.94
Sandstone, fine to medium grained, greyish mixed with shale	231.27 – 240.27	9.00

TILAKPARA (EW) (CHHAMANU BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Topsoil, sandy clay brownish yellow grey, loose, plastic with a few hard brittle pieces.	0.00-13.00	13.00
Sandstone, friable, gray fine grained with angular to sub angular quartz & fine intercalation of shale	13.00-36.00	23.00
Shale, grey, brittle with mottle clay, fine sandstone intercalation	36.00-47.00	11.00
Sandstone, grey, fine to medium with shale intercalation	47.00-61.00	14.00
Shale, grey, hard brittle with fine sandstone intercalation	61.00-70.00	9.00
Sandstone, grey, fine to medium grained with shale	70.00-76.00	6.00
Shale, grey, hard brittle with fine sandstone	76.00-89.00	13.00
Sandstone, grey, fine to medium grained with shale	89.00-114.00	25.00
Shale, grey, hard brittle with fine sandstone intercalation	114.00-117.00	3.00
Sandstone, grey, fine to medium grained with shale	117.00-140.00	23.00
Shale, grey, hard brittle with sandstone	140.00-155.00	15.00
Sandstone, grey, fine to medium grained with shale	155.00-159.00	4.00
Shale, grey, hard brittle with sandstone	159.00-175.00	16.00
Sandstone, grey, fine to medium grained with shale	175.00-181.00	6.00
Shale, grey, hard brittle with sandstone	181.00-190.00	9.00
Sandstone, grey, fine grained with shale	190.00-195.00	5.00
Shale, grey, hard brittle with sandstone	195.00-199.00	4.00
Sandstone, grey, fine to medium grained with shale	199.00-205.00	6.00
Shale, grey, hard brittle with sandstone	205.00-208.00	3.00
Sandstone, grey, fine to medium grained with shale	208.00-220.00	12.00
Shale, grey, hard brittle with sandstone	220.00-231.00	11.00
Sandstone, grey, fine to medium grained with shale	231.00-237.00	6.00
Shale, grey, hard brittle with sandstone	237.00-246.00	9.00
Sandstone, grey, fine to medium grained with shale	246.00-300.00	54.00

TILAKPARA (OW) (CHHAMANU BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Clay sandy brownish yellow and grey, loose, plastic with a few hard brittle pieces of petrified wood shale and sandstone.	0.00-13.80	13.80
Sandstone, friable, gray fine grained with angular to sub angular translucent quartz with shale	13.80-35.20	21.40
Shale, grey, hard brittle with sandstone.	35.20-56.50	21.30
Sandstone, grey, fine to medium grained with shale	56.50-74.80	18.30
Shale, grey, hard brittle with sandstone	74.80-90.10	15.30
Sandstone, grey, fine to medium grained with shale	90.1-114.50	24.40
Shale, grey, brittle with sandstone	114.50-117.50	3.00
Sandstone, grey, fine to medium grained with shale	117.50-138.90	21.40
Shale, grey, hard brittle with fine sandstone	138.90-172.40	33.50
Sandstone, grey, fine to medium grained with shale	172.40-181.60	9.20
Shale, grey, hard brittle with sandstone	181.60-196.80	15.20
Sandstone, grey, fine to medium grained with shale	196.80-206.00	9.20
Shale, grey, hard brittle with sandstone	206.00-212.10	6.10
Sandstone, grey, fine to medium grained with shale	212.10-218.20	6.10
Shale, grey, hard brittle with fine sandstone	218.20-221.20	3.00

KARAMCHERRA EW (MANU BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandstone, brown friable fine grained, angular sub translucent mainly composed of quartz with admixture of clay	0.00 – 4.00	4.00
Shale, brownish greyish hard plastic	4.00 – 14.00	10.00
Silty sandstone, greyish brown fine with angular to sub angular quartz fragments	14.00 – 21.00	7.00
Sandstone, grey fine to medium with intercalations of shale and micaceous minerals (muscovite).	21.00 – 30.00	9.00
Sandstone, grey fine grained with little intercalations of shale	30.00 – 61.00	31.00
Sandstone grey medium grained with shale and muscovite mica	61.00 – 74.00	13.00
Sandstone grey fine grained with shale	74.00 – 93.00	19.00
Shale, gray brittle with fine grained sandstone intercalations and mottle clay	93.00 – 96.00	3.00
Sandstone, grey fine grained, with little shale	96.00 – 110.00	14.00
Shale, gray brittle	11.00 – 111.00	1.00
Sandstone, grey fine to medium grained,	111.00 – 120.00	9.00
Shale, gray brittle	120.00 – 121.00	1.00
sandstone, grey fine to medium with little shale	121.00 – 136.00	15.00
Shale, gray with intercalations of fine grained sandstone	136.00 – 146.00	10.00
Sandstone, grey fine to medium grained, with little shale	146.00 – 157.00	11.00
Shale, gray mixed with intercalated sandstone	157.00 – 167.00	10.00
Sandstone, grey fine to medium grained, with muscovite mica and intercalations of shale	167.00 – 177.00	10.00
Shale, gray with intercalations of sandstone	177.00 – 193.00	14.00
Sandstone, grey fine to medium grained, with shale	193.00 – 204.00	11.00
Shale, gray brittle	204.00 – 207.00	3.00
Sandstone, grey, fine to medium grained,	207.00 – 225.00	18.00
Shale, gray brittle	225.00 – 227.00	2.00
Sandstone, grey fine to medium grained, with little intercalations of shale	227.00 – 247.00	20.00
Shale, gray brittle with fine grained sandstone	247.00 – 294.00	47.00

HARINCHERRA (AMBASSA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, brownish	00.00 – 6.00	6.00
Shale, greyish	6.00 – 10.00	4.00
Sandstone, fine grained, greyish mixed with shale	10.200 – 20.00	10.00
Shale, greyish	20.00 – 23.00	3.00
Sandstone, fine grained, greyish mixed with shale	23.00 – 53.00	30.00
Shale, greyish	53.00 – 66.00	13.00
Sandstone, fine grained, greyish mixed with shale	66.00 – 80.00	14.00
Sandstone, fine to medium grained, greyish	80.00 – 120.00	40.00
Sandstone, fine grained, greyish mixed with shale	120.00 – 150.00	30.00
Shale, greyish mixed with sandstone fine grained	150.00 – 160.00	10.00
Sandstone, fine grained, greyish, mixed with shale	160.00 – 164.00	4.00
Shale, greyish	164.00 – 203.00	39.00

KULAI EW (AMBASSA BLOCK)

Formation	Depth Range (mbgl)	Thickness
Topsoil, Brown in Colour	0-6	6
Sand, Medium Grained Sand mixed with Clay, Brown in Colour	Jun-18	12
Sand, Medium Grained Sand Mixed With Clay and Biotite, Brownish Grey in Colour	18-75	57
Sandy Clay, Medium to Coarse Grained Sandy Clay Mixed With Quartz	75-90	15
Sandy Clay, Medium grained Sandy Clay(Clay is of around 60%), Brown in Colour	90-96	6
Sand, Coarse Grained Sand Mixed With Clay, Brown in Colour	96-108	12
Sand, Coarse sand mixed with Quartz Grain, Brown in Colour	108-120	12
Sand, Medium Grained Sand, Brown in Colour	120-129	9
Sandstone, Medium Grained Sandstone Mixed With Shale, Brownish Grey in Colour	129-135	6
Sandstone, Fine to Medium Grained sand mixed with Shale, Brownish Grey in Colour	135-150	15

DURAI SIB BARI (HALAHALI) (DURGACHOWMUHANI BLOCK)

Formation	Depth Range (mbgl)	Thickness
Clay, Gray hard sticky	0.00-6.09	6..09
Sand, Gray fine to medium grained subrounded with mafic minerals.	6.09-10.05	3.96
Sand Clayey, Light brown fine to medium grained with subrounded sandstone.	10.05-16.76	6.71
Sand, Light brown fine to medium grained subrounded.	16.76-24.38	7.62
Sand clayey, Light brown fine to medium grained subrounded with gray clay.	24.38-28.34	3.96
Sand, Light brown fine to medium grained subrounded feldspathic sand.	28.34-31.92	3.58
Sand clayey, Light greenish brown fine grained occasionally coarse grained subrounded with clay and ferruginous sandstone.	31.92-36.57	4.65
Sand, Light brown fine grained subrounded occasionally coarse grained with ferruginous sandstone.	36.57-39.00	2.43
Sand clayey, Light brown fine to medium grained subrounded	39.00-40.54	1.54
Sand, Brownish gray fine to medium grained subrounded with very little clay.	40.54-43.59	3.05
Sand clayey, Light grayish brown fine to very fine sand subrounded occasionally coarse grained with mottle clay.	43.59-57.00	13.41

Sand, Light greenish brown fine grained subrounded with small nodules of ferruginous sandstone.	57.00-66.45	9.45
Sand clayey, Light brown fine grained sand with grayish brown clay.	66.45-95.68	29.43
Sandy clay, Gray with admixture of fine to medium grained with ferruginous sandstone.	95.68-118.87	23.19
Sand, Grayish brown subrounded fine to medium grained.	118.87-123.07	4.2
Sandy clay, Gray with fine grained sand.	123.07-130.45	7.38
Sand, Gray fine grained with little clay.	130.45-135.63	5.18
Sandy clay, Gray clay with fine to medium grained gray sand.	135.63-143.25	7.62
Sand, Gray fine grained sub rounded.	143.25-147.82	4.57
Sandy clay, Gray, loose clay with fine gray sand.	147.82-151.48	3.66
Sand, Brownish gray fine grained.	151.48-154.82	2.74
Clay, Sticky.	154.82-156.96	2.74
Sand, Light gray fine grained subrounded.	156.96-162.45	5.49
Sandy clay, Gray to brown sticky clay with admixture of sand.	162.45-185.93	23.48
Clay, Gray clay with very little sand.	185.93-191.57	5.64
Sandy clay, Light yellowish brown and sticky clay fine grained sand.	191.57-197.49	9.92
Clay, Brownish gray and sticky clay.	197.49-215.49	18
Sandy clay; Gray fine to medium grained subrounded with clay.	215.49-224.52	9.03
Sand; Gray fine to medium grained micaceous.	224.52-251.55	27.03

District – Khowai

BAIJALBARI EW (KHOWAI BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Clay brown sticky clay with little sand (20%)	0.00-6.60	6.60
Sand, fine to medium grained light brown, micaceous	6.60-12.70	6.10
Clay sandy, brownish sticky withy fine to medium grained sand	12.70-15.80	3.10
Clay, greyish mixed with fine sand	15.80-40.20	24.40
Clay sandy, greyish with fine to medium sand increase downward	40.20-55.40	15.20
Clay, grey, little sand 10-20%, few weathered fine sandstone	55.40-76.80	21.40
Sand, grey , angular, micaceous medium with mafics and clay	76.80-79.80	3.00
Clay sandy, grey with fine grained sand	79.80-85.90	6.10
Sand grey fine to medium with little grey clay,	85.90-101.20	15.30
Clay sandy, grey with fine medium grained sand	101.20-110.30	9.10
Sand, grey, fine to medium occasionally coarse with mafics clay content about 120% sticky soft, few pieces of quartz & feldsper	110.30-134.80	24.50
Clay, grey, sticky, hard	134.80-168.30	33.50
Sand, grey fine grained micaceous, with little clay	168.30-180.50	12.20
Clay grey , hard with fine grained sand	180.50-186.60	6.10
Sand, grey micaceous, fine to medium sand with little clay	186.60-192.70	6.10
Clay grey , hard with fine grained sand	192.70-195.80	3.10
Sand, grey fine grained micaceous with pieces of hard shale.	195.80-204.90	9.10
Sand fine grained grey micaceous sand with little clay,	204.90-208.00	3.10
Clay grey hard with little sand	208.00-211.00	3.00
Sand grey, mostly fine with sticky and ihard pieces of clay	211.00-223.20	12.20
Sandy clay, grey hard with fine grained sand	223.20-226.30	3.10
Sand, grey, very fine grained, micaceous with clay 30% sand	226.30-229.30	3.00
Clay, grey, hard, sticky with little sand (20%) sticky.	229.30-256.70	27.40

ASHRAMBARI EW (KHOWAI BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Top soil, sandy loam, light brown, fine to medium grained with little admixture of clay and laterites.	00-5.24	5.24
Sandy clay, yellowish brown clay with fine to medium sand.	5.24-10.43	5.19
Sand clayey, yellowish brown, fine to medium grained sand with little admixture of brown clay and pieces.	10.43-13.43	3.00
Clay sandy, greyish brown sand fine grained.	13.43-16.45	3.02
Sand, pink mostly fine grained.	16.45-28.50	12.05
Sand, grey fine to medium grained with micaceous minerals	28.50-34.55	6.05
Sand, brownish yellow, fine to medium grained sub-rounded.	34.55-49.57	15.02
Sand, greyish white, fine to medium with grey clay and mafics	49.57-52.62	3.02
Gravelly sand, light brown fine to coarse sand with gravel (1mm-3mm) with sub angular quartz gravel and well rounded brown ferruginous sandstone gravel and few pieces of feldspar.	52.62-55.362	3.00
Sand, light yellow, fine to medium grained sub-rounded.	55.62-64.70	9.08
Sand, light brown, fine to medium grained sub-rounded.	64.70-67.70	3.00
Sand clayey dark grey light yellow fine to medium sand with little clay and coarse pieces of ferruginous minerals.	67.70-73.74	6.04

Sand, light greyish yellow, fine to medium grained sub-rounded along with fragments of shale and decayed wood.	73.24-79.39	5.95
Clay, mottled, plastic and sticky mixed with fine grained sand.	79.69-82.77	3.08
Sand, grey fine to medium grained with a little brownish clay.	82.77-85.77	3.00
Clay sandy, mottle grey, plastic and sticky with admixture of fine-grained sand and broken pieces of ferruginous sandstone.	85.77-106.65	18.88
Sand, brownish grey, medium with feldspar, quartz and mafic	106.65-112.67	6.02
Sand clayey, grey and yellowish brown medium sand with clay.	112.67-118.69	6.02
Sand brown medium sub-rounded with weathered feldspar, quartz, mafic minerals and pieces of ferruginous sandstone.	118.69-124.73	6.04
Sand, grey, medium grained with occasional coarse sand, sub-rounded with pieces of shale3 and ferruginous sandstone.	124.73-148.73	8.99
Sand clayey, grey fine to medium with admixture of grey clay.	148.73-151.73	3.00
Sand, grey and light yellowish brown, fine to medium sub-rounded mixed with shale pieces, sandstone and little clay.	151.73-169.74	18.01
Sand, greyish black fine to medium grained, sub-rounded with pieces of sandstone, decayed wood, peat and clay.	169.74-196.88	27.14
Clay sandy, greyish and violet colour clay, silty with rounded pieces of weathered ferruginous sandstone and little sand.	196.88-199.88	3.00
Clay, dark grey, sticky with broken pieces of sandstone and quartz with occasional red colour clay.	199.88-202.86	2.96
Sand clayey, grey, greyish black and brownish yellow fine to medium, with pieces of grey micaceous shale, ferruginous sandstone, quartz, decomposed feldspar, sandstones.	202.86-232.85	29.99
Sand, brownish yellow, mostly medium along with coarse pieces of quartz, weathered ferruginous sandstone, decomposed feldspar and biotite grains and a little variegated clay.	232.85-232.76	5.91
Clay sandy, greyish brown and grey fine to medium sand with ferruginous sandstone, weathered feldspar, quartz clay plastic.	238.76-250.72	11.96
Sand, light brown to grey, fine grained, sub-rounded, micaceous with pieces of quartz (anguar grains) and little grey clay.	250.72-262.78	12.06
Sand clayey, grey fine grained, micaceous with pieces of ferruginous sandstone and grey clay and weathered feldspar.	262.78-268.78	6.00
Sand, light grey to grey, fine micaceous along with silt, ferruginous substances and decomposed feldspar and quartz	268.78-301.68	32.90

ASHRAMBARI OW (KHOWAI BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sand, brown, fine grained.	G.L- 4.00	4.00
Sand, brown, fine to medium grained with pieces of quartz, mica and mafic minerals.	4.00-16.95	12.95
Sand, White, fine to medium grained.	16.95-26.95	9.10
Clay, sandy brown sticky along with fine to medium sand.	26.95-35.25	9.20
Sand, brown fine grained with little clay.	35.25-38.025	3.00
Sand, brown to greyish brown, medium grained.	38.25-45.35	6.10
Sand, brown, fine grained.	44.35-47.45	3.10
Clay, sandy brown plastic along with fine to medium sand.	47.45-59.65	12.20
Clay, greyish brown plastic	59.65-105.35	45.70
Sand, greyish brown fine grained with little clay	105.35-108.45	3.10
Clay, brown plastic	108.45-114.55	6.10
Clay sandy, brown plastic along with fine to medium sand.	108.45-114.55	12.20
Sand, mottled (brownish) fine grained with little clay.	126.75-135.85	9.10

Clay, grey and sticky	135.85-151.15	15.30
Sand, grey fine to medium grained with little clay.	151.15-154.15	3.00
Clay, grey sticky with little admixture of fine-grained sand.	154.15-178.55	24.40

KHOWAI EW (KHOWAI BLOCK)

Lithology	Depth range (mbgl)	Thickness (m)
Shale, mixed with sandstone, brownish.	0.00 –3.60	3.60
Shale, mixed with sandstone, greyish.	3.60 – 16.36	12.76
Shale, mixed with sandstone, fine to medium, grained greyish	16.36 – 19.36	3.00
Shale, greyish, mixed with sandstone, fine to medium grained.	19.36 – 22.74	3.38
Shale, gray, mixed with sandstone.	22.74 – 32.12	9.38
Shale, mixed with sand tone, greyish.	32.12 – 35.50	3.38
Shale, brownish, mixed with sand tone, fine to medium grained.	35.50 – 61.02	25.48
Shale, greyish, mixed wth sandstone, medium grained, brownish	61.02 –67.40	6.38
Shale, greyish, mixed with sandstone, fine to medium grained.	67.40 –99.30	31.90
Shale, mixed with sandstone, gray.	99.30 -112.06	12.76
Shale, greyish, mixed with sandstone, fine to medium grained.	112.06-131.20.	19.14
Sandstone, fine to medium grained, light gray	131.20 –140.58	9.38
Shale, mixed with sandstone, greyish	140.58 –153.34	12.76
Sandstone, medium to coarse grained, light gray	153.34 –191.62	38.28
Sandstone, mixed with shale, grey	191.62 –294.92	103.30

