

# 3

## THE EXISTING ENVIRONMENT

### 3.1 Introduction

A clear understanding of both the physical and biological characteristics of the local environment is important in the planning for the drilling operation in Assam (India). Identification of both typical and extreme physical conditions that may occur over the drilling period for the proposed exploration allows prediction of the fate of any discharges from drilling operations and also enables selection of the appropriate rig, equipment and training, thereby maximizing levels of safety for the duration of the operation and minimizing the damage to local environment.

Knowledge of the characteristics of the local biological environment allows an understanding of the potential for the operations to interact with the flora and fauna so that appropriate controls can be adopted to mitigate negative impacts.

#### 3.1.1 Project Location

The Exploratory block AA-ONN-2004/4 is located in Tinsukia, district of Assam, in the northeastern part of India. The district lies between the Latitude 27°23' to 27°48' North and Longitude 95°22' to 95°38' East. Tinsukia District is in Upper Assam and bounded by, in East-South by Arunachal Pradesh, In the South-west by Dibrugarh District and in North by Dhemaji District which is separated from Tinsukia District by the mighty river Brahmaputra. The proposed block spreads over an area of 95 sq. km, and has 6.9 percent of the block area under Upper Dihing Reserve Forest. The block has a major river Buridihing with tributaries Penari Jan, Manmau Jan and Mugan Pani. The area is undulating with height upto 4000 ft. above mean sea level.

### 3.2 Climate and Meteorology

#### 3.2.1 Climate

The climate of the study area is humid and tropical. A hot and humid pre-monsoon from March to mid May, a prolonged southwest monsoon or rainy season from mid May to September, a pleasant post-monsoon or retreating monsoon from October to November and a cold pleasant winter from December to February are the characteristics of the general climate. Summer runs concurrently with the later part of the pre-monsoon season and continues throughout the monsoon season.

The four climatic seasons viz. pre-monsoon, monsoon, post-monsoon and winter could be considered as comprising of the following months:

Pre-monsoon	:	March, April and May
Monsoon	:	June, July, August and September
Post-monsoon	:	October and November
Winter	:	December, January and February

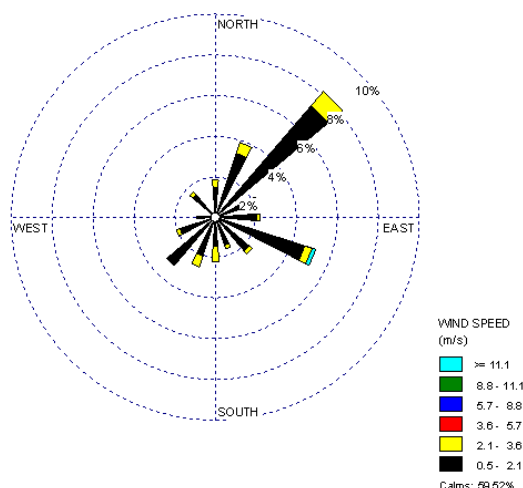
Sometimes, the monsoon commences in mid-May and ends in mid-September. Therefore, the boundaries between the seasons are not very rigid.

### 3.2.2 Temperature

The hottest months were May to September with mercury reaching 42°C during June. The coldest months were December, January and February when temperature drops to 5°C. The months, November and March, can also be quite cold in some years. During the other months, temperature was more or less moderate in nature and pleasant to bear.

### 3.2.3 Meteorology

Meteorology data has been collected from the nearest IMD observatory located at Dibrugarh. Based on the available data for the Period Dec 2007 to January 2008. In the study area, January has the highest temperature variation with minimum temperature of 7 °C and maximum of 32 °C. The air in the study area is humid throughout the major part of the year. The wind rose diagram for period December to January (2008) has been prepared based on on-site data presented in **Figure 3.1**.



Wind Direction: Wind Blowing from  
**Fig. 3.1: Wind Rose Diagram for Winter Season**

## 3.3 Air Environment

### 3.3.1 Ambient Air Quality Monitoring

#### 3.3.1.1 Ambient Air Quality Monitoring Stations

The ambient air quality in the block was monitored during the 20 Dec 2007 to 31 Jan 2008. Eight Monitoring Stations were set up for this purpose to monitor ambient air quality. In selecting the monitoring stations, the main considerations were the ready accessibility, topography and presence of hills and forests, security, availability of reliable power supply on a 24-hour basis, dominant wind direction and even distribution of sampling locations in the block. The AAQM sampling locations are described below in **Table 3.1** and shown in **Fig 3.2**

**Table 3.1: Ambient Air Quality Monitoring Stations**

Station	Name of the Sampling Station
AQ1	Margaretta
AQ2	Ketetang
AQ3	Mannogaon
AQ4	Longgoan
AQ5	Bansbari
AQ6	Ulupmani
AQ7	Khathangpani
AQ8	Tokopathar