BALUCHERRA EW (TELIAMURA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Shale, brownish	0.00 –6.35	6.35
Sandstone, medium to coarse grained, brownish, with shale.	6.35 –19.15	12.80
Sandstone, medium to coarse grained, brownish	19.15 –28.41	9.26
Shale, greyish, mixed with sandstone	28.41 –31.41	3.00
Sandstone, fine to coarse grained, greyish,	31.41 –36.54	5.13
Shale, greyish, mixed with sandstone fine grained.	36.54 –42.62	6.08
Sandstone, fine to medium grained greyish	42.62 –52.50	9.88
Shale, greyish, mixed with sandstone	52.50 –55.50	3.00
Sandstone, fine to medium grained, greyish	55.50 –79.43	23.93
Sandstone, fine to medium grained, greyish mixed with shale	79.43 –88.54	9.11
Sandstone, medium grained, greyish	88.54 –142.84	54.30
Sandstone, greyish, mixed with shale	142.84 –151.86	9.02
Shale, mixed with sandstone, greyish	151.86 –157.78	5.92
Sandstone, medium grained, greyish	157.78 –160.68	2.90
Sandstone, mixed with shale, greyish	160.68 –166.69	6.01
Shale, greyish, mixed with sandstone	166.69 –181.61	14.92
Sandstone, fine grained, greyish	181.61 –202.74	21.13
Sandstone, medium grained greyish	202.74 –217.72	14.98
Shale, greyish, mixed with sandstone, medium grained	217.72 -226.76	9.04
Sandstone, medium grained, greyish, mixed with shale	226.76 –229.76	3.00
Sandstone, medium grained greyish	229.76 –262.88	33.12

CHAKMAGHAT EW (BLOCK- TELIAMURA)

Lithology	Depth Range (mbgl)	Thickness
Topsoil	0-6	6
Shale mixed with Fine grained Sand, Grey in Colour	06-12	6
Medium Grained sandstone mixed with Shale, Grey in Colour	12-15	3
Shale Mixed With fine grained Sand, Grey in Colour	15-24	9
Shale Mixed With fine grained Sand, Brownish Grey in Colour	24-30	6
Medium Grained Sandstone Mixed With Shale, Brownish Grey in Colour	30-57	27
Coarse Grained Sandstone Mixed with Clay, Grey in Colour	57-72	15
Shale mixed with fine grained Sand, Brownish Grey in Colour	72-87	15
Medium Grained Sandstone Mixed With Shale, Grey in Colour	87-102	15
Shale mixed with fine grained Sand, Grey in Colour	102-108	6
Fine Sand Mixed With Shale , Grey in Colour	108-128	20

CHAKMAGHAT OW (BLOCK- TELIAMURA)

Lithology	Depth range (m bgl)	Thickness
Topsoil, Grey in Colour	0-6	6
Shale mixed with Fine grained Sand, Grey in Colour	6-12	6
Medium Grained sandstone mixed with Shale	12-15	3
Shale Mixed With fine grained Sand, Grey in Colour	15-24	9
Shale Mixed With fine grained Sand, Brownish Grey in Colour	24-30	6
Medium Grained Sandstone Mixed With Shale, Brownish Grey in Colour	30-57	27
Coarse Grained Sandstone Mixed with Clay, Grey in Colour	57-72	15
Shale mixed with fine grained Sand, Brownish Grey in Colour	72-87	15
Medium Grained Sandstone Mixed With Shale, Grey in Colour	87-102	15
Shale mixed with fine grained Sand, Grey in Colour	102-108	6
Fine Sand Mixed With Shale , Grey in Colour	108-128	20

TOTABARI EW (BLOCK- KALYANPUR)

Lithology	Depth Range (mbgl)	Thickness
Topsoil, Brown in Colour	0-6	6
Fine Sand Mixed with little shale, Redish Brown in Colour	Jun-36	30
Fine Sand Mixed With shale, Redish Brown in Colour	36-48	12
Coarse sand mixed with shale, Redish Brown in Colour	48-60	12
Fine Sand Mixed With shale, Grey in Colour	60-72	12
Fine Sand Mixed With shale, Grey in Colour	72-81	9
Medium grained sand mixed with shale, Grey in Colour	81-90	9
Fine Sand Mixed With Clay, Grey in Colour	90-96	6
Medium Grained Sandstone Mixed With Shale, Grey in Colour	96-142	46
Fine sand mixed with Shale, Grey in Colour	142-150	8

District – West Tripura

TRIPURA UNIVERSITY CAMPUS, SURYAMANINAGAR (DUKLI BLOCK) – PZ (EW)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, brown, sandy	00.00 – 9.95	9.95
Sandstone, fine grained, brown, with lateritic particles	9.95 – 16.10	6.15
Sandstone, medium, brownish, with laterites, quartz & feldspar	16.10 – 22.25	6.15
Sandstone, coarse grained, brown, with lateritic material and angular to sub-angular grains of quartz and feldspar.	22.25 – 34.55	12.30
Sandstone, medium to coarse, brownish, laterite, quartz, feldspar	34.55 – 58.00	23.45
Sandstone, fine to medium grained, whitish, with quartz, feldspar and ironaceous material.	58.00 – 62.15	4.15
Sandstone, fine to medium grained, whitish	62.15 – 89.90	27.75
Sandstone, fine grained with shale grey	89.90 – 94.00	4.10
Sandstone, fine to medium, creamish with quartz, feldspar, mica	94.00 – 103.00	9.00
Sandstone, very fine grained.	103.00 – 106.00	3.00
Sandstone, fine to medium with quartz, feldspar and little mica	106.00 – 135.00	29.00
Sandstone, fine grained with shale, grey	135.00 – 143.00	8.00
Sandstone, fine to medium, particles of quartz, feldspar & mica	143.00 – 180.00	37.00
Sandstone fine grained creamish in colour with shale, grey	180.00 – 185.15	6.15
Sandstone, fine to medium grained with quartz, feldspar, little micaceous mineral and shale, grey	185.15– 191.30	6.15
Sandstone fine grained creamish with shale, grey	191.30 – 200.60	9.30

TRIPURA UNIVERSITY CAMPUS, SURYAMANINAGAR (DUKLI BLOCK) – PZ (OW)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, brown, sandy	00.00 – 6.80	6.80
Sandstone, fine grained, brown	6.80 – 12.95	6.15
Sandstone, medium, brownish, with laterite, quartz and feldspar	12.95 – 25.25	12.30
Sandstone, medium to coarse, brown, with lateritic material and angular to sub-angular grains of quartz and feldspar.	22.25 – 37.55	15.30
Sandstone, coarse, brownish, with laterite, quartz and feldspar.	37.55 – 49.85	12.30
Sandstone, medium to coarse grained, brownish, with quartz, feldspar and ironaceous material.	49.85 – 62.15	12.30
Sandstone, fine to medium grained, whitish	62.15 – 71.45	9.30
Sandstone, fine to medium grained.	71.45 – 77.60	6.15
Sandstone, fine to medium grained, with shale grey	77.60 – 100.00	22.40

JIRANIA COCONUT SEED FIRM EW (JIRANIA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
urface soil	0.00-3.00	3.0
Sandstone fine to medium, brownish yellow with quartz and feldspar and a few ferruginous material	3.00 -18.00	15
Sandstone , fine to medium, light brownish yellow mostly composed of quartz and feldspar	18.00 - 45.70	27.7
Sandstone, fine to medium, yellowish mostly composed of quartz and feldspar with a few mafics minerals	45.70 – 67.00	21.3
Sandstonefine to medium, buff colour, quartzitic & feldspathic with significant muscovite and a few ferruginous material	67.00 – 73.00	6.00
Sandstone, fine to medium, yellowish with quartz and feldspar	73.00 – 94.00	21.00
Sandstone , fine to medium grained , buff coloured, mostly composed	94.00 – 103.00	9.00

of quartz and feldspar with ferruginous material		
Sandstone, fine to medium, yellowish, quartzitic & feldspathic	103.00 -122.00	19.00
Sandstone, fine to medium, greyish, quartzitic & feldspathic	122.00 –219.60	97.6
Sand stone, fine to medium, greyish white, mostly composed of quartz and feldspar with a few mafics minerals	219.60 – 231.80	12.20

NAGICHERRA (HORTICULTURE RESEARCH CENTRE), (JIRANIA BLOCK) – PZ (EW)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, reddish	00.00 – 6.80	6.80
Sandstone, fine to medium grained, brownish mixed with little clay, white. Abundant lateritic pieces present.	6.80 – 9.95	3.15
Sandstone, fine to medium, brownish, abundant laterite pieces	9.95 – 16.10	6.15
Sandstone, fine, brownish mixed with little clay, lateritic pieces	16.10 – 19.10	3.00
Sandstone, fine to medium grained, brownish	19.10 – 22.25	3.15
Sandstone, fine grained, brownish mixed with little clay.	22.25 – 25.25	3.00
Sandstone, fine to medium, brownish. Abundant lateritic pieces	25.25 – 31.40	6.15
Shale, greymixed with sandstone, fine grained, brownish	31.40 – 34.55	3.15
Sandstone, fine grained, brownish mixed with little clay.	34.55 – 43.70	9.15
Sandstone, fine to medium grained, whitish.	43.70 – 56.00	12.30
Sandstone, fine to medium grained, whitish mixed with little clay	56.00 – 59.15	3.15
Sandstone, fine grained, whitish.	59.15 – 62.15	3.00
Sandstone, fine grained, whitish mixed with little shale, grey	62.15 – 65.30	3.15
Shale, greymixed with sandstone, fine grained, whitish	65.30 – 68.30	3.00
Sandstone, fine, whitish with little shale, grey. Pieces of iron	68.30 – 71.45	3.15
Sandstone, fine to medium grained, whitish mixed with shale, grey. Pieces of iron bearing minerals are present.	74.45 – 92.90	18.45
Sandstone, fine, light brownish. Pieces of iron bearing minerals	92.90 – 96.05	3.15
Sandstone, fine, light brownish with shale, grey. Pieces of iron	96.05 – 111.35	15.30
Sandstone, fine grained, light brownish.	111.35 – 139.10	27.75
Sandstone, fine to medium, light brownish. Pieces of iron minerals	139.10 – 142.10	3.00
Sandstone, fine, light brownish with little shale, grey. Pieces of iron bearing minerals are present.	142.10 – 160.55	18.45
Sandstone, fine to medium grained, light brownish. Pieces of iron bearing minerals are present.	160.55 – 179.00	18.45
Shale, grey mixed with sandstone, fine grained, light brownish.	179.00 – 185.15	6.15
Sandstone, fine grained, light brownish mixed with shale, grey.	185.15 – 197.45	12.30

NAGICHERRA (HORTICULTURE RESEARCH CENTRE), (JIRANIA BLOCK) – PZ (OW)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, reddish	00 – 6.80	6.80
Sandstone, fine to medium grained, brownish with lateritic pieces	6.80 – 37.55	30.75
Sandstone, fine grained, light brownish	37.55 – 52.85	15.30
Sandstone, fine grained, brownish mixed with shale, grey	52.85 – 68.30	15.45
Sandstone, fine grained, light brownish	68.30 – 117.30	49.00
Sandstone, fine to medium grained, light brownish	117.30 – 129.80	12.50
Shale, grey sandstone, fine grained, brownish	129.80 – 135.95	6.15
Sandstone, fine grained, brownish mixed with shale, grey	135.95 – 139.10	3.15
Sandstone, fine grained, brownish	139.10 – 142.10	3.00
Sandstone, fine grained, brownish mixed with shale, grey	142.10 – 148.25	6.15
Sandstone, fine to medium grained, light brownish	148.25 – 157.55	9.30
Sandstone, fine grained, brownish	157.55 – 166.70	9.15

Sandstone, fine to medium grained, brownish	166.70 – 169.85	3.15
Sandstone, fine grained, brownish mixed with little shale, grey	169.85 – 179.00	9.15
Sandstone, fine grained, greyish	179.00 – 200.45	21.85

BADHARGHAT (PHE SUB-DIVISION - X, AGARTALA), (DUKLI BLOCK) – PZ (EW)

Lithology	Depth Range(mbgl)	Thickness (m)
Sandstone, medium to coarse grained, light brownish	00.00 – 9.95	9.95
Shale, grey	9.95 – 16.10	6.15
Sandstone, medium grained, mixed with shale brownish.	16.10 – 22.25	6.15
Sandstone, fine grained, brownish	22.25 – 37.55	15.30
Sandstone, very fine grained, brownish	37.55 – 43.70	6.15
Sandstone, fine to medium grained, greyish	43.70 – 49.85	6.15
Sandstone, fine to medium grained, mixed with shale	49.85 – 74.45	24.60
Sandstone, coarse grained with quartz, feldspar and mica.	74.45 – 77.60	3.15
Sandstone, fine grained, mixed with shale, grey	77.60 – 111.35	33.75
Sandstone, medium to fine grained, whitish with shale, grey.	111.35 – 123.65	12.30
Shale, grey	123.65 – 129.80	6.15
Sandstone, fine to medium grained, whitish with shale, grey.	129.80 – 142.10	12.30
Sandstone, medium to fine grained, whitish.	142.10 – 154.40	12.30
Sandstone, fine to medium grained with shale, grey.	154.40 – 157.55	3.15
Sandstone, medium to fine grained, whitish.	157.45 – 166.70	9.25
Sandstone, fine to medium grained, creamish with shale, grey.	166.70 – 182.15	15.45
Sandstone, medium to fine grained, creamish.	182.15 – 188.30	6.15
Sandstone, fine to medium grained, creamish with shale, grey.	188.30 – 194.45	6.15
Sandstone, fine grained, creamish.	194.45 – 200.60	6.15

BADHARGHAT (PHE SUB-DIVISION-X, AGARTALA), (DUKLI BLOCK) – PZ (OW)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandstone, medium to coarse grained, brown	00.00 – 6.80	6.80
shale, brown	6.80 – 12.95	6.15
Sandstone, medium grained, brownish, mixed with shale	12.95 – 25.25	12.30
Sandstone, fine to medium grained, brown, with lateritic material	22.25 – 37.55	15.30
Sandstone, fine grained, brownish.	37.55 – 49.85	12.30
Sandstone, fine to medium grained, greyish, mixed with shale	49.85 – 71.45	21.60
Sandstone, coarse grained, whitish	71.45 – 77.60	6.15
Sandstone, fine grained mixed with shale.	77.60 – 92.90	15.30

BODHJUNGNAGAR, GREATER AGARTALA (INDUSTRIAL GROWTH CENTER) – PZ (EW)

Lithology	Depth Range (m bgl)	Thickness (m)
Surface soil, clay mixed with fine sand, reddish	00.00 – 6.80	6.80
Sandstone, medium to fine grained, reddish brown, angular grains of quartz, feldspar and ironaceous material	6.80 – 12.95	6.15
Shale, greyish brown	12.95 – 22.10	9.15
Sandstone, medium to fine, brown, angular grains of quartz, feldspar and ironaceous material with shale and lateritic material	22.10 – 31.40	9.30
Sandstone, fine to medium grained, brownish	31.40 - 43.70	12.30
Sandstone, fine to medium, brownish mixed with shale, grey	43.70 – 56.00	12.30
Sandstone, fine to medium grained, brownish	56.00 – 74.45	18.45
Sandstone, fine to medium, brownish, with lateritic material	74.45 – 86.75	12.30
Sandstone, fine to medium grained, brownish	86.75 – 105.20	18.45
Shale, greyish brown	105.20 – 120.50	15.30
Sandstone, fine to medium, brownish mixed with shale, grey	120.50 – 123.65	3.15

Sandstone, fine to medium grained, brownish	123.65 – 126.65	3.00
Sandstone, fine to medium, brownish mixed with shale, grey	126.65 – 132.80	6.15
Sandstone, fine grained, brownish	132.80 – 154.40	21.60
Sandstone, fine to medium grained, light grey	154.40 – 182.00	27.60
Sandstone, fine to medium, light grey mixed with shale, grey	182.00 – 200.45	18.45

NARSINGARH, AGARTALA, (POLYTECHNIC INSTITUTE) – PZ (EW)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, reddish	00.00 – 6.80	6.80
Clay, brownish	6.80 – 28.40	21.60
Shale, gray	28.40 – 49.85	21.45
Shale, gray, mixed with sandstone,fine grained	49.85 – 59.15	9.30
Sandstone, fine grained, brownish mixed with shale, pieces of quartz and feldspar present	59.15 – 71.45	12.30
Sandstone, fine grained, whitish, mixed with shale, gray	71.45 – 80.60	9.15
Sandstone, fine to medium grained, greyish.	80.60 – 108.35	27.75
Sandstone, fine grained, whitish, mixed with shale, gray	108.35 – 111.35	3.00
Sandstone, fine to medium grained, greyish	111.35 – 117.50	6.15
Sandstone, fine grained, greyish, mixed with shale, gray	117.50 – 139.10	21.60
Shale, mixed with sandstone, fine grained, greyish	139.10 – 142.10	3.00
Sandstone, medium to fine grained, greyish.	142.10 – 145.25	3.15
Sandstone, fine grained, greyish	145.25 – 151.40	6.15
Sandstone, fine grained, greyish mixed with shale, grey	151.40 – 154.40	3.00
Sandstone, fine to medium grained, greyish.	154.40 – 169.85	15.45
Sandstone, fine grained, greyish mixed with shale, grey	169.85 – 179.00	9.15
Sandstone, fine grained, greyish	179.00 – 185.30	6.30
Shale, mixed with sandstone, fine grained, greyish	185.30 - 200.55	15.25

LICHUBAGAN, AGARTALA (MUNICIPALITY SECTOR OFFICE) – PZ (EW)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, brown, sandy	00.00 – 6.80	6.80
Sandstone, medium to coarse grained, brownish	6.80 – 12.95	6.15
Sandstone, medium to fine grained, brownish	12.95 – 43.70	30.75
Sandstone, fine grained, brownish	43.70 – 56.00	12.30
Sandstone, medium to fine grained, brownish	56.00 – 62.15	6.15
Sandstone, very fine grained, brownish,	62.15 – 65.30	3.15
Sandstone, medium to fine grained, brownish	65.30 – 92.90	27.60
Sandstone, medium to fine grained, mixed with little shale	92.90 – 99.05	6.15
Sandstone, medium to fine grained, brownish	99.05 – 105.20	6.15
Sandstone, medium to coarse grained, creamish	105.20 – 123.65	18.45
Sandstone, medium to fine grained, mixed with shale	123.65 – 129.80	6.15
Sandstone, medium to fine grained, greyish	129.80 – 151.40	21.60
Sandstone, medium to fine grained, mixed with shale	151.40 – 157.55	6.15
Sandstone, medium to fine grained, greyish	157.55 – 182.15	24.60
Sandstone, fine grained, mixed with shale	182.15 – 185.15	3.00
Sandstone, medium to fine grained, mixed with shale	185.15 – 197.45	12.30

GPA AGARTALA (OLD AGARTALA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandstone reddish yellow fine grained	0.00-2.70	2.70
Sandstone reddish yellow fine grained	2.70-5.70	3.00

Sandstone yellow fine to coarse grained	5.70-28.40	22.70
Sandstone yellow medium coarse grained with quartz grains	28.40-3.40	3.00
Sandstone yellow fine medium to coarse very coarse grained	31.40-95.50	64.10
Sandstone grey, coloured fine to coarse with shale pieces	95.50-98.50	3.00
Shale grey coloured with fine gained sand	98.50-104.60	6.10
Sandstone, grey fine grained with shale pieces	104.60-110.70	6.10
Sandstone grey coloured, fine grained sandstone	110.70-129.00	18.30
Sandstone, grey coloured fine grained with shale pieces.	129.00-135.10	6.10
Sandstone, grey coloured fine grained, sandstone friable	135.10-147.30	12.20
Sandstone, grey coloured, fine grained with shale pieces.	147.30-150.40	3.10
Sandstone, grey coloured, fine gained	150.40-153.40	3.00
Shale grey coloured, with fine grained sandstone	153.40-159.40	6.00
Sandstone, grey, fine to medium grained	159.40-187.00	27.60
Shale, grey coloured with fine sandstone.	187.00-190.00	3.00

19 BSF CAMP SALBAGAN (OLD AGARTALA BLOCK) - 1979

Lithology	Depth Range (mbgl)	Thickness (m)
Sandy loam, Brown colour, fine grained with little clay	0.00-3.00	3.00
Sand, brown, fine grained with occasional medium grains sand and little mafic minerals	3.00-13.10	10.10
Sand, brown, fine to medium with occasional mafic minerals.	13.10-19.20	6.10
Sandy clay, brown, fine sand with admixture of clay and mafic	19.20-31.40	12.20
Sand brown fine to medium grained with very little clay content.	31.40-83.30	51.90
Sand brown colour, medium with very little clay and mafics.	83.30-89.40	6.10
Sandy clay, sand, fine grained with clay admixture and mafics.	89.40-92.40	3.00
Sandy gray, fine grained with little clay admixture in the top portion, **clay**content decreases downward.	92.42-101.60	9.20
Clay sandy, gray sticky with fine grained sand	101.60-116.80	15.00
Sand, gray, fine to medium with very little clay and mafics.	116.80-135.00	18.20
Clay sandy, gray sticky with fine grained sand, clay content increases in the middle	135.00-142.20	7.20
Sand, greyish fine grained with very little clay admixture sand becomes medium grains toward downward portion.	142.20-166.60	24.40
Clay sandy, greyish sticky with fine grained sand	166.60-172.70	6.10
Sand gray, fine grained with mafics minerals.	172.70-182.90	9.20
Clay sandy, greyish sticky with fine grained sand	182.90-184.90	3.00
Sand, greyish fine to medium grained with very little clay content, clay portion decreases downward.	184.90-203.20	18.30

19 BSF CAMP SALBAGAN (OLD AGARTALA BLOCK) – 2004

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil: Reddish brown with lateritic fragments mixed with brownish sand.	00.00-6.80	6.80
Shale: Mixed with fine grained sandstone, brown.	6.80-12.95	6.15
Sandstone: Fine grained ferruginous with little reddish shale.	12.95-34.55	21.60
Sandstone: Very fine grained light yellowish in colour.	34.55-49.85	15.30
Sandstone: Fine grained greyish brown in colour.	49.85-71.45	21.60

Sandstone: Fine grained brownish in colour.	71.45-77.60	6.15
Sandstone: Fine grained creamish in colour.	77.60-99.05	21.45
Sandstone: Fine grained greyish brown in colour.	99.05-105.20	6.15
Sand stone: Fine grained mixed with grey shale.	105.20-114.50	9.30
Sandstone: Fine grained light brownish in colour.	114.50-142.10	27.60
Sandstone: Fine grained greyish in colour.	142.10-148.25	6.15
Shale: Grey in colour.	148.25-154.40	6.15
Sandstone: Fine grained greyish in colour.	154.40-172.85	18.45
Sandstone: Fine to medium grained greyish in colour.	172.85-185.15	12.30
Sandstone: Fine to medium grained mixed with silt stone.	185.15-200.75	15.60

P&T COLONY, ARUNDHUTINAGAR, AGARTALA (DUKLI BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Shale, fine grained, grey	0.00-7.00	7.00
Sandstone, fine gained with piece of shale	7.00-13.30	6.30
Shale, fine grained	13.30-19.20	5.9
Sandstone, fine gained	19.20-52.70	33.50
Shale, fine grained	52.70-64.66	11.96
Sandstone, fine gained	64.66-69.54	4.88
Shale, fine grained	69.54-71.06	1.52
Sandstone, fine gained	71.06-78.69	7.63
Shale, fine grained	78.69-88.45	9.76
Sandstone, fine gained	85.45-92.11	6.66
Sandstone, fine gained with intermixing of shale	92.11-95.16	3.05
Sandstone, fine gained	95.16-99.43	4.27
Shale, fine grained	99.43-109.83	10.4
Sandstone, fine gained	109.83-148.84	39.01
Shale, fine grained	148.84-153.11	4.27
Sandstone, fine gained	153.11-162.26	9.15
Shale, fine grained	162.26-163.17	0.91
Sandstone, fine gained	163.17-171.10	7.93
Shale, fine grained	171.10-186.05	14.95
Sandstone, fine gained	186.05-205.20	19.15
Shale, fine grained	205.20-208.30	3.10
Sandstone, fine gained	208.30-211.30	3.00
Shale, fine grained	211.30-214.40	3.10
Sandstone, fine gained	214.40-226.60	12.20

BELBARI EW (BELBARI BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandy clay, yellowish brown, fine to medium grained.	0.00-10.00	10
Sandstone, light yellow, fine to medium grained.	10.00-19.00	9
Sand, light yellow, fine to medium, trace mica, slight ferruginous	19.00-40.00	21
Sand, yellowish grey, medium to fine, micaceous and the percentage ferruginous materials are higher than above.	40.00-74.00	34
Sand, yellowish grey, fine to medium micaceous with a few intercalation of shale, bluish.	74.00-77.00	3

Sand as above, but the percentage of shale is high.	77.00-86.00	9
Sand yellowish grey, medium to fine micaceous	86.00-100.00	14
Sand, yellowish grey, fine to medium with intercalation of shale	100.00-107.00	7
Sandy clay, bluish, sticky,	107.00-110.00	3
Sand, light grey, fine to medium with little clay,	110.00-120.00	10
Sand light grey, fine to medium with a few chips of shale.	120.00-150.00	30
Sand yellowish grey, medium to fine	150.00-225.00	75
Sand yellowish grey, fine to medium with little clay sticky.	225.00-233.00	8
Sand yellowish grey, medium to fine	233.00-257.00	24

FATIKCHERRA, BSF CAMPUS EW (LEFUNGA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, gray	00.00-3.00	3.00
Clay stone, light gray	3.00-6.80	3.80
Clay stone, dark gray in colour	6.80-16.10	9.30
Clay stone, dark gray mixed with fine grained sandstone	16.10-25.25	9.15
Clay stone, dark gray in colour	25.25-46.75	21.50
Clay stone, mixed with fine grained sandstone	46.75-55.90	9.15
Sandstone medium to fine grained mixed with clay stone	55.90-8380	27.9
Sandstone, medium grained with little clay stone	83.80-92.95	9.15
Sand stone, coarse grained with feldspar and quartz particles.	92.96-96.10	3.15
Sandstone, brownish medium to fine with feldspathic particles	96.10-105.25	9.15
Sandstone, brownish, medium to coarse grained with shale gray	105.25-114.55	9.3
Sandstone, brownish fine to medium with quartz, feldspar & mica	114.55-142.15	27.6
Sandstone, whitish, fine to medium with quartz and feldspar	142.15-169.75	27.6
Sandstone, very fine grained with silt stone	169.75-200.50	30.75

District – Sepahijala

GOKULNAGAR BSF CAMPUS EW (BISHALGARH BLOCK) - 2002

Lithology	Depth Range (mbgl)	Thickness (m)
Shale, brownish	0 – 6.80	6.80
Sandstone, fine, light brown with little ferruginous compound	6.80 – 16.10	9.30
Sandstone, medium to fine grained, brownish with quartz, feldspar & ferruginous materials	16.10 – 46.85	30.75
Sandstone, fine grained, brownish	46.85 – 49.85	3.00
Sandstone, medium to fine grained, brown, with quartz, feldspar & ferruginous materials	49.85 – 62.15	12.30
Sandstone, fine to medium, brownish with occasional laterites	62.15 – 68.30	6.15
Sandstone, medium to fine, brown, quartz & ferruginous nodules.	68.30 – 99.05	30.75
Shale, greyish, mixed with fine-grained sandstone.	99.05 – 105.20	6.15
Sandstone, medium to fine grained, light brownish.	105.20 – 108.35	3.15
Sandstone,fine to medium, brownish to gray & ferruginous grains	108.35 – 111.35	3.00
Sandstone, fine to medium, brownish with ferruginous nodules.	111.35 – 114.50	3.15
Sandstone,fine to medium grained, gray in colour with shale.	114.50 – 123.65	9.15
Sandstone,fine to medium, gray with ferruginous materials.	123.65 – 126.80	3.15
Sandstone,fine to medium grained, gray, mixed with shale.	126.80 – 139.10	12.30
Sandstone, fine grained, gray.	139.10 – 142.10	3.00
Sandstone, medium to fine grained, gray.	142.10 – 154.40	12.30
Sandstone,medium grained, gray.	154.40 – 160.55	6.15
Sandstone,fine to medium, light brown, mixed with shale gray.	160.55 – 163.70	3.15
Sandstone, gravelly**,** with shale gray,	163.70 – 200.00	36.30

KONABAN EW (BISHALGARH BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sand fine to medium light yellowish brown	0.00-18.80	48.80
Sand fine to medium yellowish brown with few chips of shale	18.80-67.10	19.30
Sand fine to medium, light grey with few chips of shale	67.10-91.50	24.40
Shale with **minor fine sand**, grey amount decreasing with depth	91.50-179.90	88.40
Grey sticky **clay**.	179.90-280.60	100.70

GOLAGHATI EW (CHARILAM BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sand fine to medium yellowish white	0.00-14.00	14.00
Sand fine to medium light brown	14.00-62.00	40.00
Sand fine to medium light gray, micaceous with little quartz and a few ferruginous material	62.00-72.00	9.20
Sand fine to medium dark gray, micaceous with quartz and a few ferruginous material	72.00-81.00	9.00
Sand fine to medium dark gray, with little clay, sticky	81.00-84.20	3.20
Sand fine to medium gray, micaceous with quartz and a few ferruginous material	84.20-108.60	24.40
Sand fine to medium dark gray, with chips of shale	108.60-114.60	60.00
Sand fine to medium gray, micaceous	14.60-142.10	27.50
Sand fine to medium gray, with chips of shale	142.10-151.20	9.10
Sand fine to medium gray, micaceous	151.20-186.20	35.00
Sandy clay light yellow, sticky	186.20-222.80	36.60

Sand fine to medium gray	222.80-270.00	47.20

GOKULNAGAR, BSF CAMP EW (BISHALGARH BLOCK) - 1976

Lithology	Depth Range (mbgl)	Thickness (m)
Clay: dark, reddish brown with little fine grained sand and mica.	0.00-3.00	3.00
Sandy clay: Reddish brown, sand fine to medium , clay sticky and soft sand content is about 30%	3.00-6.55	3.55
Sand: reddish brown, fine to medium, little micaceous clay (10%)	6.55-15.93	9.38
Clay: Redish brown, sticky, hard and micaceous, little fine sand.	15.93-19.31	3.38
Sandy clay: Reddish brown to dirty brown, fine to medium and occasionally coarse sand (Feldspar and quartz pieces of kankar)	19.31-28.69	9.38
Clay: Reddish brown, slightly micaceous with patches of dark brown, lateritic formation and 5% sand.	28.69-32.07	3.38
Sandy clay: Reddish brown to dirty brown, fine to medium occasionally coarse sand (Feldspar and quartz pieces of kankar)	32.07-63.92	31.85
Sand: Brownish gray to dark grey, fine to medium, micaceous	63.92-70.35	6.43
Clay: Dark grey to reddish brown with patches of lateritic material, sticky, hard with 20 to 30% of fine grained sand.	70.35-95.87	25.52
Clay: reddish brown to brown micaceous with patches of dark grey clay, fine grained sand is about 15%.	95.87-99.25	3.38
Sand: Reddish brown, fine to medium grained, micaceous with little admixture of clay, sand is occasionally coarse grained.	99.25-108.63	9.38
Sand: Reddish brown, fine to medium, mica, little dark grey sand	108.63-115.01	6.38
Sandy clay: reddish brown, fine to medium sand, micaceous with pieces of kankar, brown to grey coloured clay, sticky	115.01-118.39	3.38
Sand: Reddish brown, fine to medium with patches of lateritic material, silt content is about 10%, and occasional grey clay	118.39-127.97	9.58
Sandy clay: Reddish brown, fine to medium, micaceous with kankar, clay is sticky, hard, dirty grey and 30% of total volume.	127.97-134.15	6.38
Sand: Grey to brownish grey, fine to medium grained, micaceous, with pieces of kankar, silt content is about 10%.	134.15-175.81	41.66
Clayey sand: Grey to dark grey, miceceous sand, fine grained with pieces of kankar and clay (about 30-40%).	175.81-182.19	6.38
Clay: Grey to dark grey, sticky, hard, with medium and fine sand	182.19-204.33	22.14

District – Gomati

TULAMURA EW (KANKRABAN BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandy loam, light pink, fine grained	0.00-4.50	4.50
Sand brown, fine to medium grained	4.50-7.00	2.50
Clay sandy, brown, plastic with fine grained sand.	7.00-34.00	27.00
Clay, brownish grey, plastic, sticky and hard.	34.00-52.00	18.00
Clay sandy grey to brownish grey, plastic and sticky along with fine grained sand	52.00-73.00	19.00
Sand brown, fine to medium grained	73.00-115.00	42.00
Sand grey, fine to medium grained	115.00-123.00	18.00
Sand clayey, grey, medium grained along with little plastic and sticky clay.	123.00-151.00	18.00
Sand grey, fine to medium grained	151.00-157.00	6.00
Clay sandy, grey, plastic and sticky with admixture of medium grained sand.	157.00-175.00	18.00
Sand clayey, grey, medium grained with little plastic clay.	175.00-178.00	3.00
Sand grey, mostly medium grained and very little amount of clay.	178.00-247.00	69.00

AMARPUR EW (AMARPUR BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Shale, greyish, mixed with sandstone	0.00 – 9.98	9.98
Sandstone, fine grained, brownish mixed with shale	9.98 – 25.74	15.76
Sandstone, fine grained, greyish mixed with shale	25.74 – 35.50	9.76
Sandstone, fine to medium grained, greyish mixed with shale	35.50 – 73.78	38.28
Sandstone, fine to medium grained, greyish	73.78 – 83.16	9.38
Sandstone, fine grained, greyish mixed with shale	83.16 – 95.92	12.76
Sandstone, fine to medium grained, greyish	95.92 –115.06	19.14
Sandstone, fine grained, greyish mixed with shale	115.06 – 127.82	12.76
Sandstone, fine to medium grained, greyish	127.82 – 143.58	15.76
Sandstone, fine grained, greyish mixed with shale	143.58 – 153.34	9.76
Sandstone, fine to medium grained, greyish	153.34 – 178.86	25.52
Sandstone, fine grained, greyish mixed with shale	178.86 – 191.62	12.76
Shale, greyish	191.62 – 210.76	19.14
Shale, greyish mixed with fine grained sandstone	210.76 – 250.42	44.66

OMPINAGAR EW (OMPI BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandy clay, fine sands with clay costing gray to brown in colour with little admixture of mica.	0.00-3.00	3.00
Sand brown to yellowish brown, fine grained sand, with mica	3.00-6.55	3.55
Sandy clay, brown to yellowish brown, fine grained sand with abundance of clay materials.	6.55-9.93	3.38
Sand, Brown sand with greyish ting, fine grained moderately sorted, with abundance of mica.	9.93-16.31	6.38
Sandy clay, brown to yellowish brown, fine grained with clay.	16.31-19.31	3.00
Sand, Grey to brownish grey, medium to fine grained sand, moderately sorted, sub rounded with abundance of mica	19.31-25.69	6.38
Sandy clay, grey with little blackish shale's, sand fine grained and moderately sorted sand and clay ratio 50:50	25.69-29.07	3.38