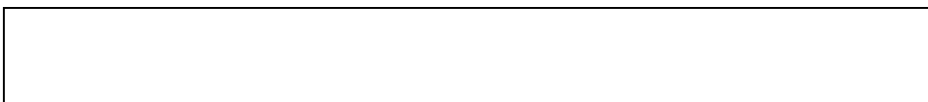
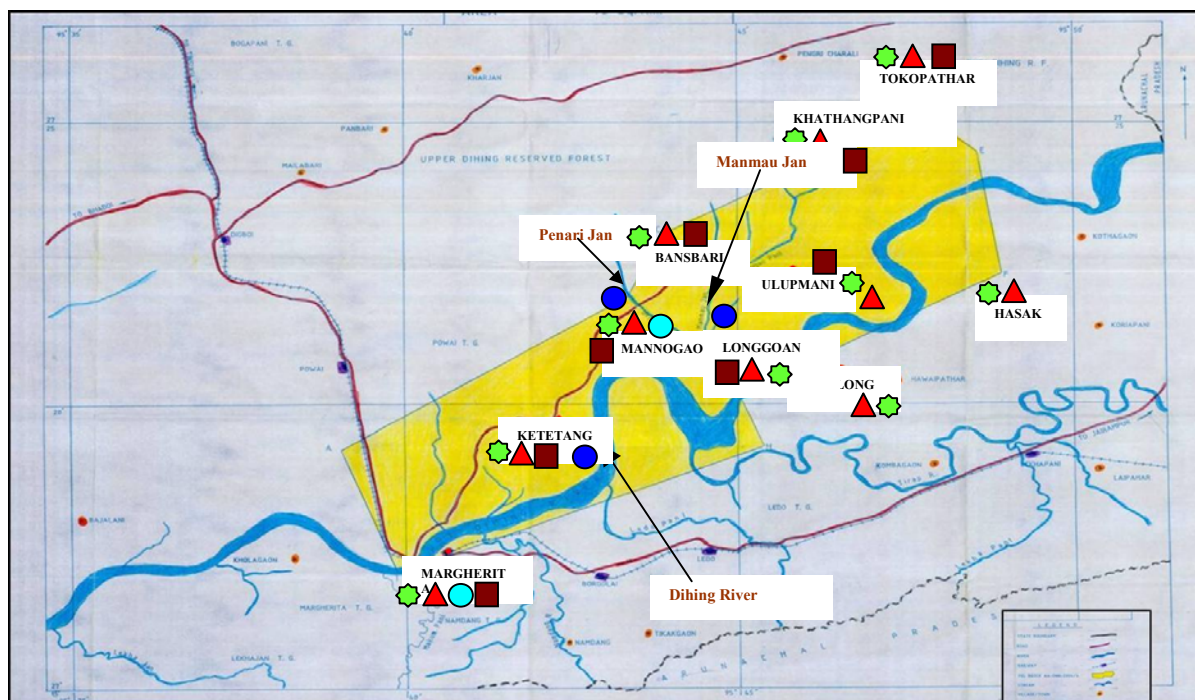
### 3.3.1.2 Parameters, Frequency and Monitoring Methodology

The following parameters were measured for the duration of ~~XXX~~60 days.

- Suspended Particulate Matter (SPM)
- Respirable Particulate Matter (RPM)
- Sulphur Dioxide (SO<sub>2</sub>)
- Oxides of Nitrogen (NO<sub>x</sub>)
- Hydrocarbons (HC)
- Volatile Organic Compounds (VOCs)

Ambient air quality monitoring was conducted over five weeks period (December 20- January 31, 2008) at frequency of twice a week at each station adopting a 24-hours schedule.

The equipment was placed at open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results. While placing the sampler it was ensured that it is free from any vertical obstruction within a cone of 120° from its actual position so that any impedance to the pollutants from entering into the sampler was avoided. The equipments were placed at the open, away from dense tree and vegetation cover, which act as a sink for pollutants resulting in lower than normal levels during the monitoring. At all locations, the sampler was placed at a distance of at least 100 m from highways/roads to avoid inclusion of traffic-related emissions. Methods suggested by CPCB, New Delhi were used for sample collection and analysis.



**Figure: 3.2 Monitoring Location Map**

### 3.3.1.3 Monitoring Results

The monitoring results of SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub>, HC and VOCs corresponding to air quality stations AQ1 to AQ8 are presented in **Annex 1**. Monitoring station-wise statistical analysis (minimum and maximum) for measured level of SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub>, HC and VOCs in the study area for the monitoring period are shown parameter wise in **Table 3.2 to 3.6**.

### 3.3.2 Ambient Air Quality in the Study Area

#### 3.3.2.1 Suspended Particulate Matter (SPM)

The 24-hourly average SPM level varied station wise between 30 µg/m<sup>3</sup> (at AQ8) to 65 µg/m<sup>3</sup> (at AQ1). The overall ranges of values for the entire period of measurement are well within the prescribed limits irrespective of category of area. Due to vehicular traffic and human activities the value SPM found to be more at some locations. All the cases within the study area the 24-hourly average value of SPM were observed to be below the limit of 200 µg/m<sup>3</sup> for residential and commercial area and 100 µg/m<sup>3</sup> for sensitive area. The summary of SPM levels monitored in the study area has been given in **Table 3.2**.