Sand, brownish grey, medium grained sub rounded sands, with abundance of mica flakes and occasional chips of shale.	29.07-35.45	6.38
Sandy clay, gray fine grained with admixture of clay (50:50) poorly sorted, iron con-creations present, ample flakes of mica	35.45-48.85	12.80
Sand grey coloured, medium grained moderately sorted with very little amount of clay pieces of shale and iron concretion present a few grains of mafic minerals.	48.25-73.73	25.48
Sand with little clay, grey coloured fine to medium grained sand with abundance mafics, shale pieces are also present clay content is little high compared to the above unit.	73.73-76.73	3.00
Sandy clay, Grey colour, fine grained, sand poorly sorted, with abundance of mafics shale particles, clay admixture, carbonaceous material and numerous from pyrites observed.	76.73-80.11	3.38
Sand grey coloured medium grained with abundance of mafics and iron pyrites.	80.11-83.11	3.00
Sandy clay, grey, medium to fine moderate sub rounded sand mixed with clay and carbonaceous material with pyrites	83.11-92.87	9.76
Sand, grey coloured, medium grained, moderately sorted sand grained, sub rounded with very little clay.	92.87-99.25	6.38
Sand with little clay, sand, grey, coloured fine grained clay, content with little higher than the above, abundance of mica	99.25-102.25	3.00
Sandy clay, sand gray coloured fine grained with little clay admixture of mafics.	102.25-108.63	6.38
Sand grey, fine to medium grained moderately sorted sub rounded with little amount of clay, flakes of mica and little mafics	108.63-131.15	22.52
Sandy clay, grey, fine grained, clay portion in higher than the above formation mica and mafics are abundance.	131.15-140.53	9.38
Sand, grey, fine grained, moderately sorted sand pieces of fossil wood present, clay content is very less.	140.53-150.29	9.76
Sand with little clay, grey, fine grained, moderately sorted, with slightly higher clay content.	150.20-153.29	3.00
Sandy clay, Grey, fine moderately sorted sub rounded with still higher clay content, and abundance of mafics and mica flakes.	153.29-178.81	25.52
Sand, grey coloured medium to fine grained sub rounded, moderately sorted, sand with pieces with fossil wood	178.81-182.19	3.38
Clay, grey to dark gray, sticky, with abundance with mafics	182.19-239.51	57.32
Sandy clay, Grey, fine little compact, with abundant mafics.	239.51-242.51	3.00
Clay, grey to dark grey, fine grained, sticky with abundance of mafics and mica.	242.51-250.00	8.51

DHUPTALI EW (MATABARI BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sandstone, fine grained, brownish	00.00 – 31.10	31.10
Sandstone, fine grained, brownish mixed with shale	31.10 – 34.20	3.10
Shale, brownish	34.20 – 37.20	3.00
Sandstone, fine grained, brownish	37.20 – 52.50	15.30
Shale, brownish	52.50 – 55.50	3.00
Sandstone, medium grained, greyish mixed with shale	55.50 – 147.00	91.50
Shale, greyish, mixed with fine grained sand stone, fine grained	147.00 – 208.00	61.00

District – South Tripura

BAGAFA BSF CAMPUS EW (BAGAFA BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, brown, with lateritic fragments	00.00 – 3.00	3.00
Shale, mixed with ferruginous sandstone.	3.00 – 12.00	9.00

Shale, gray.	12.95 – 16.50	3.55
Sandstone, fine grained, greyish white.	16.50 – 19.50	3.00
Shale, gray.	19.50 – 27.50	8.00
Sandstone, fine grained, greyish	27.50 – 30.50	3.00
Shale, mixed with fine grained sand stone, greyish	30.50 – 43.00	12.50
Sandstone, fine grained, greyish	43.00 – 47.00	4.00
Shale, mixed with fine grained sandstone	47.00 – 73.50	26.50
Sandstone, fine grained, greyish	73.50 – 76.00	3.00
Shale, gray	76.00 – 81.50	4.50
Sandstone, fine grained, greyish	81.50 – 86.00	4.50
Shale, mixed with fine grained sandstone	86.00 – 91.00	5.00
Sandstone, fine, greyish white & occasional mafic minerals	91.00 – 94.50	3.50
Shale, with fine grained sandstone	94.50 – 102.20	25.70
Sandstone, fine grained, greyish	102.20 – 106.00	3.80
Shale, with fine grained sandstone	106.00 – 109.00	3.00
Sandstone, fine to medium grained, greyish white.	109.00 – 114.00	5.00
Shale, gray	114.00 –115.50	1.50
Sandstone, fine to medium grained, greyish white.	115.50 – 119.50	3.00
Shale, gray	119.50 – 123.00	3.50
Sandstone, fine grained, greyish	123.00 – 131.00	8.00
Sandstone, fine grained, mixed with shale	131.00 – 137.50	6.50
Sandstone, fine to medium grained, greyish white.	137.50 – 150.00	12.50
Sandstone, fine grained, mixed with shale	150.00 – 158.00	8.00
Sandstone, fine grained, greyish	158.00 – 175.00	17.00
Sandstone, very fine grained, mixed with siltstone	175.00 – 197.50	22.50

SATCHAND EW (SATCHAND BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface soil, brown	00.00 – 3.00	3.00
Shale, brownish.	3.00 – 7.00	4.00
Sandstone, fine to medium grained, brownish mixed with shale	7.00 – 13.40	6.40
Sandstone, fine to medium grained, brownish	13.40 – 34.40	21.00
Sandstone, fine to medium grained, greyish mixed with shale	34.40 – 58.40	24.00
Sandstone, fine to medium grained, greyish	58.40 – 64.40	6.00
Shale, greyish, mixed with fine to medium grained sand stone	64.40 – 70.40	6.00
Sandstone, fine to medium grained, greyish	70.40 – 235.40	165.00
Sandstone, fine to medium grained, greyish mixed with shale	235.40 – 238.40	3.00
Sandstone, fine to medium grained, greyish	238.40 – 253.40	15.00

RAJNAGAR EW (RAJNAGAR BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Sand, brownish yellow, fine to medium grained with clay between 8.23 and 11.27m.	0.00-11.27	11.27
Sand, brownish, yellow, medium to coarse grained with clay intercalations between 38.1-39.62 and 42.67-44.20	11.27-65.53	54.26
Claysandy grey , sticky clay with fine grained sand	65.53-99.05	33.52
Clay, grey sticky, little admixture of sand.	99.05-109.73	10.68
Sand, light gray, fine to medium grained sand.	109.73-124.96	15.23
Sand clayey, light gray sand with grey clay.	124.96-135.63	11.67
Sand, light gray, fine to medium grained (mostly medium)	135.63-150.87	15.24
Clay, grey sticky with little admixture of sand.	150.87-154.84	3.97
Sand, light gray, fine to medium grained sand.	154.84-165.52	10.68
Clay, grey sticky with little amount of sand.	165.52-166.43	0.91

Sand ,light gray mostly medium grained sand	166.43-183.80	17.37
Sand clayey, grey, mostly medium grained sand with grey clay.	183.80-190.42	6.62
Sand, gray, fine to medium grained sand sub rounded.	190.42-193.42	3.00
Clay sandy, grey to brownish yellow plastic sticky clay with admixture of fine sand	193.42-245.30	51.88
Sand, gray, fine to medium grained with a little clay.	245.30-249.24	3.94
Clay sandy, grey, sticky clay with admixture of grey clay.	249.24-177.00	
Shale grey with intercalation of sandstone.	177.00-193.00	14.00
Sandstone, grey fine to medium with shale	193.00-204.00	11.00
Shale, grey, brittle	204.00-207.00	3.00
Sandstone, grey, fine to medium grained.	207.00-225.00	18.00
Shale, grey, brittle	225.00-227.00	2.00
Sandstone gray, fine to medium with little intercalation of shale.	227.00-247.00	20.00
Shale, grey, brittle with fine grained sandstones.	247.00-294.00	47.00

HARIPUR EW (HRISHYAMUKH BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface clay, Yellowish in colour	00-6.65	6.65
Clay, Sticky, yellowish in colour	6.65-28.05	21.40
Clay, Black in colour with minute fine grained sand.	28.05-31.05	3.00
Clayey sandstone, Brown in colour sand fine grained	31.05-37.15	6.10
Clay, sticky , brown to dirty brown with some feldsper and mica	37.15-67.65	30.50
Clayey sandstone, yellow in colour sand fine grained	67.65-76.85	9.20
Sandstone, Medium to coarse grained, yellowish in colour	76.85-95.15	18.30
Clay, sticky, grey in colour	95.15-104.25	9.10
Sandstone, Grey fine to medium grained	104.25-113.45	9.20
Clay, Reddish brown in colour, mixed with little sand	113.45-143.95	30.50
Sandstone, fine to medium grained, yellowish in colour.	143.95-150.05	6.10
Clayey sandstone, Yellowish in colour sand fine grained	150.05-153.05	3.00
Clay Sticky grey in colour	153.05-159.15	6.10
Sandstone, Medium to fine grained yellowish in colour.	159.15-201.85	42.70

HARIPUR OW (HRISHYAMUKH BLOCK)

Lithology	Depth Range (mbgl)	Thickness (m)
Surface clay, Redish brown	00-6.65	6.65
Clay, sticky, reddish brown in colour occasionally with little sand	6.65-55.45	48.80
Sandstone, fine to medium grained reddish brown in colour.	55.45-61.45	6.00
Sandy clay, grey in colour, sand occasionally fine grained	61.45-64.65	3.20
Clay grey in colour occasionally with little snd	64.65-114.55	49.90
Sandy clay yellowish brown in colour sand fine gained.	114.55-168.35	53.80
Sandstone, Medium grained yellowish in colour.	168.35-189.55	21.20

PASCHIM JALEFA EW (SATCHAND BLOCK)

Lithology	Depth Range	Thickness

	(mbgl)	
Top Soil with Silt and Clay, Top Soil comprising clay yellowish brown, semisticky and minor very fine sand and silt.	0-3.5	3.5
Clay, steel grey hard sticky	3.5-6.8	3.3
Clay, yellowish grey semisticky	6.8-15.9	9.1
Clay, yellow semisticky	15.9-19	3.1
Sand fine to medium, yellow with minor clay greyish yellow semi-sticky with a few brown ferruginous concretions.	19-25.1	6.1
Sand medium to coarse, mainly yellow and slightly greyish yellow with a few brown ferruginous concretions.	25.1-31.2	6.1
Sand medium to coarse, light grey, transparent, yellowish grey with a few brown ferruginous concretions and rock fragments with quartz	31.2-34.2	3
Sand clayey : sand fine to medium, light grey to minor yellowish grey & dark grey clay	34.2-40.3	6.1
Sand, medium to coarse and colour varied from yellow, light yellow and greyish yellow to yellowish grey and then grey mixed with a significant amount of brown ferruginous kankar and rock fragments including quartz	40.3-55.6	15.3
Sand, fine to medium, light yellow, greyish yellow, yellowish grey and light grey with a few rock fragments including shale and quartz	55.6-64.7	9.1
Sand medium to coarse, light yellow, yellow and greyish yellow with minor amount of medium gravel sized rock fragments and brown ferruginous kankar	64.7	9.2
Sand fine to medium, transparent, light yellow, greyish yellow, yellowish grey, grey with a few large quartz fragments, brown ferruginous kankar and other rock fragments	73.9-122.7	48.8
Sand very fine to medium, transparent, light yellow, greyish yellow, yellowish grey with little clay yellowish grey to earthy	122.7-128.8	6.1
Clay grey to dark grey, semi-sticky with minor sand very fine to fine, yellowish grey to grey & transparent.	128.8-134.9	6.1
Sandy Clay, clay semi-sticky, grey to light grey with minor sand, very fine to fine, minor medium sized, yellowish grey, transparent, grey	134.9-137.9	3
Sand, fine to medium, yellow, light yellow, greyish yellow, beige, transparent, off-white, mainly quartzitic and minor blackish grey to dark brown ferruginous grains.	137.9-153.2	15.3
Sand, medium grained, yellow, light yellow, off-white, transparent mixed with appreciable amount of semi-sticky variegated clay in the form of pellets	153.2-156.2	3
Sand, medium, yellow, light yellow, beige, mixed with rock fragments (mainly brown chert nodules/kankar, transparent & white quartz fragments) & little variegated clay	156.2-165.4	9.2
Sand, fine to medium grained, light grey, yellowish grey and transparent mixed with rock fragments, ferruginous concretion/kankars	165.4-175.5	10.1

PASCHIM JALEFA OW (SATCHAND BLOCK)

Lithology	Depth Range (mbgl)	Thickness
Top Soil with Silt and Clay, Top Soil comprising clay yellowish brown, semisticky and minor very fine sand and silt.	0-3.5	3.5
Clay, steel grey hard sticky	3.5-6.8	3.3
Clay, yellowish grey semisticky	6.8-15.9	9.1
Clay, yellow semisticky	15.9-19	3.1
Sandfine tomedium, yellow with minor clay greyish yellow semi-sticky with a few brown ferruginous concretions.	19-25.1	6.1
Sand medium to coarse, mainly yellow and slightly greyish yellow	25.1-31.2	6.1

with a few brown ferruginous concretions.		
Sand medium to coarse, light grey, transparent, yellowish grey with a few brown ferruginous concretions and rock fragments with quartz	31.2-34.2	3
Sand clayey : sand fine to medium, light grey to minor yellowish grey and dark grey clay	34.2-40.3	6.1
Sand, medium to coarse and colour varied from yellow, light yellow and greyish yellow to yellowish grey and then grey mixed with a significant amount of brown ferruginous kankar and rock fragments including quartz	40.3-55.6	15.3
Sand, fine to medium, light yellow, greyish yellow, yellowish grey and light grey with a few rock fragments including shale and quartz	55.6-64.7	9.1
Sand medium to coarse, light yellow, yellow and greyish yellow with minor amount of medium gravel sized rock fragments and brown ferruginous kankar	64.7-73.9	9.2
Sand fine to medium, transparent, light yellow, greyish yellow, yellowish grey, grey with a few large quartz fragments, brown ferruginous kankar and other rock fragments	73.9-122.7	48.8
Sand very fine to medium, transparent, light yellow, greyish yellow, yellowish grey with little clay yellowish grey to earthy	122.7-128.8	6.1
Clay grey to dark grey, semi-sticky with minor sand very fine to fine, yellowish grey to grey & transparent.	128.8-134.9	6.1
Sandy Clay, clay semi-sticky, grey to light grey with minor sand, very fine to fine, minor medium sized, yellowish grey, transparent, grey	134.9-137.9	3
Sand, fine to medium, yellow, light yellow, greyish yellow, beige, transparent, off-white etc. mainly quartzitic and minor amount of blackish grey to dark brown ferruginous grains.	137.9-153.2	15.3
Sand, medium grained, yellow, light yellow, off-white, transparent mixed with appreciable amount of semi-sticky variegated clay in the form of pellets	153.2-156.2	3
Sand, medium, yellow, light yellow, beige, with rock fragments (mainly brown chert nodule /kankar and transparent & white quartz fragments) and little variegated clay pellets.	156.2-165.4	9.2
Sand, fine to medium grained, light grey, yellowish grey and transparent mixed with rock fragments, ferruginous concretion/kankars	165.4-175.5	10.1

TUICHAMA EW (SATCHAND BLOCK)

Lithology	Depth Range (mbgl)	Thickness
Top Soil lateritic comprising Sand, Silt and Clay: Sand very fine to fine, brown and yellowish brown and minor silt and clay semi-sticky brown and reddish brown.	0-6.8	6.8
Clay: very hard, sticky with variegated colour (brown, reddish brown, yellow, off-white, beige, grey)	6.8-9.8	3
Sand: medium to fine, quartzitic, yellow, brownish yellow etc.	9.8-12.8	3
Sand: fine to coarse, quartzitic, yellow, orangish yellow, brownish yellow mixed with minor amount of small to medium gravel (sub-angular to sub-rounded quartz fragments and brown chert nodules)	12.8-19	6.2
Gravel : medium to large quartzitic, sub-angular to sub-rounded (white, off-white, yellowish white, yellow, brownish yellow, transparent) and ferruginous chert, sub-rounded to rounded, brown	19-23.5	4.5
Clay : very hard, sticky, variegated colour (brown, reddish brown, yellow, off-white, beige, grey)	23.5-34.1	10.6
Sand clayey : fine, light yellow, yellow, transparent, minor clay yellow and brown ferruginous kankar	34.1-37.3	3.2
Sand : fine to medium, little clay yellow and sizeable chert nodules,	37.3-40.4	3.1

light brown to brown		
Sand : fine yellow mixed with little gravel	40.4-43.5	3.1
Sand : fine to medium, buff, pinkish white, white with gravel small quartzitic and chert nodules	43.5-46.5	3
Sand : fine to medium, yellow, yellowish white, white, orangish white, off-white, brownish yellow	46.5-49.5	3
Sandy Clay : Clay plastic semi-sticky, yellowish, yellowish brown and sometimes variegated with minor sand fine, yellow, brownish yellow, light yellow, off-white etc.	49.5-58.5	9
Clayey Sand : Sandfine with clay, yellow, yellowish brown and variegated at places	58.5-61.6	3.1
Clayey Sand : Sand fine to medium, quartzitic, light yellow, yellow, brownish yellow, off-white, transparent with minor clayvariegated (light brown, yellow, yellowish brown, off-white, light grey)	61.6-67.6	6.1
Sand with Clay : Sand fine to medium, quartzitic, light yellow, brownish yellow, transparent, off-white; variegated claylight brown, yellow, yellowish brown, off-white, light grey; minor small to medium gravel	67.7-70.8	3.1
Sand : fine to medium, deep yellow, yellowish transparent, orangish yellow, yellowish white and minor white sand; little brown ferruginous kankar and quartz frags. white & yellowish transparent.	70.8-92.2	21.4
Sand : medium to coarse, yellow, light yellow, yellowish transparent, yellowish white, transparent mainly quartzitic and minor amount of deep brown to brown ferruginous cherts of coarse sand size.	92.2-95.2	3
Sandy Clay : plastic, nonsticky, light yellow with minor sand fine to medium, light yellow, yellowish transparent, yellowish white, transparent and chert fragments, small gravel sized, deep brown.	95.2-98.5	3.3
Sand : fine to medium, light yellow, yellowish transparent, yellowish white, transparent with little gravel small sized (mainly brown chert nodules/kankar and transparent & white quartz fragments).	98.5-101	2.5
Sand : fine to medium grained, mostly light yellow, yellowish transparent , off-white, orangish light yellow coloured and also some white and transparent grains	101-104.5	3.5
Clayey Sand : Sand fine, light yellow, yellowish transparent, off-white, orangish yellow and some white and transparent grains with little clay, non-sticky, plastic, light grey, beige, yellowish grey.	104.5-113.5	9
Sand : fine, light yellow, yellowish transparent , off-white, orangish white with few white, deep brown & transparent grains mixed with a few ferruginous nodules, reddish to dark brown & white quartz.	113.5-116.5	3
Sand : fine to medium, mainly yellow, yellowish transparent, orangish yellow, off-white, deep yellow, reddish yellow with a few ferruginous nodules, minor coarse sand and little small gravels.	116.5-128.8	12.3
Sand : medium to coarse, light yellow, greyish yellow, light grey, off-white, white mixed with abundant small to medium gravel sized brown to deep brown chert & little quartz, white, yellow, yellowish white.	128.8-135	6.2
Sand with Chert Nodules : medium to coarse, light yellow, off-white and minor amount of white, reddish yellow, brownish yellow and small to medium gravel sized brown to deep brown chert nodues	135-140.3	5.4
Sand : fine to medium, light yellow, off-white, reddish & brownish yellow, little clay light yellow, plastic	140.3-147.1	6.6
Sand : mainly medium and minor fine grained, light yellow, greyish yellow, yellowish transparent, off-white and less reddish yellow and brownish yellow.	147.1-153.2	6.1
Sand : fine, light yellow, yellow, orangish yellow, off-white, yellowish transparent	153.2-159.5	6.3
Clay : semi-sticky, plastic, light yellow to greyish yellow with minor sand, fine, light yellow, yellow, orangish yellow, off-white, yellowish transparent and very little chert	159.5-171.5	12
Sand : fine, orangish yellow, light yellow, off-white, yellowish	171.5-174.5	3

transparent; trace clay		

TUICHAMA OW (SATCHAND BLOCK)