**Table 3.2: Summary of SPM Levels Monitored in the Study Area**

Location Code	Station Location	Area Category	24-hourly Average SPM ( $\mu\text{g}/\text{m}^3$ )		
			Min	Max	Limit
AQ1	Margaretta	Commercial	42	65	200
AQ2	Ketetang	Residential	39	57	200
AQ3	Mannogaon	Residential	34	61	200
AQ4	Longgoan	Residential	32	58	200
AQ5	Bansbari	Residential	33	54	200
AQ6	Ulupmani	Residential	40	62	200
AQ7	Khathangpani	Residential	32	57	200
AQ8	Tokopathar	Residential	30	59	200

### 3.3.2.2 Respirable Particulate Matter (RPM)

The 24-hourly average values of RPM varied between  $4.9 \mu\text{g}/\text{m}^3$  (at AQ5) to  $17 \mu\text{g}/\text{m}^3$  (at AQ1). It is observed that the concentration of respirable particulate matter at all the stations is well within the prescribed limits for residential, sensitive and commercial area. The summary of RPM levels monitored in the study area has been given in the **Table 3.3**

**Table 3.3: Summary of RPM Levels Monitored in the Study Area**

Location Code	Station Location	Area Category	24-hourly Average RPM ( $\mu\text{g}/\text{m}^3$ )		
			Min	Max	Limit
AQ1	Margaretta	Commercial	9	17	200
AQ2	Ketetang	Residential	5.5	16	200
AQ3	Mannogaon	Residential	5.8	11.7	200
AQ4	Longgoan	Residential	4.9	11.5	200
AQ5	Bansbari	Residential	5	12.2	200
AQ6	Ulupmani	Residential	7.5	14	200
AQ7	Khathangpani	Residential	7	16.1	200
AQ8	Tokopathar	Residential	5.7	12.6	200

### 3.3.2.3 Sulphur Dioxide ( $\text{SO}_2$ )

The 24-hourly  $\text{SO}_2$  level over the entire study area measured at the eight monitoring stations ranged between  $3 \mu\text{g}/\text{m}^3$  (at AQ6) to  $8.9 \mu\text{g}/\text{m}^3$  (at AQ1). The area being mostly covered with the forests and forest villages with very little industrial activities, the  $\text{SO}_2$  levels are expected to be very low. The summary of  $\text{SO}_2$  levels monitored in the study area has been shown below in **Table 3.4**.

**Table 3.4: Summary of  $\text{SO}_2$  Levels Monitored in the Study Area**

Location Code	Station Location	Area Category	24-hourly Average $\text{SO}_2$ ( $\mu\text{g}/\text{m}^3$ )		
			Min	Max	Limit
AQ1	Margaretta	Commercial	4.1	8.9	80
AQ2	Ketetang	Residential	3.5	7.1	80
AQ3	Mannogaon	Residential	3.3	7.5	80
AQ4	Longgoan	Residential	3.1	7.8	80
AQ5	Bansbari	Residential	3.7	7.3	80
AQ6	Ulupmani	Residential	3.0	6.9	80
AQ7	Khathangpani	Residential	3.1	7.7	80
AQ8	Tokopathar	Residential	3.6	8.1	80

### 3.3.2.4 Oxides of Nitrogen (NO<sub>x</sub>)

The 24-hourly NO<sub>x</sub> level over the entire study area measured at the eight monitoring stations ranged between 3.1 µg/m<sup>3</sup> (at AQ2) to 12.6 µg/m<sup>3</sup> (at AQ1). The data depicted that the concentration of oxides of nitrogen at all the stations are well within the prescribed limits for residential and commercial area. The summary of NO<sub>x</sub> levels monitored in the study area has been shown in **Table 3.5**.

**Table 3.5: Summary of NO<sub>x</sub> Levels in the Study Area**

Location Code	Station Location	Area Category	24-hourly Average NO <sub>x</sub> (µg/m <sup>3</sup> )		
			Min	Max	Limit
AQ1	Margaretta	Commercial	3.2	12.6	80
AQ2	Ketetang	Residential	3.1	10.5	80
AQ3	Mannogaon	Residential	6.4	11.2	80
AQ4	Longgoan	Residential	6.8	12.2	80
AQ5	Bansbari	Residential	5.4	9.8	80
AQ6	Ulupmani	Residential	5.7	10.4	80
AQ7	Khathangpani	Residential	5.9	12.3	80
AQ8	Tokopathar	Residential	7.2	11.6	80

### 3.3.2.5 Hydrocarbons (HC)

The sampling for HC has been carried out at five stations (at AQ1, AQ2, AQ4, AQ6, and AQ8). The 8-hourly average value varied between 90 µg/m<sup>3</sup> (at AQ2) and 198 µg/m<sup>3</sup> (at AQ1). The summary of HC levels monitored in the study area has been shown in **Table 3.6**.

**Table 3.6: Summary of HC in the Study Area**

Location Code	Station Location	8-hourly Average HC (µg/m <sup>3</sup> )	
		Min	Max
AQ1	Margaretta	111	198
AQ2	Ketetang	90	185
AQ4	Longgoan	95	189
AQ6	Ulupmani	102	190
AQ8	Tokopathar	99	188

### 3.3.2.6 Volatile Organic Compounds (VOCs)

The sampling for VOCs was carried out at five stations (AQ1, AQ2, AQ4, AQ6, and AQ8). The concentration of VOCs was observed below detectable limit at all locations.