Lithology	Depth Range (mbgl)	Thickness
Top Soil lateritic comprising Sand, Silt and Clay: Sand very fine to fine, brown and yellowish brown, minor silt and clay semi-sticky yellowish brown and reddish brown.	0-6.8	6.8
Clay: hard, sticky with variegated colour (brown, reddish brown, yellow, off-white, beige, grey, light grey etc.)	6.8-9.8	3
Sand: medium to fine, quartzitic, yellow, brownish yellow etc.	9.8-13	3.2
Clay non-sticky brownish yellow with minor sand fine to medium	13-19.05	6.05
Sand fine to medium with minor clay brownish yellow	19.05-22	2.95
Clay non-sticky brownish yellow with minor sand fine to medium	22-25.5	3.5
Sand fine with minor clay brownish yellow	25.5-28	2.5
Sand fine with clay brownish yellow	28-31.2	3.2
Sand fine with minor clay earthy yellow	31.2-40.4	9.2
Sand very fine to fine with clay earthy yellow	40.4-43.5	3.1
Sand fine reddish brown, yellow, light brown, yellowish transparent with trace clay	43.5-49.5	6
Sand fine reddish brown, yellow, light brown, yellowish transparent with minor clay variegated to yellow to brownish yellow.	49.5-52.8	3.3
Sand fine reddish brown, yellow, light brown, yellowish transparent	52.8-61.8	9
Sand fine to medium yellow, brownish yellow	61.8-67.8	6
Sand fine to medium yellow, brownish yellow with clay light yelow	67.8-74	6.2
Sand medium (major), fine (minor), yellow, brownish yellow, yellowish brown, orangish	74-80	6
Sand fine to medium, yellow, brownish yellow, yellowish brown, orangish mixed with minor white quartz fragments, brown chert fragments and clay yellow, yellowish brown	80-98.4	18.4
Sand fine, yellow, light yellow, brownish yellow, yellowish brown, orangish, off-white with minor clay yellowish light brown.	98.4-104.3	5.9
Sand fine to medium, light yellow, brownish yellow, yellowish brown, orangish, offwhite	104.3-116.6	12.3
Sand fine to medium light yellow, off-white, yellowish transparent, orangish yellow, brownish yellow with trace clay light grey	116.6-122.6	6
Sand fine to medium greyish yellow, off-white with a few quartz fragments small to large	122.6-128.8	6.2
Sand fine to medium light yellow, yellowish transparent, orangish yellow	128.8-141	12.2
Sand fine to medium light yellow, yellow, brownish yellow, orangish and reddish yellow	141-147	6
Sand fine to medium light yellow, yellow, brownish yellow, orangish and reddish yellow with minor clay variegated grey, off-white, yellow and brownish yellow	147-153	6
Sand medium (major), fine (minor), yellow, light yellow, yellowish transparent, orangish yellow, off-white mixed with minor brown ferruginous kankar/chert nodules	153-160	7

RAJIB NAGAR EW (SATCHAND BLOCK)

Lithology	Depth Range (mbgl)	Thickness

Top Soil lateritic comprising Sand, Silt and Clay: Sand very fine to fine, brown and yellowish brown, minor silt and clay semi-sticky yellowish brown and reddish brown.	0-6.8	6.8
Clay: hard, sticky with variegated colour (brown, reddish brown, yellow, off-white, beige, grey, light grey etc.)	6.8-9.8	3
Sand: medium to fine, quartzitic, yellow, brownish yellow etc.	9.8-13	3.2
Clay non-sticky brownish yellow with minor sand fine to medium	13-19.05	6.05
Sand fine to medium with minor clay brownish yellow	19.05-22	2.95
Clay non-sticky brownish yellow with minor sand fine to medium	22-25.5	3.5
Sand fine with minor clay brownish yellow	25.5-28	2.5
Sand fine with clay brownish yellow	28-31.2	3.2
Sand fine with minor clay earthy yellow	31.2-40.4	9.2
Sand very fine to fine with clay earthy yellow	40.4-43.5	3.1
Sand fine reddish brown, yellow, light brown, yellowish transparent with trace clay	43.5-49.5	6
Sand fine reddish brown, yellow, light brown, yellowish transparent with minor clay variegated to yellow to brownish yellow.	49.5-52.8	3.3
Sand fine reddish brown, yellow, light brown, yellowish transparent	52.8-61.8	9
Sand fine to medium yellow, brownish yellow	61.8-67.8	6
Sand fine to medium yellow, brownish yellow with clay light yellow	67.8-74	6.2
Sand medium (major), fine (minor), yellow, brownish yellow, yellowish brown, orangish	74-80	6
Sand fine to medium, yellow, brownish yellow, yellowish brown, orangish mixed with minor white quartz fragments, brown chert fragments and clay yellow, yellowish brown	80-98.4	18.4
Sand fine, yellow, light yellow, brownish yellow, yellowish brown, orangish, off-white with minor clay yellowish light brown.	98.4-104.3	5.9
Sand fine to medium, light yellow, brownish yellow, yellowish brown, orangish, offwhite	104.3-116.6	12.3
Sand fine to medium light yellow, off-white, yellowish transparent, orangish yellow, brownish yellow with trace clay light grey	116.6-122.6	6
Sand fine to medium greyish yellow, off-white with a few quartz fragments small to large	122.6-128.8	6.2
Sand fine to medium light yellow, yellowish transparent, orangish yellow	128.8-141	12.2
Sand fine to medium light yellow, yellow, brownish yellow, orangish and reddish yellow	141-147	6
Sand fine to medium light yellow, yellow, brownish yellow, orangish and reddish yellow with minor clay variegated grey, off-white, yellow and brownish yellow	147-153	6
Sand medium (major), fine (minor), yellow, light yellow, yellowish transparent, orangish yellow, off-white mixed with minor brown ferruginous kankar/chert nodules	153-160	7

RAJAPUR EW (BOKAFA BLOCK)

Lithology	Depth Range (mbgl)	Thickness
Sand, Light brown to brown, fine to medium grained with mafic minerals.	0.00-25.89	25.89
Clay, Sandy, brownish grey to brown, sticky with fine grained sand	25.89-38.01	12.12
Sand, Grey fine to coarse grained along with pieces of gravel and mafics	38.01-53.09	15.08
Clay, Sandy, grey, fine to medium grained sand with quartz.	53.09-55.01	1.92
Sand, Grey, medium grained with pieces of ferromagnesian minerals	55.01-94.98	49.97

and mica.		
Clay, Sandy, grey with very fine grained sand.	94.98-107.04	12.06
Clay, Grey, sticky with admixture of fine grained sand.	107.04-118.99	11.95
Sand, Grey, fine to medium grained with mafic minerals and clay.	118.99-127.99	9.00
Clay, Grey, sticky with little fine grained sand.	127.99-140.00	12.01
Clay, Sandy, grey, clay plastic with fine grained sand.	140.00-149.06	9.06
Clay, Grey, sticky with a admixture of sand.	149.06-165.03	16.97
Clay, Grey plastic with very little sand.	165.03-167.03	2.00
Sand, Grey medium grained, subrounded with clay.	167.03-175.03	8.00
Clay, Sandy, grey, clay plastic with fine grained sand.	175.03-178.95	3.92
Clay, Grey, sticky with sand.	178.95-187.84	8.89
Clay, Sandy, grey, clay plastic with fine grained sand.	187.84-195.71	15.87
Sand, Grey, fine grained with clay.	195.71-251.54	55.83

ANNEXURE-X (Hydrogeological Parameters)

DETAILS OF DISTRICT WISE CGWB EXPLORATION WITH REFERENCE TO VALLEYS AND RIVER BASINS

1. Hydrogeological Details of Ground Water Exploration in North Tripura

Sl. No.	Site name/ Block / Co-ordinates	Surface elevation (m. amsl)	Drilling period	Depth Drilled/ Assembly length(m)	Position of slot (m)	Thickness of aquifer tapped (m)	SWL (m bgl)	Discharge		Draw Down (m)	Specific capacity (lpm/ mdd)	Transm-issivity (m^2/day)	Perme-ability (m/day)	Stora-tivity	Remark
								m^3/hr	lps						
Dharmanagar Valley & Juri Basin (North Tripura District)															
1.	**Ichaicherra**			255.2/209	72-85, 110-140 182-192, 201-206	56	0.42 agl	24.4	6.77	23.4	16.6	7.8	0.1	-	Auto Flow EW
2.	**Nayapara**			251.8/160	66-73, 77-103 128-145, 148-157	59	2.34 agl	82.4	22.88	25.43	54.3	74.3	12.6	2.7×10^{-4}	Auto Flow EW
3.	**Haflongcherra**			232.7/180	80-98, 134-154 158-176	44	17.20	3.9	1.08	23.35	2.7	20	0.4	-	EW
4.	**Dharmanagar**			251/210	59-80, 135-156 183-204	63	7.15	22.5	6.25	4.30	87.2	340	5.4	-	EW
5.	**Sanicherra**			250.3/237	73-76, 90-95 151-172, 184-198 204-213, 221-234	59	6.47	11.4	3.16	31	6.1	5.7	-	-	EW
6.	**Tilthaigram**			250.9/145	45-51, 61-76, 78-97 113-119, 136-142	55	1.12	95.4	26.5	23.2	64.6	627	11.4	-	EW
7.	**Panisagar**		2005	198/154	84-99, 105-135, 142-148	51	16.93	27.66	7.68	6.73	68.61	507.4	9.95	-	EW
8.	**Panisagar BSF** N lat $23^0$16'30" E long 92^0 09'30"		1977	198/171	83-89, 100-134 143-149, 162-168	51	23.86	65.98	18.33	41.73	25.98	50.06	0.91	-	Deposit well
Kanchanpur Valley															
9	Kanchanpur N lat $24^0$03'24" E long 92^0 12'04"			92.30/90.50	51-57, 63-72, 75-87	24	4.64	48	13.33	4.84	2.9	234.27			EW & OW

2. Hydrogeological Details of Ground Water Exploration in Unakoti District

Sl. No.	Site name/ Block / Co-ordinates	Surface elevation (m. amsl)	Drilling period	Depth Drilled/ Assembly length(m)	Position of slot (m)	Thickness of aquifer tapped (m)	SWL (m bgl)	Discharge		Draw Down (m)	Specific capacity (lpm/ mdd)	Transm-issivity (m^2/day)	Perme-ability (m/day)	Stora-tivity	Remark
								m^3/hr	lps						
Dharmanagar Valley & Manu-Deo Basin (Unakoti District)															
1	**Pecharthal** N lat 24°11'16" E long 92°06'07"	(29.44) **Toposheet No. 83 D/4**	1981	292.9/ 199.8	112-115, 144-159 174-198	42	2.85 agl	14.9	4.16	29.50	8.46	4.5	0.1	-	Auto Flow, EW
2	**Machmara** N lat 24°08'19" E long 92°07'06"	(33.26) **Toposheet No. 83 D/4**	1983	300.30/ 184	116-125, 128-137 140-149, 154-166 175-181	45	0.70	91	25.29	18.44	82.3	222	5.8	$4.2*10^{-4}$	EW
3	**Machmara** N lat 24°08'19" E long 92°07'06"	(33.41) **Toposheet No. 83 D/4**	1983	208/ 182	120-123, 132-135, 144-147, 157-163,177-179	18	1.48			5.66		200	4.4	$6.8*10^{-3}$	OW
Kailasahar Valley & Manu Deo Basin (Unakoti District)															
3	**South Irani**	(25.42)	1981	300	Abandoned due to lack of granular zone										Slim Hole
4	**Gaurnagar** N lat 24°17'21" E long 92°02'03"	**Toposheet No. 83 D/3**	1982	300/255	88-94, 118-124, 136-142, 172-184, 205-208 223-229, 250-262	51	1.82	90.4	25.11	6.7	225.9	1212.9	23.7	-	Auto Flow, EW
5	**Kumarghat** N lat 24°08'00" E long 92°03'00"	(36.31) **Toposheet No. 83 D/4**	1983	250/159	54-72, 75-87, 92-101, 104-111, 144-150, 150-156	55	1.66	85	23.65	25.75	55.1	189	3.5	2.2×10^{-3}	EW & OW
Kanchanpur Valley (Unakoti District)															
6	**Karaicherra**		2016	116.6	Abandoned due to lack of granular zone										EW

3. Hydrogeological Details of Ground Water Exploration in Dhalai district

Sl. No.	Site name/ Block / Co-ordinates	Surface elevation (m. amsl)	Drilling period	Depth Drilled/ Assembly lowered (m)	Position of slot (m)	Thickness of aquifer tapped (m)	SWL (m bgl)	Discharge		Draw Down (m)	Specific capacity (lpm/ mdd)	Transm-issivity (m^2/day)	Perme-ability (m/day)	Stora-tivity	Remark
								m^3/hr	lps						
Kamalpur Valley & Dhalai Basin															
1.	**Durai SibBari EW** N lat 24⁰06′40″ E long 91⁰49′30″	**Toposheet No. 78 P/16**	1979	251.5/ --	Abandoned due to lack of granular zones										
2.	**Kamalpur EW** N lat 24⁰ 12′ 00″ E long 91⁰ 50′ 00″	(30.97) **Toposheet No. 78 P/16**	1977	250/ --	Abandoned due to lack of granular zones										
3.	**Santir bazar EW**	**Toposheet No. 79 M/13**		265/ --	Abandoned due to lack of granular zones										
4.	**Abhanga** N lat 24⁰03′05″ E long 91⁰50′20″	**Toposheet No. 78 P/16**	1979	240/231	64–67, 179-188 191-194, 200-203 206-218, 222-228	36	5.70 agl	129.7	36.02	28.14	76.8	1462.1	40.4	$2.85x10^{-4}$	Autoflo w EW & OW
5.	**Bhatkhowri** N lat 23⁰59′50″ E long 91⁰50′10″	(57.745) **Toposheet No. 79 M/13**	1979	305/203	60-66, 98-114 120-123, 132-138 147-154, 194-200	44	2.48	167.4	46.50	14.73	189.8	1186.6	26.9	-	EW
6.	**Kulai** N lat 23⁰56′54″ E long 91⁰49′39″	**Toposheet No. 79 M/13**	2018	150/111	36-42, 75-84, 99-108	27	3.25	82.8	23	0.58					EW
Kailasahar Valley & Manu Deo Basin															
7.	**Karamcherra** N lat 24⁰02′30″ E long 92⁰00′30″	(38.036) **Toposheet No. 83 D/4**	1980	294/175	52-65, 71-83 89-104, 125-130 149-155, 167-173	57	0.42	210.5	58.48	20.88	168	603	10.35	-	EW
8.	**Tilokpara** N lat 23⁰56′00″ E long 92⁰02′00″	(51.250) **Toposheet No. 84 A/1**	1980	300/221	54-60, 72-75 96-111, 120-138 176-179, 200-203 212-218	54	2.37	90.0	25.00	18.22	83.08	225	4.2	$5.89x10^{-4}$	EW & OW
9.	**Chhawmanu** N lat 23⁰50′49″ E long 91⁰59′43″	(70.54) **Toposheet No. 79 M/13**	1981	300/259.5	126-131, 134-146 148-152, 156-158, 221-229, 233-242, 246-255	50	1.74 agl	37.9	10.52	38.36	16.47	26.4	0.52	-	Autoflo w EW