## 3.4 Water Environment

### 3.4.1 Water Quality Monitoring

#### 3.4.1.1 Water Quality Monitoring Locations

Surface water quality data was available at three different sampling stations spread over the Block. Two representative groundwater quality monitoring locations comprising tube wells in

the study area were identified for the monitoring and assessment of groundwater quality. The locations of these stations are given in **Table 3.7** and **Table 3.8** and shown in **Fig 3.2**.

**Table 3.7: Location of the Sampling Stations for Surface water**

Station No	Name of the sampling Location
SW1	Dihing River
SW2	Pennri Jan
SW3	Manmau Jan

**Table 3.8: Ground Water Sampling Stations**

Station	Location of the sampling stations
GW1	Margherita
GW2	Mannogaon

XXXX

#### 3.4.1.2 Frequency and Methodology of Water Quality Monitoring

Grab samples for surface and ground water ~~quality were~~quality were collected and analysed for relevant physical, chemical and biological parameters including few heavy metals, trace elements and toxic constituents. All the basic precautions and care were taken during the sampling to avoid contamination. Analysis of the samples was carried out as per established standard methods and procedures prescribed by the CPCB, e.g. relevant IS Codes (IS:2488 (Part-1 to 5) “Methods for Sampling and Testing of Industrial Effluents”), and “Standard Methods for Examination of Water and Wastewater” published by APHA. The results of surface water and ground water quality have been shown in **Table 3.9** and **3.10**.

**Table 3.9: Physical-Chemical Characteristics of Surface Water**

Source	Temperature	pH	Turbidity NTU	Conductivity   $\mu\text{s/cm}$	Total Hardness as $\text{CaCO}_3$ (mg/L)	Calcium as $\text{CaCO}_3$ (mg/L)	Magnesium as $\text{MgCO}_3$ (mg/L)	Total Alkalinity as $\text{CaCO}_3$ (mg/L)	Total Iron as Fe (mg/L)	Nitrate as N (mg/L)	Ammonical Nitrogen as N (mg/L)	Phosphate as $\text{PO}_4$ (mg/L)	Fluoride as F	Sodium as Na (mg/L)	Potassium as K (mg/L)	Dissolved Oxygen DO (mg/L)	Total Dissolved Solid (mg/L)	Chloride as Cl (mg/L)
<u>RSW1</u>	17°C	7.5	3.2	183	116	98	23	110	0.2	0.16	Trace	0.03	0.05	2.8	1.4	7.3	104	15
<u>SWR2</u>	17°C	7.3	3.7	165	123	104	26	119	0.1	0.14	Trace	0.04	0.04	6.9	2.5	7.2	109	17
<u>SWR3</u>	17°C	7.6	4.5	189	136	89	28	115	0.2	0.15	Trace	0.05	0.07	6.8	2.3	7.7	98	20

**Table 3.10: Physico-Chemical Characteristics of Ground Water**

Source	pH	Temperature	Turbidity NTU	Conductivity   $\mu\text{s/cm}$	Total Hardness as $\text{CaCO}_3$ (mg/L)	Calcium as $\text{CaCO}_3$ (mg/L)	Magnesium as $\text{MgCO}_3$ (mg/L)	Total Alkalinity as $\text{CaCO}_3$ (mg/L)	Chloride as Cl (mg/L)	Total Iron as Fe (mg/L)	Ammonical Nitrogen as N (mg/L)	Fluoride as F	Nitrate as N (mg/L)	Sodium as Na (mg/L)	Potassium as K (mg/L)	Phosphate as $\text{PO}_4$ (mg/L)
GW1	7.1	19°C	1.1	134	73	54.8	16.3	66.2	17.6	0.3	BDL	0.5	0.17	2.6	1.5	0.6
GW2	7.2	19°C	1.3	146	74	63.1	21.6	69.6	15.8	0.2	BDL	0.4	0.19	2.9	1.8	0.4

### 3.4.1.3 Monitoring Results

#### i) Surface water quality in the Study Area

The data can be summarized as follows:

- All the water samples have some amount of turbidity (range: 3.2 – 4.5 NTU), which may be largely due to the turbulence created by the monsoon rains and entry of storm water runoff.
- pH of all the water samples was within the acceptable limit of 7.3 to 7.6.
- Electrical conductivity values varied in a significantly wide range of 165 to 189 mS/cm.
- Phosphate was recorded in all 3 sources (range 0.03 to 0.05 mg/L) but shows a little presence.
- The contents of common metallic constituents viz., calcium, magnesium, sodium and potassium, were in the ranges of Calcium: 89 mg/L (SW3) – 104 mg/L (SW2), Magnesium: 23 mg/L (SW1) – 28 mg/L (SW3), Sodium: 2.8mg/L (SW1) – 6.9 mg/L (SW2), and Potassium: 1.4 mg/L (SW1) – 2.5 mg/L (SW2).