4. Hydrogeological Details of Ground Water Exploration in Khowai District

Sl. No.	Site name/ Block / Co-ordinates	Surface elevation (m. amsl)	Drilling period	Depth Drilled/ Assembly length(m)	Position of slot (m)	Thickness of aquifer tapped (m)	SWL (m bgl)	Discharge		Draw Down (m)	Specific capacity (lpm/ mdd)	Transm-issivity (m^2/day)	Perme-ability (m/day)	Stora-tivity	Remark
								m^3/hr	lps						
Khowai Valley & Khowai Basin (Khowai District)															
1.	**Bonbazar**			256	52-61, 85-100	24	Flowing	-	-	NA	-	-	-	-	EW, Sand flow
2.	**Asharambari** N lat 24^{0}09'40" E long 91^{0}42'42"	31.515	1980	301/170	51-62, 107-112 120-146, 155-167	54	0.5agl	28	7.65	10.45	44.6	-	-	-	Autoflow EW & OW
3.	**Badlabari**			250/225	60-78, 84-96 120-126, 162-180 216-222	60	0.80	-	-	NA	-	-	-	-	EW
4.	**Khowai** N lat 24^{0}03'45" E long 91^{0}36'30"	25.4	1976	295/257	132-137, 153-188 236-255	59	7.68 magl	79.2	22	13.6	207	1689	28.4	-	Autoflow EW
5.	**Baijalbari** N lat 24^{0}02'00" E long 91^{0}33'10"	35.5	1978	256.7/ 231	76-80, 88-92 110-134, 168-180 195-208, 217-229	71	10.41	74	20.56	5.68	217	1102	15.52	-	EW
6.	**Balucherra** N lat 23^{0}51'15" E long 91^{0}38'20"		1979	302/240	56-70, 75-79 92-107, 126-141 205-217, 231-237	66	6.41	91	22.52	6.83	197	1047	15.9	-	EW
7	**Chakmaghat** N lat 23^{0}50'05" E long 91^{0}40'33"	54	2017	128/102	40-49 60-69 90-99	27	3.5	15.84	4.4	5.3					(EW +OW)
8	**Kalyanpur (Totabari)** N lat 23.909 E long 91.620	52	2018	150/112	52-58 60-69 81-90	24	15.6	71.6	21	10.15					(EW+OW)

5. Hydrogeological Details of Ground Water Exploration in West Tripura District

Sl. No.	Site name/ Block / Co-ordinates	Surface elevation (m. amsl)	Drilling period	Depth Drilled/ Assembly length(m)	Position of slot (m)	Thickness of aquifer tapped (m)	SWL (m bgl)	Discharge		Draw Down (m)	Specific capacity (lpm/ mdd)	Transm-issivity (m^2/day)	Perme-ability (m/day)	Stora-tivity	Remark
								m^3/hr	lps						
Agartala Valley & Haora Basin (West Tripura District)															
1.	**Jirania BDO office**			254.8/198	50-73, 105-115 127-136, 185-195 230-245	64	1.47	10.08	2.80	14.97	123.5	1100	17.0	-	EW
2.	**Belbari** N lat 23^{0}46'00" E long 91^{0}29'30"	24.59m	1985	257/250	57-72, 87-96 154-166, 178-191 236-247	60	2.78	34.78	9.66	30.53	19.4	617	2.93	$7.5x10^{-4}$	EW & OW
3.	**Jirania Coco Firm** N lat 23^{0}51'19" E long 91^{0}26'01"		1986	232/174	86-92, 110-122 134-146, 152-171	48	9.30	63.8	17.72	5.05	210	892	18.43	-	Deposit well
4.	**Champaknagar**			261.3/191	41-52, 124-136 147-188	64	NA	0.78	0.22	20.92	10.3	-	-	-	EW
5.	**Sasubari** N lat 23^{0}55'30" E long 91^{0}27'30"			281/182	98-110, 116-122 128-143, 153-162 165-179	56.9	-	-	-	-	-	-	-	-	EW yet to be tested
6.	**Salbagan BSF** N lat 23^{0}53'27" E long 91^{0}17'29"		1979	203.2/ 163	64-68, 72-81 94-100, 120-134 144-150, 156-160	41	13.90	42.40	11.78	17.26	40.94	933	22.76	-	Deposit well
7.	**Salbagan BSF** N lat 23^{0}53'27" E long 91^{0}17'29"		2004	200.8/ 183	71-98, 171-180	36	2.4	7.20	2	15.57	13.37			-	EW & OW
8.	**GPA Agartala** N lat 23^{0}07'45" E long 91^{0}38'10"		1980	190/187	60-84, 90-96 140-146, 166-184	54	9.81	164.87	45.79	12.63	217.43	1449	26.8	-	Deposit well
9.	**Fatikcherra BSF** N lat 23^{0}57'28" E long 91^{0}21'00"		2004	200/172	94-103, 120-126 145-169	39	1.95	50	13.88	8.92	98.02	934.43	23.96	$2.06x10^{-3}$	EW & OW
10.	**Vivekananda nagar**			255/155	43-89, 95-98 105-111	55	NA	3.96	1.10	0.5	104.7	161.4	2.4	-	EW
Agartala Valley & Haora Basin (West Tripura District)															
11.	**Suryamaninagar (Tripura University)** N lat 23^{0}46'30" E long 91^{0}16'00"		2004	200.60/ 183	96-102, 104-122 145-154, 174-180	39	6.45	46.55	12.93	4.67	177.37	986.74	25.30	-	EW & OW

12.	**Badharghat** N lat 23^{0}48'28" E long 91^{0}16'02"		2005	200.60/ 193	140-155, 157-167 180-190	35	3.06	61.16	16.98	17.46	58.36	735.1	21	-	EW & OW
13.	**Lichubagan** N lat 23^{0}52'30" E long 91^{0}17'15"		2006	197.45/ 179	114-120, 132-144 164-176	30	5.70	28.85	8.01	5.76	83.47	453.64	15.12	-	EW & OW
14.	**Narsingarh** N lat 23^{0}54'08" E long 91^{0}15'22"		2006	200.55/ 186	113-119, 143-149 154-169, 180-183	30	10.69	37.24	10.34	3.22	186.97	1225.31	40.85	-	EW & OW
15.	**Bodhjungnagar** N lat 23^{0}56'26" E long 91^{0}20'30"		2006	200.45/ 187	154-160, 166-184	24	20.92	6.07	1.65	4.46	22.65	86.67	3.62	-	EW & OW
16.	**Nagicherra** N lat 23^{0}48'40" E Pz 91^{0}90'21"		2007	197/181	119-125, 131-137 160-178	30	No pumping test due to low discharge and heavy draw down								EW & OW
17.	**Arundhatinagar P&T Colony, Agartala**		1982	226.6/200	66-68, 72-78,89-92, 110-116, 136- 148,154-160,164- 170, 174-177, 190- 196	51	4.65	70.68	19.63	7.62	160	6859	134.5		Deposit well

6. Hydrogeological Details of Ground Water Exploration in Sipahijala District

Sl. No.	Site name/ Block / Co-ordinates	Surface elevation (m. amsl)	Drilling period	Depth Drilled/ Assembly length(m)	Position of slot (m)	Thickness of aquifer tapped (m)	SWL (m bgl)	Discharge		Draw Down (m)	Specific capacity (lpm/ mdd)	Transm-issivity (m^2/day)	Perme-ability (m/day)	Stora-tivity	Remark
								m^3/hr	lps						
Agartala - Sonamura Valley & Burigang Basin (Sipahijala District)															
1	**Bishalgarh**			235/95	47-92	45	NA	10.32	2.87	13.65	210.0	1438	28.3	$1.28x10^{-4}$	EW
2	**Jampuijala** N lat 23°42'30" E long 91°27'55"			205/180	69-80, 98-110 116-128, 140-153 171-177	53	0.05	62.8	17.4	4.95	211.7	709	11.8	-	EW
3	**Golaghati** N lat 23°48'45" E long 91°21'30"	28.045	1985	270/170	65-77, 88-100 119-125, 131-137 156-168	48	1.46	20.70	5.75	10.74	32.1	90.9	1.83	$4.4x10^{-4}$	EW & OW
4	**Gokulnagar BSF** N lat 23°42'10" E long 91°16'40"		2003	200/163	57-61, 69-73, 82-91 109-111, 115-119, 125-127, 145-160	40	11.14	35	9.84	6.03	98.33	1302	32.92	$2.06x10^{-3}$	EW & OW
5	**Gokulnagar** N lat 23°42'53" E long 91°16'56"		1976	204/175	63-70, 99-109 118-128, 134-173	66	7.86	113	31.41	27.94		904.8	13.7	-	Deposit well
6.	**Konaban** N lat 24°42'20" E long 91°12'45"	39.455	1986	200.6	-	-	-	-	--	-	-	-	-	-	Slim Hole

7. Hydrogeological Details of Ground Water Exploration in Gomti District

Sl. No.	Site name/ Block / Co-ordinates	Surface elevation (m. amsl)	Drilling period	Depth Drilled/ Assembly length(m)	Position of slot (m)	Thickness of aquifer tapped (m)	SWL (m bgl)	Discharge		Draw Down (m)	Specific capacity (lpm/ mdd)	Transm-issivity (m^2/day)	Perme-ability (m/day)	Stora-tivity	Remark
								m^3/hr	lps						
Amarpur Valley & Gomti Basin (Gomti District) block - Amarpur															
1.	**Amarpur** N lat 23^{0}31'20" E long 91^{0}39'38"		1975	255/178	35-42, 72-83 92-115, 125-140 153-176	76	9.93	158	44	9.08	133.6	794.7	10.43	-	EW
2.	**Ompinagar** N lat 23^{0}40'27" E long 91^{0}38'16"		1976	250/153	55-73, 111-130 140-150	47	0.7	158	44	24.3	181.0	362	7.1	$1.77x10^{-3}$	EW & OW
3.	**Nutan Bazar**			250/60	30-56	27	2.53	12	3.33	8.5	23.5	-	-	-	EW
4.	**Rangkhang**			190/181	47-56, 65-88 108-114, 144-147 156-168, 172-178	39	10.4	85.1	23.63	10.6	134.0	329.0	8.4	-	Deposit well
5.	**Duluma**			208/158	63-75, 86-98 12-121, 142-151	42	10.5	96.5	26.80	14.4	112.0	325.2	7.76	-	Deposit well
Udaipur-Sabroom Valley & Gomti Basin (Gomti District) block- Matabari															
6.	**Bagma**			201/162	64-70, 115-133	36	4.5	48.6	13.5	20.3	30.8	330	9	-	EW
7.	**Tulamura** N lat 23^{0}27'35" E long 91^{0}27'10"	(18.925)	1979	247/212.6	75-81, 85-91 99-111, 179-191 197-210	48	1.0 magl	112	31.21	24.0	78	246	5.1	-	EW Auto flow
8.	**Dhupthali** N lat 23^{0}13'25" E long 91^{0}23'20"	(19.675)	1990	208/ 132	56-80, 92-104 110-128	54	1.50 magl	36	10	6.80	88	263	4.8	-	EW & OW Auto flow

8. Hydrogeological Details of Ground Water Exploration in South Tripura District

Sl. No.	Site name/ Block / Co-ordinates	Surface elevation (m. amsl)	Drilling period	Depth Drilled/ Assembly length(m)	Position of slot (m)	Thickness of aquifer tapped (m)	SWL (m bgl)	Discharge		Draw Down (m)	Specific capacity (lpm/ mdd)	Transm-issivity (m^2/day)	Perme-ability (m/day)	Stora-tivity	Remark
								m^3/hr	lps						
Udaipur-Sabroom Valley & Muhuri Basin (South Tripura District)															
1	**Rajapur** Block - Rajnagar N lat 23^{0}20'45" E long 91^{0}29'15"	(13.16)	1979	252/215	50-53, 56-59, 65-70 75-86, 119-126 150-155, 162-165 169-174, 197-212	56	5.30	143	39.72	10.30	232	1577	27.4	-	EW
2	**Rajnagar** N lat 23^{0}40'27" E long 91^{0}38'16"	(13.16)	1979	252/186	51-93, 113-125 136-148, 157-163 171-183	54	2 magl	151	42.08	25.0	101	222	4.1	-	EW & OW Auto flow
3	**Matai** Block - Rajnagar			232/200	64-82, 140-152 161-173, 183-195	54	3.6	12	3.33	17.6	11.4	47.4	0.87	2.2x 10^{-4}	EW
4	**Manubazar** N lat 23^0 04' 34" E long 91^0 38' 35"	Blk-Satchand **Toposheet No. 79 M/12**		233/208	87-106, 117-120 162-168, 193-205	40	19.95	79.5	22.08	5.4	24.5	897	22.4	-	Deposit well
Udaipur-Sabroom Valley & Muhuri Basin (South Tripura District)															
5	**Ghoshkhamar** Block - Rajnagar			220/206	52-58, 79-97 130-142, 154-166 186-192, 197-203	60	1.48	12	3.33	11.3	17.7	164	2.70	-	EW
6	**Bagafa BSF** N lat 23^{0}20'03" E long 91^{0}35'03"		2004	197.5/ 167	103-106, 109-114 116-119, 123-131 138-150, 158-164	37	20.92	36.79	10.21	12.21	50.22	752.45	20.34	-	EW
Udaipur-Sabroom Valley & Fenni Basin (South Tripura District)															
7	**Haripur** Rajnagar block	(25.972)	1991	202/187	80-92, 104-110 144-150, 160-184	48	1.9	30	8.33	7.12	70.2	330	4.8	2.38x10^{-3}	EW & OW
8	**Satchand** N lat 23^{0}07'45" E long 91^{0}38'10"	(17.465) **Toposheet No.79 M/12**	1979	253/200	60-63, 83-88, 93-99 117-120, 130-133, 147-153, 168-180, 183-189, 192-198	50	0.42 magl	91	25.25	12.47	121.2	887.7	17.75	-	EW Auto flow
Udaipur-Sabroom Valley & Muhuri Basin (South Tripura District)															
9	**Ghoshkhamar** Block - Rajnagar			220/206	52-58, 79-97 130-142, 154-166 186-192, 197-203	60	1.48	12	3.33	11.3	17.7	164	2.70	-	EW Auto flow
10	**Bagafa BSF** N lat 23^{0}20'03"		2004	197.5/ 167	103-106, 109-114 116-119, 123-131	37	20.92	36.79	10.21	12.21	42.76	752.45	20.34	-	EW

	E long $91^0$35’03”				138-150, 158-164										
Udaipur-Sabroom Valley & Fenni Basin (South Tripura District)															
11	**Tuisama EW** N 23.156692 E 91.66163		2015	174.5/154	74–80, 86 – 92, 98 – 104	18	16.06	13.212		2.93					EW
12	**Tuisama OW** N 23.156692 E 91.66163		2015	174.5/154	74 – 80, 86 – 92, 98 – 104,130 –139, 48– 151	30	12.67	14.4		2.72					OW
13	**Paschim Jalefa EW** N 23.0331692 E 91.6873053		2015	175.5/151	77– 83, 89 – 101, 113– 119, 142–148	30		18.432		0.99					Autoflow EW
14	**Paschim Jalefa OW** N 23.0331692 E 91.6873053		2015	158.60/151	77-83, 92-98, 113-119, 142-148	24		16.488		0.72					Autoflow OW
15	**Rajib Nagar Block-Satchand** N lat $23^0$03’25” E long $91^0$39’23”	25m 79 M/12 & 3B	2015-16	160/153	75-81; 105-117; 123-135; 141-150	39	8.94	72	20	0.75	1066	1783.08		$3.80x10^{-4}$	EW
16	**Rajib Nagar Block-Satchand** N lat $23^0$03’25” E long $91^0$39’23”	79 M/12 & 3B	2016	160/152	71-77, 89-95, 104-110, 122-128, 143-149	30	7.83	16.236		0.73					OW

ANNEXURE-XI (Pumping Test)

RESULTS OF PUMPING TEST ON EXPLORATORY WELLS AND OBSERVATION WELLS CONSTRUCTED BY CGWB

District – NORTH TRIPURA

Sl No	Village	Type of Well	Type of Test	Date	SWL (m bgl)	Step /Duration in min	Discharge in lps	Draw down (m)	Specific Cap lpm/m	Sp.Drawdown m/m3/min	Formation loss (m)	Well loss (m)	Well Effeciency	Caliculated Drawdown m	Transmissivity m2/day	Perme ability m/day	Stora tivity
1.	Panisagar BSF (2005)	EW	SDT	09.9.05	16.93	1- 60	6.3	5.8	65.8	15.17	5.15	0.63	89	-	-	-	-
						2- 60	7.7	7.6	61.2	16.34	6.24	0.93	87	-	-	-	-
						3- 60	8.8	8.7	60.9	16.42	7.15	1.24	85	-	-	-	-
						4- 60	9.9	9.6	62.2	16.1	8.02	1.55	83	-	-	-	-
			APT	10.9.05	16.93	650	7.7	6.7	-	-	-	-		-	507	9.95	
2.	Panisagar BSF (1977)	EW	SDT	28.11.77	23.49	1-130	11.6	26.8	-	38.54	20.15	5.79	-	25.94	-	-	-
						2- 60	13.8	31.2	-	37.81	23.92	8.16	-	32.08	-	-	-
						3- 60	14.7	34.9	-	39.65	25.52	9.28	-	34.74	-	-	-
						4- 75	16.9	39.4	-	38.77	29.46	12.38	-	41.82	-	-	-
						5- 75	18.3	42.3	-	38.45	31.9	14.52	-	46.45	-	-	-
			APT	01.12.77	23.86	480	18.3	41.7	25.98	-	-	-		-	50	0.91	-

District – UNAKOTI

Sl No	Village	Type of Well	Type of Test	Date	SWL (m bgl)	Step /Duration in min	Discharge in lps	Draw down (m)	Specific Cap lpm/m	Sp.Drawdown m/m3/min	Formation loss (m)	Well loss (m)	Well Effeciency	Caliculated Drawdown m	Transmissivity m2/day	Perme ability m/day	Stora tivity
1	Pechartal	EW	SDT	15.12.81	2.85 m agl	1- 60	3.5	22.5	9.4	106.27	22.02	0.89	96	-	-	-	-
						2- 60	3.9	26.1	9.0	111.00	24.41	1.10	95	-	-	-	-
						3- 60	4.2	28.5	8.8	114.00	25.97	1.25	95	-	-	-	-
			APT	16.12.81	2.85 m agl	500	4.2	29.5	8.5	-	-	-		-	4.5	0.1	-
2	Kumarghat	EW	SDT	14.7.83	1.64	1- 60	16.0	15.3	-	-	-	-	-	-	-	-	-
						2- 60	20.1	18.9	-	-	-	-	-	-	-	-	-
						3- 60	23.7	24.6	-	-	-	-	-	-	-	-	-
						4- 60	26.8	27.5	-	-	-	-	-	-	-	-	-
			APT	16.7.83	1.58	1440	23.7	25.7	290.0	-	-	-		-	346	7.2	2.2 x10 -3
		OW		16.7.83				4.9									
3	Machmara	EW	SDT	22.4.83	0.62	1-60	15.8	9.4	100	9.95	9.85	0.72	93	-	-	-	-
						2-60	20.0	12.8	93	10.67	12.46	0.92	93	-	-	-	-