#### ii) Ground Water Quality Monitoring

The results of ground water quality monitoring are summarized as follows:

- The water samples were clear and transparent with little amount of turbidity (range: 1.1– 1.3 NTU).
- Electrical conductivity values varied in a wide range of 134  $\mu$ S/cm (at GW1) to 146  $\mu$ S/cm (at GW2) – indicating the presence of considerable amount of ionic matter in ground water.
- Chloride recorded appreciable contents in the ground water samples. The chloride content was found at the source GW1 is 17.6 mg/L and 15.8 mg/L was measured at the source GW2.
- Phosphate was recorded at sources range 0.4 to 0.6 mg/L. The contents are very low and insignificant.

The contents of calcium, magnesium, sodium and potassium, were in the ranges of Calcium: 54.8 mg/L (GW1) – 63.1 mg/L (GW2), Magnesium: 16.3 mg/L (GW1) – 21.6 mg/L (GW2), Sodium: 2.6 mg/L (GW1) – 2.9 mg/L (GW2), and Potassium: 1.5 mg/L (at GW1) - 1.8 mg/L (GW2). All these values are within prescribed limits.

### 3.5 Land Environment

The land environment was studied in terms of soil quality and land use pattern.

#### 3.5.1 Physio-Chemical Characteristics of Soil

The Physio-chemical characteristics of the soil in the study area were examined by obtaining soil samples from selected points and by analysis of the same. Quality data are available from ten sampling stations. The soil sampling locations are given in **Table 3.11** and shown in **Fig 3.2**. The soil quality data is described in **Table 3.12**.

**Table 3.11: Location of the Soil Sampling Stations**

Station	Location of the sampling stations
SQ1	Margaretta
SQ2	Ketetang
SQ3	Mannogaon
SQ4	Longgoan
SQ5	Bansbari
SQ6	Ulupmani
SQ7	Khathangpani
SQ8	Tokopathar
SQ9	Toklong
SQ10	Hasak

**Table 3.12: Physico-Chemical Characteristics of Soil Samples**

Source	Soil Type	pH	% organic matter	% Carbon	Sodium mg/gm	Potassium mg/gm	%TK N	T.Phos Mg/gm	Pb	Zn mg/gm	Cu mg/gm	T.Cr Mg/gm	Ni mg/gm	% water holding capacity	C.d. mg/gm
S1	Clay loam	5.2	1.95	0.93	0.14	0.04	0.33	1.4	BDL	0.003	0.006	BDL	BDL	53.5	BDL
S2	Clay loam	5.5	1.56	0.91	0.15	0.03	0.35	1.6	BDL	0.005	0.005	BDL	BDL	53.5	BDL
S3	Clay loam	5.8	1.78	1.20	0.19	0.08	0.36	1.7	BDL	0.007	0.068	BDL	BDL	49.4	BDL
S4	Clay loam	5.7	1.54	1.16	0.13	0.04	0.33	1.3	BDL	0.008	0.002	BDL	BDL	52.4	BDL
S5	Clay loam	5.1	1.98	1.323	0.28	0.08	0.38	1.8	BDL	0.006	0.019	BDL	BDL	51.5	BDL
S6	Clay loam	5.4	1.68	1.38	0.24	0.03	0.33	1.5	BDL	0.001	0.005	BDL	BDL	51.8	BDL
S7	Clay loam	5.7	1.62	1.15	0.26	0.07	0.39	1.8	BDL	0.038	0.007	BDL	BDL	52.7	BDL
S8	Clay loam	5.5	1.71	1.27	0.28	0.04	0.33	1.3	BDL	0.008	0.008	BDL	BDL	55.2	BDL
S9	Clay loam	5.8	1.79	1.31	0.15	0.07	0.40	1.5	BDL	0.003	0.008	BDL	BDL	57.2	BDL
S10	Clay loam	5.1	1.83	1.28	0.18	0.06	0.37	1.7	BDL	0.009	0.005	BDL	BDL	56.6	BDL

The parameters were selected with the objective of acquiring insight into the physical, chemical and fertility characteristics of the soil. The following conclusions could be made from the data generated below.

- Soil pH varied in the range 5.1 – 5.8 with an average value of 5.5. The soil of the study area is acidic in character. Soil samples are loamy and red grey in colour
- Water holding capacity is one of the most important significant parameters to evaluate the soil strength, development of root system etc. The soil in the study area may be considered as having relatively good water retaining capacity, a property very essential for rising of crops. Its values found in the range of 49.4 % to 57.2 % indicating suitable for vegetation.
- Hydraulic conductivity is an important soil property which governs the soil water flow, movement of water to roots, evaporation of water from surface soil etc, and water movement through soil is governed by a number of factors such as gravitational, adsorption and osmosis.
- The values of percent organic matter and percent carbon in the soil sample are in satisfactory level in respect to plant productivity. The value of percent organic matter is found in the range 1.54 to 1.98 percent and carbon in range of 0.91 to 1.38 percent.
- It is observed that the main nutrient parameters i.e. Nitrogen and Phosphate of the soil in all the samples are well within the suitable range 0.33% - 0.40% of TKN (Total Kjeldahl Nitrogen) and 1.30 mg/gm – 1.8 mg/gm of phosphate. Presence of suitable amount of nitrogen in the soil encourages the above ground vegetation growth and gives deep green color to the plant leave. Similarly phosphate has an important role in plant growth and production.
- Sodium and potassium, the two commonly occurring metals in all soils, were found in ranges of Sodium: 0.13–0.28 mg/gm, potassium: 0.03-0.08 mg/gm. The important role of potassium is a good activator of enzymes responsible for plant metabolic process and also increases crop resistance. The sodium content at soil sample S<sub>5</sub> also observed slightly high due to some industrial discharge containing total dissolved solids.
- The metal content of the soil is quite normal as revealed by the analysis. Toxic metals i.e. Pb, Cr, Ni, Cd are found below detectable limit. Zn and Cu content in the soil are in satisfactory level.

### 3.5.2 Conclusion from Soil Analysis

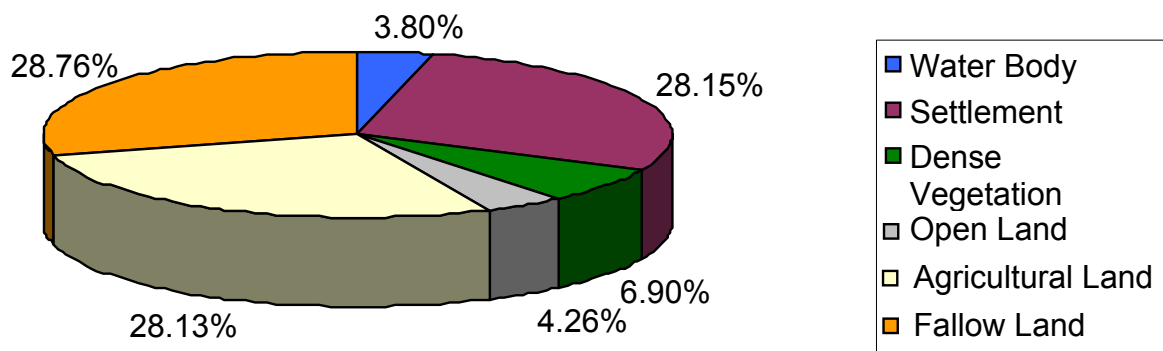
The Soils in the study area are acidic in nature with average pH level of below 6.0. The soils possess good amounts of the nutrient elements, nitrogen, phosphorus and potassium and the levels of the other elements are also within the limits. The overall fertility status of the soils within the study area can be considered as satisfactory and not detrimental to the growth of agricultural and forest crops.

### 3.5.3 Land use pattern:

The land of the proposed study area is covered mostly by fallow and agricultural land. The land use pattern in the survey area is shown in the **Table 3.13** and **Fig 3.3**

**Table 3.13: Land Use Pattern of the Study Area**

Land Use	Area (%)
Fallow Land	28.76
Agriculture Land	28.13
Settlement	28.15
Open Land	4.26
Dense Vegetation	6.90
Water Body	3.80



**Fig 3.3: Landuse pattern of the Study Area**

#### **3.5.4 Satellite data-Records:**

The LANDSAT image has been procured and data was used for land use/land cover study. The view of classified satellite image is shown in **Fig. 3.4**.