						3-60	23.7	15.4	92	10.87	14.75	1.09	93	-	-	-	-
						4-60	26.8	17.6	92	10.91	16.72	1.24	93	-	-	-	-
						5-60	29.3	19.3	91	10.98	18.3	1.35	93	-	-	-	-
			APT	24.4.83	0.61	1320	25.3	18.4	82.28	-	-	-		-	222	5.8	-

District - DHALAI

Sl. No	Village	Type of Well	Type of Test	Date	SWL (m bgl)	Step - Duration in min	Discharge (lps)	Draw down (m)	Specific Capacity lpm/m	Sp. Drawdown (m/m^3/min)	Formation loss (m)	Well loss (m)	Well Effeciency	Calculated Drawdown (m)	Transmissivity (m^2/day)	Perme ability (m/day)	Stora tivity
1.	Abhanga	EW	SDT	07.6.79	5.7	1- 90	27.1	16.7	97.4	10.27	14.22	3.3	-	17.52	-	-	-
						2- 90	31.2	20.6	91.2	10.97	16.38	4.38	-	20.76	-	-	-
						3- 90	34.6	23.5	88.3	11.32	18.14	5.37	-	23.51	-	-	-
						4- 90	36.8	26.0	84.9	11.77	19.33	6.1	-	25.43	-	-	-
						5- 90	39.1	29.0	80.8	12.37	20.52	6.87	-	27.39	-	-	-
			APT	08.6.79	5.7	600	36.0	28.1	76.8	-	-	-	-	-	1425	40.4	2.85 x 10^{-4}
		OW			5.7		-	1.4	-	-	-	-	-	-	-	-	-
2.	Bhat-khowri	EW	SDT	03.7.79	2.5	1- 120	34.5	11.0	189.2	5.28	0.93	9.94	-	10.87	-	-	-
						2- 120	42.1	13.9	181.5	5.51	1.14	12.12	-	13.26	-	-	-
						3- 120	52.2	17.7	176.9	5.65	1.4	15.02	-	16.42	-	-	-
			APT	07.7.79	2.5	510	46.5	14.7	189.8	-	-	-	-	-	1187	26.9	-
3.	Karam-cherra	EW	SDT	25.4.80	0.4	1- 60	31.2	9.6	195.0	5.13	8.38	1.23	-	9.61	-	-	-
						2- 60	43.7	14.4	182.0	5.49	11.72	2.40	-	14.12	-	-	-
						3- 60	53.9	18.2	178.0	5.60	14.48	3.66	-	18.14	-	-	-
						4- 60	63.2	21.2	178.0	5.59	16.97	5.03	-	22.00	-	-	-
			APT	26.4.80	0.4	960	58.5	20.9	168.0	-	-	-	-	-	603.0	10.4	-
4.	Tilakpara	EW	SDT	28.2.79	2.4	1- 60	15.8	9.5	100.1	9.98	7.79	1.34	-	9.13	-	-	-
						2- 60	21.8	13.9	94.1	10.63	11.07	2.57	-	13.64	-	-	-
						3- 60	26.8	17.8	90.2	11.08	13.59	3.88	-	17.47	-	-	-
						4- 60	30.8	20.8	88.9	11.25	15.64	5.14	-	20.78	-	-	-
			APT	25.5.79	2.4	1440	25.2	18.2	83.1	-	-	-	-	-	225.0	4.0	
		OW			2.4		24.1	5.1	-	-	-	-	-	-	229.3	-	6.3 x10^{-4}
5.	Chha-manu	EW	SDT	12.5.81	1.7 m agl	1- 60	6.6	19.6	20.1	49.87	17.87	1.74	91	19.60	-	-	-
						2- 60	9.3	28.9	19.4	51.63	25.42	3.51	87	28.94	-	-	-
						3- 60	11.5	36.9	18.8	53.31	31.44	5.37	85	36.81	-	-	-
						4- 60	13.2	36.9	21.5	46.47	30.04	7.08	80	37.12	-	-	-
			APT	13.5.81	1.74 m agl	480	10.5	38.1	16.5	-	-	-	-	-	26.4	0.52	-

District - KHOWAI																
Sl. No.	Village	Type of Well	Type of Test	Date	SWL (m bgl)	Step - Duration (min)	Discharge (lps)	Drawdown (m)	Specific Capacity (lpm/m)	Sp. Drawdown (m/m^3/min)	Formation loss (m)	Well loss (m)	Well effeciency (%)	Calculated Drawdown (m)	Transmissivity (m2/day)	Perme ability (m/day)	Stora tivity
1	Balu-cherra	EW	SDT	01.8.79	6.41	1- 90	15.77	4.30	220.0	4.55	3.5	0.85	-	4.35	-	-	-
						2- 90	17.97	5.17	208.0	4.8	3.98	1.11	-	5.1	-	-	-
						3- 90	20.75	6.04	206.0	4.85	4.6	1.48	-	6.09	-	-	-
						4- 90	22.52	6.66	202.0	4.93	4.99	1.75	-	6.75	-	-	-
						5- 90	23.98	7.21	199.0	5.01	5.32	1.98	-	7.3	-	-	-
			APT	03.8.79	6.41	900	22.52	6.83	197.0	-	-	-		-	1047	15.9	-
2	Khowai	EW	SDT-1	02.7.76	7.00 m agl	1- 70	21.82	6.90	189.0	-	-	-	-	-	-	-	-
						2-150	26.73	8.14	197.0	-	-	-	-	-	-	-	-
						3-120	31.30	9.67	194.0	-	-	-	-	-	-	-	-
						4-100	36.10	10.44	207.0	-	-	-	-	-	-	-	-
			SDT-2	08.10.77	7.66 m agl	1-30	6.28	1.59	62.0	-	-	-	-	-	-	-	-
						2-20	8.80	2.66	105.0	-	-	-	-	-	-	-	-
						3-30	11.00	2.71	133.0	-	-	-	-	-	-	-	-
						4-30	12.93	3.66	194.0	-	-	-	-	-	-	-	-
						5-30	14.67	4.21	255.0	-	-	-	-	-	-	-	-
			APT	09.10.77	7.68 m agl	795	22.00	-	-	-	-	-	-	-	1689	28.4	-

District – WEST TRIPURA																	
Sl. No.	Village	Type of Well	Type of Test	Date	SWL (m bgl)	Step / Duration (min)	Discharge (lps)	Drawdown (m)	Specific Cap (lpm/m)	Sp.Drawdown (m/m^3/min)	Formation loss (m)	Well loss (m)	Well effeciency (%)	Calculated Drawdown (m)	Transmissivity (m2/day)	Perme ability (m/day)	Stora tivity
1.	Arundhu-tinagar	EW	SDT	27.1.82	4.66	1-60	14.92	5.21	90.8	11.02	5.37	0.34	94	5.71	-	-	-
						2-60	19.62	7.35	160.7	6.24	7.06	0.59	93	7.66	-	-	-
						3-60	23.46	9.13	154.2	6.48	8.44	0.85	90	9.29	-	-	-
			APT	29.1.82	4.65	360	19.63	7.62	160.0	-	-	-		-	6860	134	
2.	Fatik-cherra	EW	SDT	17.11.04	1.95	1-60	7.25	4.27	101.9	9.81	4.13	0.42	91	-	-	-	-

						2-60	9.90	6.00	99.0	10.10	5.60	0.79	88	-	-	-	_
						3-60	12.11	7.60	95.6	10.45	6.91	1.19	85	-	-	-	_
						4-60	14.00	8.80	95.5	10.48	7.98	1.59	83	-	-		_
			APT	11.11.04	1.95	1000	14.00	8.93	-	-	-	-		-	922	24	_
3.	**Badhar-ghat**	EW	SDT	29.3.05	6.45	1-60	6.81	6.00	68.1	14.67	6.42	1.39	82	-	-	-	_
						2-60	9.21	9.84	56.2	17.79	8.68	2.55	77	-	-	-	_
						3-60	11.23	12.67	53.2	18.80	10.58	3.78	74	-	-	-	_
						4-60	12.93	15.24	50.9	19.64	12.18	5.02	71	-	-	-	_
			APT	30.3.05	0.43	1000	16.98	17.46		-	-	-		-	735.0	21.0	_
4.	**Suryama-ninagar**	EW	SDT	03.02.05	6.45	1-60	6.81	1.91	214.0	4.67	1.55	0.43	78		-	-	_
						2-60	9.21	2.88	192.0	5.21	2.1	0.78	73		-	-	_
						3-60	11.23	3.77	179.0	5.59	2.56	1.16	69		-	-	_
						4-60	12.93	4.57	170.0	5.89	2.94	1.54	66		-	-	_
			APT	04.2.05	6.45	1000	12.93	4.67	-	-	-	-		-	986.0	25.3	_
5.	**Bodhju-ngnagar**	EW	SDT	06.4.07	20.90	1-60	0.98	2.60	22.7	43.33	2.13	0.46	82	-	-	-	_
						2-60	1.60	3.83	25.1	38.3	3.55	1.27	74	-	-	-	_
						3-60	1.92	6.07	19.0	50.58	4.26	1.82	70	-	-	-	_
			APT	07.4.07	20.92	500	1.68	4.46	22.7	-	-	-		-	86.67	3.62	-
6.	**Lichu-bagan**	EW	SDT	25.2.07	5.73	1-60	4.11	2.20	112.0	8.91	1.31	0.84	61	-	-	-	_
						2-60	5.81	3.61	97.0	10.34	1.85	1.68	52	-	-	-	_
						3-60	7.27	4.59	95.0	10.56	2.31	2.63	47	-	-	-	_
						4-60	8.06	5.74	84.0	11.88	2.56	3.22	44	-	-	-	_
			APT	26.2.07	5.70	600	8.01	5.76	83.5	-	-	-		-	454	15.1	_
7.	**Narsin-garh**	EW	SDT	17.3.07	10.71	1-60	6.32	1.44	263.0	3.79	1.25	0.67	65	-	-	-	_
						2-60	8.07	2.01	241.0	4.19	1.58	1.07	60	-	-	-	_
						3-60	9.53	2.60	220.0	4.56	1.88	1.51	55	-	-	-	_
						4-60	11.23	3.26	207.0	4.87	2.21	2.08	52	-	-	-	_
			APT	18.3.07	10.69	600	10.35	3.32	187.0	-	-	-		-	1225	40.85	-
8.	**Baijalbari**	EW	SDT	19.7.79	10.48	1- 90	12.92	3.08	366.0	3.97	2.48	0.56	-	-	-	-	_
						2- 90	16.50	4.14	314.0	4.14	3.19	0.92	-	-	-	-	_
						3- 90	18.85	4.83	292.0	4.27	3.61	1.19	-	-	-	-	_
						4- 90	20.75	5.49	227.0	4.41	3.98	1.44	-	-	-	-	_
			APT	21.7.79	10.45	1080	20.56	5.68	217.0	-	-	-		-	1102	15.5	_

9.	**Jirania Coconut Seed Farm**	EW	SDT	04.5.86	9.30	1- 60	13.63	3.36	243.0	4.1	1.93	1.39	55	-	-	-	-
						2- 60	15.08	3.84	236.0	4.24	2.13	1.71	56	-	-	-	-
						3- 60	16.59	4.43	225.0	4.44	2.35	2.07	53	-	-	-	-
						4- 60	17.92	4.98	216.0	4.63	2.53	2.41	51	-	-	-	-
			APT	06.5.86	9.30	500	17.72	5.05	210.0	-	-	-		-	892	18.43	-
10.	**Belbari**	EW	SDT	10.3.85	2.78	1- 60	5.93	13.20	27.0	37	8.90	4.12	68	-	-	-	-
						2- 60	8.33	20.50	24.0	41	12.50	8.13	61	-	-	-	-
						3- 60	10.35	28.30	22.0	45.57	15.53	12.53	56	-	-	-	-
			APT	14.3.85	2.77	855	14.30	30.33	187.0	-	-	-		-	590	3.33	7.07×10^{-4}
11.	**GPA Agartala**	EW	SDT	28.7.80	9.85	1- 60	30.28	7.37	246.0	4.05	7.44	0.27	96	-	-	-	-
						2- 60	38.35	9.85	233.0	4.28	9.43	0.44	95	-	-	-	-
						3- 60	45.80	11.77	233.0	4.28	11.26	0.63	94	-	-	-	-
						4- 60	52.23	13.64	229.0	4.35	12.84	0.82	94	-	-	-	-
			APT	30.7.80	9.81	480	45.79	12.63	217.0	-	-	-		-	1449	26.83	-
12.	**Salbagan**	EW	SDT	24.8.79	14.20	1- 90	8.38	11.93	42.5	23.57	10.89	0.75	-	11.64	-	-	-
						2- 170	10.21	14.75	41.5	24.1	13.28	1.12	-	14.4	-	-	-
						3- 130	11.78	15.84	44.6	22.49	15.32	1.49	-	16.81	-	-	-
						4- 100	12.92	19.03	40.7	24.55	16.79	1.79	-	18.59	-	-	-
			APT	26.8.79	1.90	480	11.78	17.26	40.9	-	-	-		-	933	22.8	-
						2- 90	17.97	5.17	208.0	4.8	3.98	1.11	-	5.1	-	-	-
						3- 90	20.75	6.04	206.0	4.85	4.6	1.48	-	6.09	-	-	-
						4- 90	22.52	6.66	202.0	4.93	4.99	1.75	-	6.75	-	-	-
						5- 90	23.98	7.21	199.0	5.01	5.32	1.98	-	7.3	-	-	-
			APT	03.8.79	6.41	900	22.52	6.83	197.0	-	-	-		-	1047	15.9	-

District – SEPAHIJALA															
Sl. No.	Village	Type of Well	Type of Test	Date	SWL (m bgl)	Step - Duration (min)	Discharge (lps)	Drawdown (m)	Specific Capacity (lpm/m)	Sp. Drawdown (m/m^3/min)	Formation loss (m)	Well loss (m)	Well effeciency (%)	Calculated Drawdown (m)	Transmissivity (m2/day)	Perme ability (m/day)	Stora tivity
1	Gokul-nagar	EW	SDT	28.3.76	7.86	1-180	16.92	10.17	99.8	-	-	-	-	-	-	-	-
						2-120	24.43	15.83	92.6	-	-	-	-	-	-	-	-
						3-75	31.42	19.41	97.11	-	-	-	-	-	-	-	-
						4-15	36.67	19.96	110.2	-	-	-	-	-	-	-	-
			APT	30.3.76	7.86	390	31.42	19.41		-	-	-	-	-	904	13.71	-

District – GOMATI																
Sl. No.	Village	Type of Well	Type of Test	Date	SWL (m bgl)	Step - Duration (min)	Discharge (lps)	Drawdown (m)	Specific Capacity (lpm/m)	Sp. Drawdown (m/m^3/min)	Formation loss (m)	Well loss (m)	Well effeciency (%)	Calculated Drawdown (m)	Transmissivity (m2/day)	Perme ability (m/day)	Stora tivity
1	Dhuptali	EW	SDT	11.12.91	1.5 magl	1- 50	6.20	3.71	20.05	-	3.03	0.96	76.0	19.6	-	-	-
						2- 50	8.30	5.18	19.37	-	4.06	1.72	70.0	28.9	-	-	-
						3- 50	9.50	6.29	18.76	-	4.65	2.25	67.0	36.8	-	-	-
						4- 50	11.00	7.38	21.52	-	5.39	3.02	64.0	37.1	-	-	-
			APT	12.12.91	1.5 m agl	1200	10.00	6.80	88.0	-	-	-	-	-	259	4.80	4.2×10^{-4}
		OW			1.36 magl		-	1.72	-	-	-	-	-	-	-	-	-
2	Tulamura	EW	SDT	20.79	1.0 m agl	1-60	24.75	21.53	69.0	14.49	17.52	3.99	-	-	-	-	-
						2- 60	27.08	24.11	67.0	14.83	19.17	4.77	-	-	-	-	-
						3- 60	29.28	26.30	67.0	14.97	20.73	5.58	-	-	-	-	-
						4- 60	31.18	27.67	67.0	14.78	22.07	6.33	-	-	-	-	-
			APT	21.7.79	1.0 m agl	720	31.22	24.09	-	-	-	-	-	-	246	5.10	-
3	Ompi-nagar	EW	SDT	16.5.76	1.42	1- 360	36.60	21.16	103.0	-	-	-	-	-	-	-	-
						2- 240	44.00	23.45	112.0	-	-	-	-	-	-	-	-
						3- 225	73.33	25.73	170.0	-	-	-	-	-	-	-	-
			APT	18.5.76	1.42	2880	44.00	24.50	-	-	-	-	-	-	362	7.09	1.775×10^{-4}
		OW	APT	18.5.77	-	-	-	6.62	-	-	-	-	-	-	-	-	-
4	Amar-pur	EW	SDT	11.4.75	9.93	1- 120	22.00	4.47	295.0	-	-	-	-	-	-	-	-
						2- 120	31.40	6.68	282.0	-	-	-	-	-	-	-	-
						3- 120	44.00	9.03	292.0	-	-	-	-	-	-	-	-
			APT	13.4.75	9.93	300	44.00	9.08		-	-	-	-	-	794.0	10.43	-