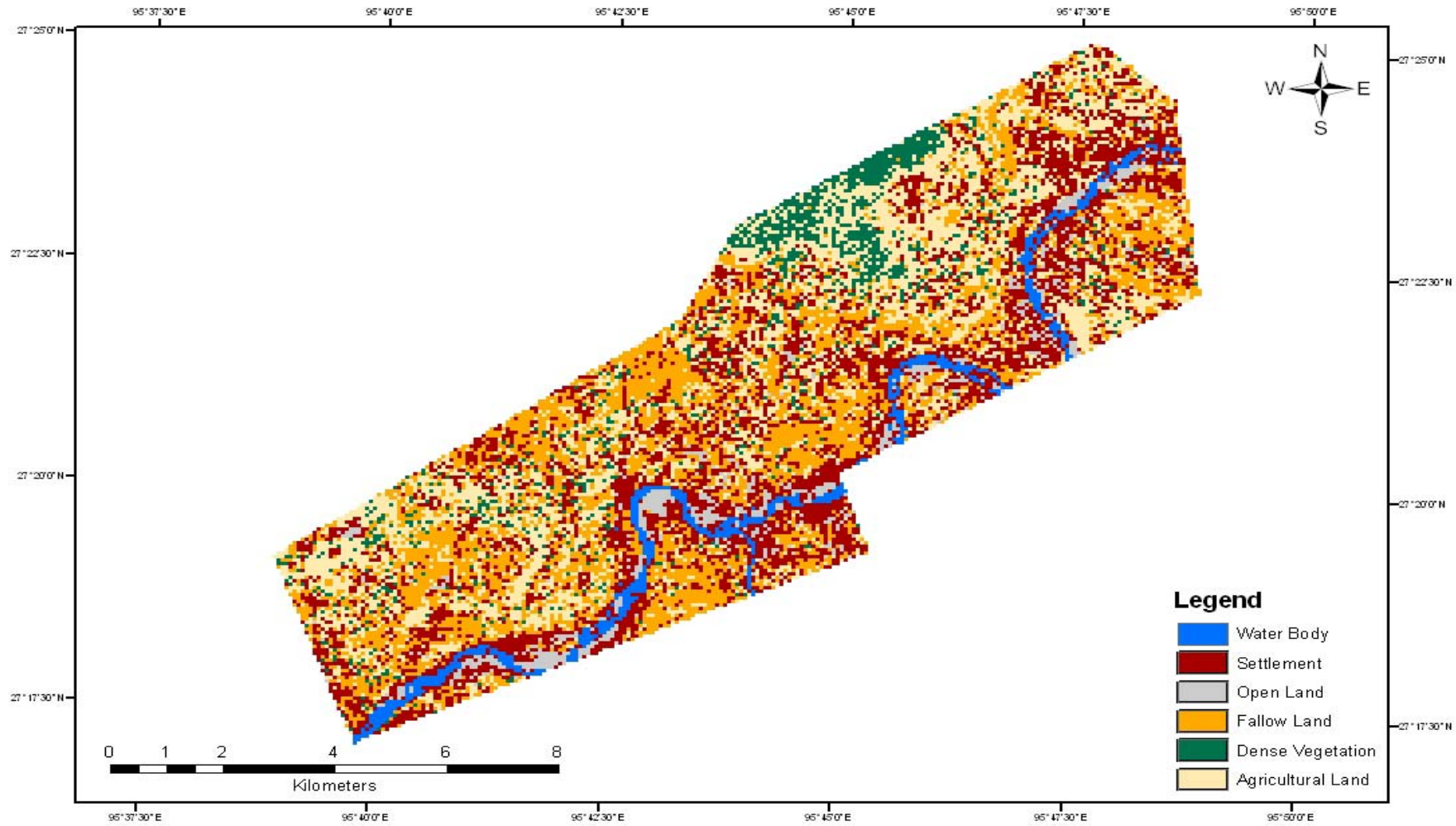


Fig.3.4 Classified LANDSAT Image of the Study Area

### 3.6 Noise Environment

#### 3.6.1 Major sources of noise in the study area:

- Noise made by normal human activities and by domestic animals,
- Natural noise, consisting of sounds made by birds, animals and insects, and also by wind particularly in the forest area,
- Noise made by vehicles, carts, etc., and
- Noise made by occasional movement of machineries, operation of pumps, etc.

The purpose of noise monitoring at different locations is obtain baseline noise levels for future reference.

#### 3.6.2 Ambient Noise Monitoring

##### 3.6.2.1 Noise Monitoring Locations

Ambient noise monitoring was conducted to assess the background noise levels in the study area. A total of ten locations within the study were selected for the measurement of ambient noise levels covering commercial and residential and silence areas. Noise monitoring was carried out on a 24-hour basis to assess the baseline noise-levels and to evaluate the impact, if any. The locations selected for the study are given in **Table 3.14** and shown in **Fig 3.2**. The ~~XXXX~~summary of ambient noise levels monitored in the study area is given in **Table 3.15**.

**Table 3.14: Location of the Noise Monitoring Stations**

Sr No	Name of the Location	Location Number
1	Margaretta	N1
2	Ketetang	N2
3	Mannogaon	N3
4	Longgoan	N4
5	Bansbari	N5
6	Ulupmani	N6
7	Khathangpani	N7
8	Tokopathar	N8
9	Toklong	N9
10	Hasak	N10

Ambient noise level monitoring was carried out during the month of Dec.-January 2008. At each location, noise monitoring was conducted continuously over a period of twenty-four hours to obtain  $L_{eq}$  values at uniform time intervals of 1 hour. For each location, day and night time  $L_{eq}$  values have then been computed from the hourly  $L_{eq}$  values such that comparison could be made with the national ambient noise standards.

Day time  $L_{eq}$  has been computed from the hourly  $L_{eq}$  values between 6.00 a.m. and 10.00 p.m. and night time  $L_{eq}$  from the hourly  $L_{eq}$  values between 10.00 p.m. and 6.00 a.m. using the following formula:

$$L_{eq\ day} = 10 \log \frac{1}{16} \sum_{i=1}^{16} 10^{\frac{L_i}{10}} \quad L_{eq\ night} = 10 \log \frac{1}{8} \sum_{i=1}^8 10^{\frac{L_i}{10}}$$

where,  $L_i = L_{eq}$  value of the  $i^{th}$  hourly time interval.

**Table 3.15: Summary of Ambient Noise Levels Monitored in the Study Area**

Location Code	Station Location	Area Category	Day		Night	
			Lmin	Lmax.	Lmin	Lmax.
N1	Margaretta	Commercial	40	63	34	49
N2	Ketetang	Residential	33	55	28	48
N3	Mannogaon	Residential	38	58	31	45
N4	Longgoan	Residential	34	56	29	43
N5	Bansbari	Residential	39	59	32	45
N6	Ulupmani	Residential	36	56	31	41
N7	Khathangpani	Residential	31	61	30	39
N8	Tokopathar	Residential	37	59	31	38
N9	Toklong	Residential	33	62	28	40
N10	Hasak	Residential	38	61	29	44

Area category: *I-Industrial, C-Commercial, R-Residential, S-Silence zone*

Day time: 6.00 a.m. to 10.00 p.m.