District – SOUTH TRIPURA																
Sl. No.	**Village**	**Type of Well**	**Type of Test**	**Date**	**SWL (m bgl)**	**Step - Duration (min)**	**Discharge (lps)**	**Drawdown (m)**	**Specific Capacity (lpm/m)**	**Sp. Drawdown (m/m^3/min)**	**Formation loss (m)**	**Well loss (m)**	**Well effeciency (%)**	**Calculated Drawdown (m)**	**Transmissivity (m2/day)**	**Perme ability (m/day)**	**Stora tivity**
1.	**Bagafa**	EW	SDT	13.7.04	20.42	1- 60	6.31	7.80	48.84	20.58	6.44	1.38	82.0	-	-	-	-
						2- 60	8.39	11.36	44.31	22.58	8.55	2.43	77.9	-	-	-	-
						3- 60	10.22	14.34	42.76	23.39	10.42	3.61	74.3	-	-	-	-
						4- 60	11.80	16.87	41.96	23.83	12.04	4.82	71.4	-	-	-	-
			APT	16.7.04	20.90	1000	10.22	12.21	50.22	-	-	-		-	752	20.3	
2.	**Rajapur**	EW	SDT	10.8.79	5.30	1- 90	30.28	6.76	268.0	3.72	4.63	2.11	-	-	-	-	-
						2- 90	34.57	8.22	252.0	3.96	5.28	2.75	-	-	-	-	-
						3- 90	39.87	10.03	238.0	4.19	6.09	3.66	-	-	-	-	-
						4-90	44.34	11.57	229.0	4.35	6.78	4.53	-	-	-		
						5-90	49.27	13.17	224.0	4.45	7.53	5.59	-	-	-		
			APT	12.8.79	5.30	1290	39.87	10.30	232.0	-	-	-		-	1576	27.4	-
3.	**Haripur**	EW	SDT	04.10.91	1.13	1- 50	5.20	3.83	-	-	3.12	0.68	82.0	-	-	-	-
						2- 50	6.60	5.24	-	-	3.96	1.09	78.0	-	-	-	-
						3- 50	7.60	6.20	-	-	4.56	1.44	75.0	-	-	-	-
						4- 50	9.00	7.52	-	-	5.40	2.03	72.0	-	-	-	-
			APT	05.10.91	0.43	1000	8.33	7.12	70.0	-	-	-	-	-	410	8.5	2.38 x10^{-3}
		OW			3.70		-	0.68	-	-	-	-	-		470		
4.	**Raj-nagar**	EW	SDT	03.9.79	2.0 m agl	1- 60	30.23	17.93	101.0	9.88	16.87	1.18	-	-	-	-	-
						2- 60	34.52	22.27	92.0	10.75	19.26	1.34	-	-	-	-	-
						3- 60	38.30	23.48	97.0	10.22	21.37	1.49	-	-	-	-	-
						4- 60	42.08	24.98	101.0	9.89	23.48	1.64	-	-	-	-	-
			APT	05.9.79	2.0 m agl	720	42.08	25.01	-	-	-	-	-	-	222	4.10	
5	**Sat-chand**	EW	SDT	10.8.79	0.39 m agl	1- 60	17.95	7.80	137.0	7.24	7.70	1.71	-	9.41	-	-	-
						2- 60	21.78	10.24	133.0	7.83	9.36	2.70	-	12.06	-	-	-
						3- 60	25.25	12.09	125.0	7.98	10.80	2.41	-	13.21	-	-	-
						4- 60	26.77	12.97	123.0	8.07	11.52	2.56	-	14.08	-	-	-
			APT	08.9.79	0.425 m agl	600	25.25	12.48	121.0	-	-	-	-	-	887	17.75	-

ANNEXURE-XII (Water Quality)

RESULTS OF CHEMICAL ANALYSIS OF GROUND WATER FROM EXPLORATORY TUBE WELLS CONSTRUCTED BY CGWB

NORTH TRIPURA DISTRICT																		
Sl. No.	Village	Well Type	Test Type	Date of Collection	pH	EC	TH	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4	NO_3	F	Fe
							in PPM											
Deo Basin																		
1.	Pechertal	EW	SDT	15.12.81	8.78	322	5	Tr	Tr	-	-	18	214	7	-	-	-	0.4
					8.66	322	7.5	Tr	Tr	-	-	15	195	7	-	-	-	0.4
					8.96	322	7.5	Tr	Tr	-	-	21	189	7	-	-	-	0.4
			APT	16.12.81	8.9	322	5	Tr	Tr	-	-	18	183	7	-	-	-	0.4
Juri Basin																		
2.	Panisagar BSF (1977)	EW	SDT	28.11.77	6.3	140	34	6.4	4.4	-	-	Nil	54	4	-	-	-	-
			APT	01.12.77	6.3	115	32	6.4	4	-	-	Nil	51	4	-	-	-	12
3.	Panisagar BSF (2005)	EW	SDT	09.9.05	6.35	115	35	6	4.9	-	-	Nil	43	25	1		0.12	-
					6.36	114	30	8	2.4	-	-	Nil	43	18	1		BDL	-
					6.34	113	35	8	3.6	-	-	Nil	43	21	1		0.08	-
					6.37	114	38	4	4.9	-	-	Nil	43	18	1		0.01	-
			APT	10.9.05	-	-	-	-	-	-	-	-	-	-	-	-	-	12.38
					-	-	-	-	-	-	-	-	-	-	-	-	-	21
4.	Dharmanagar	EW			6.5	180	40	14	1	12	2	-	98	7	-	-	-	9.3
5.	Ichaicherra	EW			8.3	180	60	12	7	-	-	-	60	7	-	-	-	-
6.	Tithaigram	EW			8.1	127	40	10	4	-	-	-	50	12	-	-	-	-
7.	Haflongchera	EW			6.8	50	20	8	ND	1	3	-	37	7	-	-	-	7.3
8.	Sanicherra	EW			8	161	50	10	6	-	-	-	65	7	-	-	-	-
Manu Basin																		
9.	Chawmanu	EW			7.7	418	5	1	0.6	-	-	-	49	11	-	-	-	-

DHALAI DISTRICT																		
Sl. No.	Village	Well Type	Test Type	Date of Collection	pH	EC	TH	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4	NO_3	F	Fe
							in PPM											
Dhalai Basin																		
1.	Abhanga	EW	SDT	07.6.79	8.1	130	70	18	6	-	-	0	73	18	-	-	-	0.3

				07.6.79	8.3	140	70	18	6	-	-	Tr	98	25	-	-	-	0.3
				07.6.79	8.3	135	65	20	4	-	-	Tr	92	25	-	-	-	0.25
				07.6.79	8.2	150	75	20	6	-	-	Tr	110	25	-	-	-	0.3
			APT	08.6.79	7.5	150	75	20	6	-	-	0	104	21	-	-	-	0.3
2.	Bhatkhawri	EW	SDT	03.7.79	8.3	110	50	12	5	-	-	Tr	67	14	-	-	-	0.4
				03.7.79	8.1	118	45	12	4	-	-	0	73	11	-	-	-	0.25
			APT	05.7.79	8.3	121	40	12	2.5	-	-	Tr	67	14	-	-	-	0.2
Manu Basin																		
3.	Karamcherra	EW	SDT	25.4.80	8.3	163	45	10	5	-	-	Tr	73	7	-	-	-	0.3
				25.4.80	8.4	146	-	-	-	-	-	-	-	-	-	-	-	0.5
				25.4.80	8.3	142	50	10	6	-	-	Tr	73	7	-	-	-	0.3
				25.4.80	8.2	146	50	12	5	-	-	0	73	7	-	-	-	0.3
			APT	26.4.80	8.1	146	45	10	5	-	-	0	79	7	-	-	-	0.2
4.	Tilakpara	EW	SDT	28.2.79	8	184	65	16	6	-	-	0	98	9	-	-	-	0.3
				28.2.79	7.2	180	65	14	7	-	-	0	92	7	-	-	-	0.3
				28.2.79	8	180	65	16	6	-	-	0	98	7	-	-	-	0.4
				28.2.79	7.8	180	60	12	7	-	-	0	98	7	-	-	-	0.45
			APT-1	25.5.79	8	172	60	14	6	-	-	0	92	7	-	-	-	0.45
			APT-2	25.5.79	7.2	163	60	12	7	-	-	0	90	7	-	-	-	0.45
		OW			7.8	163	55	12	6	-	-	0	79	5	-	-	-	0.4
5.	Chawmanu	EW	SDT	12.5.81	8.45	418	7.5	2	0.6	ND	ND	6	49	14	-	-	-	-
				12.5.81	8.45	408	7.5	1	1	ND	ND	3	49	18	-	-	-	-
				12.5.81	8.5	398	5	1	0.6	ND	ND	9	52	14	-	-	-	-
				12.5.81	7.65	449	7.5	2	0.6	ND	ND	0	52	14	-	-	-	-
			APT	13.5.81	7.7	418	5	1	0.6	ND	ND	0	49	11	-	-	-	-

KHOWAI DISTRICT																		
Sl. No.	**Village**	**Well Type**	**Test Type**	**Collection Date**	**pH**	**EC**	**TH**	**Ca**	**Mg**	**Na**	**K**	**CO_3**	**HCO_3**	**Cl**	**SO_4**	**NO_3**	**F**	**Fe**
								in PPM (mg/lt)										
Khowai Basin																		
1	Baijalbari	EW	SDT	19.7.79	8.1	105	40	8	5	-	-	Nil	61	14	-	-	-	-
					8.2	100	40	8	5	-	-	Nil	61	14	-	-	-	0.3
			APT	22.7.79	8.1	95	45	8	6	-	-	Nil	67	14	-	-	-	0.2
2	Ashrambari	EW	APT	16.4.80	8.2	89	45	10	5	-	-	Nil	61	7	-	-	-	-
3	Khowai	EW	APT	09.10.77	6.75	222	86	16	11	-	-	Nil	132	2.8	-	-	-	-
4	Balucherra	EW	SDT	01.8.79	8	88	30	6	4	-	-	Nil	43	12	-	-	-	0.4
					7.3	90	35	8	4	-	-	Nil	37	12	-	-	-	0.3
			APT	03.8.79	7.3	88	35	8	4	-	-	Nil	49	12	-	-	-	0.2

WEST TRIPURA DISTRICT																		
Sl. No.	Village	Well Type	Test Type	Collec-tion Date	pH	EC	TH	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4	NO_3	F	Fe
								in PPM (mg/lt)										
Haora Basin																		
1.	Arundhuti nagar	EW	SDT	27.1.82	6.86	154	80	26	4	-	-	Nil	91	7	-	-	-	-
			APT	29.1.82	6.9	150	85	26	5	-	-	Nil	95	7	-	-	-	-
2.	Bodhjung nagar	EW	SDT	24.7.06	7.2	158	40	12	2.4	-	-	Nil	61	18	14	-	0.5	8.9
		OW	APT	28.8.06	7.15	115	35	6	4.9	-	-	Nil	49	11	14	-	0.9	2.5
3.	Lichu-bagan	EW	SDT	25.2.07	6.45	110	40	8	4.7	-	-	Nil	67	7.1	1	-	0.0	12.
					6.95	108	45	8	6.1	-	-	Nil	61	7.1	1	-	0.0	12. 8
					6.95	108	40	8	4.7	-	-	Nil	67	7.1	1	-	0.0	12
					7.02	107	40	8	4.7	-	-	Nil	61	7.1	1	-	0.0	10. 8
			APT	26.2.07	6.95	108	40	8	4.7	-	-	Nil	67	7.1	1	-	0.0	10. 8
					6.99	108	45	8	6.1	-	-	Nil	61	7.1	1	-	0.0	9.3
4.	Narsin-garh	EW	CD	31.10.06	7.12	196	85	16	11	-	-	Nil	104	11	9	-	1.1	3.7
			SDT	17.3.07	6.71	175	70	18	6.1	-	-	Nil	98	7.1	5	-	0.1	5.5
				17.3.07	6.72	174	70	18	6.1	-	-	Nil	92	7.1	4	-	0.1	5.5
				17.3.07	6.71	173	65	18	4.9	-	-	Nil	92	7.1	5	-	0.1	5.4
				17.3.07	6.69	173	65	18	4.9	-	-	Nil	92	7.1	5	-	0.0	5.5
			APT	18.3.07	6.62	175	70	18	6.1	-	-	Nil	98	7.1	4	-	0.0	5.1
				18.3.07	6.63	175	65	18	4.9	-	-	Nil	98	7.1	5	-	0.0	5.1
5.	Belbari	EW	SDT	10.3.85	7.6	240	60	18	5.2	-	-	Nil	65	3.9	-	-	-	4.3
					7.2	230	60	18	5.2	-	-	Nil	60	3.6	-	-	-	4.2
					7.4	235	58	7.4	5.3	-	-	Nil	61	4	-	-	-	3.9
			APT	14.3.85	7.5	240	60	18	5.1	-	-	Nil	65	4.1	-	-	-	4
6.	Jirania Coconut Seed Farm	EW	SDT	04.5.86	8.5	96	6	8	10	-	-	24	49	7	-	-	-	10
				04.5.87	8.2	94	30	8	2	-	-	Nil	85	7	-	-	-	11.2
				04.5.88	8.5	92	30	8	2	-	-	24	49	14	-	-	-	11.5
				04.5.89	8.2	96	30	8	2	-	-	Nil	98	7	-	-	-	12.2
			APT	06.5.86	8.1	92	30	8	2	-	-	Nil	73	7	-	-	-	10
7.	GPA	EW	SDT	28.7.80	6.7	80	30	8	3	-	-	Nil	38	7	-	-	-	-
					6.9	86	30	8	3	-	-	Nil	33	7	-	-	-	-
					6.66	90	35	10	3	-	-	Nil	36	7	-	-	-	-
					7.1	80	30	8	3	-	-	Nil	36	7	-	-	-	-
			APT	30.7.80	6.9	92	35	8	4			Nil	35	7				0.3 5
8.	Salbagan	EW	SDT	24.8.79	7.45	105	9	35	6	-	-	Nil	49		-	-	-	5
					7.25	90	9	50	10	-	-	Nil	67		-	-	-	6
					7.5	100	9	45	10	-	-	Nil	49		-	-	-	5
			APT	26.8.79	6.5	92	18	30	6			Nil	49					4
9.	Champ-aknagar	EW	APT		8.1	236	100	32	5	-	-	Nil	98	21	-	-	-	-

SEPAHIJALA DISTRICT																		
Sl. No.	Village	Well Type	Test Type	Collec-tion Date	pH	EC	TH	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4	NO_3	F	Fe
								in PPM (mg/lt)										
Burigang Basin																		
1	Golaghati	EW	SDT	06.7.87	7.3	305	90	18	11	35	-	Nil	165	21	-	-	-	-
					7.5	305	85	22	7	25	-	Nil	153	11	-	-	-	2
					7.6	305	85	28	11	24	-	Nil	153	11	-	-	-	-
					7.6	294	85	18	12	19	-	Nil	153	11	-	-	-	-
					7.7	283	85	20	9	23	-	Nil	153	11	-	-	-	-
			APT	09.7.87	7.5	294	100	20	12	23	-	Nil	153	14	-	-	-	2
				10.7.87	7.6	294	90	22	9	21	-	Nil	153	11	-	-	-	1.8
2	Gokulnagar	EW	APT	30.3.76	8.15	123	60	10.02	8.5	-	-	Nil	92	7	-	-	-	-

GOMATI DISTRICT																		
Sl. No.	Village	Well Type	Test Type	Date of Collec-tion	pH	EC	TH	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4	NO_3	F	Fe
								in PPM (mg/lt)										
Gomati Basin																		
1	Dupthali	EW	SDT	11.12.91	6.89	179	85	22	7	10	2	Nil	73	21	-	-	-	5.4
					6.78	189	90	22	8	10	2	Nil	85	14	-	-	-	5
					6.78	188	85	22	7	10	2	Nil	79	14	-	-	-	5
			APT	14.12.91	7.2	188	80	22	6	8	2	Nil	73	14	-	-	-	4.9
2	Tulamura	EW	SDT	20.7.79	8.3	190	115	26	12	-	-	Tr	128	11	-	-	-	-
					8.3	185	120	26	13	-	-	Tr	122	14	-	-	-	-
			APT	21.7.79	8.6	210	115	20	16	-	-	9	122	11	-	-	-	0.4
3	Ompinagar	EW	APT	18.5.76	7.4	106	35	10	2.4	-	-	Nil	79	7	-	-	-	-

SOUTH TRIPURA DISTRICT																		
Sl. No.	Village	Well Type	Test Type	Date of Collec-tion	pH	EC	TH	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4	NO_3	F	Fe
							in PPM (mg/lt)											
Muhari Basin																		
1.	Rajanagar	EW	SDT	03.9.79	7.6	130	65	16	6	-	-	Nil	80	14	-	-	-	-
					6.9	135	65	16	6	-	-	Nil	91	14	-	-	-	0.45
			APT	04.9.79	6.9	130	65	16	6	-	-	Nil	85	14	-	-	-	-
2.	Rajapur	EW	SDT	10.8.79	8	116	50	16	2.5	-	-	Nil	73	14	-	-	-	-
					7.7	120	50	16	2.5	-	-	Nil	61	11	-	-	-	0.3
			APT	12.8.79	8.1	120	55	16	4	-	-	Nil	67	11	-	-	-	0.2
3.	Matai	EW			6.7	82	25	6	2	4	2	-	31	11				5
4.		EW			8	56	40	10	4	2	2	-	31	11				4.8

	Ghoshkhamar																	
Fenny Basin																		
5.	Haripur	EW	SDT	04.10.91	7.74	45	25	8	1	1	3	Nil	18	7	-	-	-	1.9
					7.56	40	25	8	1	1	3	Nil	18	7	-	-	-	1.3
					7.63	41	25	8	1	1	3	Nil	18	7	-	-	-	1.2
					7.63	40	25	8	1	1	3	Nil	18	7	-	-	-	1.2
			APT	05.10.91	7.56	42	25	8	1	1	3	Nil	18	7	-	-	-	0.7
				06.10.91	7.33	77	65	14	7	10	3	Nil	49	18	-	-	-	0.2
6.	Satchand	EW	SDT	07.9.79	6.9	130	75	16	8.5	-	-	Nil	92	9	-	-	-	-
			APT	08.9.79	7.1	130	70	14	8.5	-	-	Nil	92	9	-	-	-	0.4