Night time: 10.00 p.m. to 6.00 a.m.

Permissible ambient noise standards in dB (A):

Industrial Area : Day time: 75, Night time: 70

Commercial Area : Day time: 65, Night time: 55

Residential Area : Day time: 55, Night time: 45

Silence Zone : Day time: 50, Night time: 40

### 3.6.3 Analysis of the Data

**Residential Area:** The population density in the residential area is very thin. Assessment of noise level was carried out at various places to evaluate the ambient noise level in the residential area as well as possible impact due to project activities. The values of noise level, which are recorded lies between 31 dB (A) to 63 dB (A) at day time and 28 dB (A) to 48 dB (A) at night time. This is due to activities during daytime. On the other hand the noise level in the night time is well within the permissible limit.

**Commercial Area:** The noise level at commercial area varied between 40 dB (A) to 63 dB (A) at day time and 34dB (A) to 49 dB (A) at night time which is within the prescribed limit.

### 3.7 Biological Environment

The objective of the biological environment study is

- To assess the floristic composition of the forests
- To assess the animals and plants in the aquatic ecology area.
- Identification of sensitive areas with respect to species (endangered).
- To assess the animal and plants available in the terrestrial ecology area.

### 3.7.1 Floristic Composition:

### 3.7.2 Agriculture and Agronomy

The agriculture in the block has two cropping patterns namely:

- 1) Food crops
- 2) Plantation of commercial plants/ trees.

The important food crop is paddy. Other crops are sweet potato and local vegetables varieties. Tea is a major commercial crop in the area.

### 3.7.3 Tree Species

Upper Dihing reserved forest is located on the northern side of the block. The common tree species observed in the study area, both cultivated and naturally growing is shown in the Table 3.16 below.

**Table 3.16: Tree Species Grown in the Study Area (Both Cultivated and naturally growing).**

Scientific Name	Local Name	Scientific Name	Local Name
1. <i>Gmelina arborea</i>	Gameri	24. <i>Biscofia javanica</i>	Uriam
2. <i>Lagerstroemia parviflora</i>	Sida	25. <i>Delonix regia</i>	Radhasura
3. <i>Lagerstroemia Speciosa</i>	Ajaha	26. <i>Bombax ceiba</i>	Simalu
4. <i>Ficus hispida</i>	Dimaru	27. <i>Caeslpinia pulcherima</i>	Krishnasura
5. <i>Tetrameles nudiflora</i>	Bheleu	28. <i>Dipterocarpus macrosorpus</i>	Hollong
6. <i>Terminalia chebula</i>	Silikha	29. <i>Canarium bengalensis</i>	Dhuna
7. <i>Terminalia myricarpa</i>	Hollokh	30. <i>Euclyptus sp.</i>	--
8. <i>Tactona grandis</i>	Segun	31. <i>Artocarpus intergifolia</i>	Kathal
9. <i>Psidium gujava</i>	Madhuriam	32. <i>Dillenia indica</i>	Outenga
10. <i>Melia azedarch</i>	Ghoraneem	33. <i>Gravelia robusta</i>	Solver oat
11. <i>Mangifera indica</i>	Aam	34. <i>Annona squamosa</i>	Atlas
12. <i>Mesua ferrea</i>	Nahar	35. <i>Areca catachue</i>	Tabal
13. <i>Michelia champaca</i>	Titachopa	36. <i>Citrus grandis</i>	Rabab tenga
14. <i>Pongamia pinnata</i>	Karach	37. <i>Bauhinia variegata</i>	Kanchan
15. <i>Polyalthia longifolia</i>	Debadaru	38. <i>Cocoss nucifera</i>	Narikal
16. <i>Ficus religiosa</i>	Ahat	39. <i>Pterospermum acerifolium</i>	Kanak champa
17. <i>Eugenia pracco</i>	Bogijamu	40. <i>Alibizza lebbek</i>	Sirish
18. <i>Aegle marmelos</i>	Bel	41. <i>Baccaurea sapida</i>	Leteku
19. <i>Acacia auriculoformis</i>	Moj	42. <i>Butea monosperma</i>	Palas
20. <i>Alistonia scholaris</i>	Satiana	43. <i>Zyzphus jujuba</i>	Bagari
21. <i>Anthocephalus sinensis</i>	Kadam	44. <i>Terminalia arjuna</i>	Arjun gosh
22. <i>Alianthus grandii</i>	Borpat	45. <i>Erythrina variegata</i>	Modar
23. <i>Azadirachta indica</i>	Mahaneem	46. <i>Calicarpa arborea</i>	--

The identified non-flowering plants/ ferns species in the area are presented in the following **Table 3.17**.

**Table 3.17: List of Pteridophytes Observed in the Block**

S. No.	Scientific Name
1.	<i>Angiopteris evecta</i>
2.	<i>Dryopteris sp.</i>
3.	<i>Blechnum oriental</i>
4.	<i>Pteris longifolia</i>
5.	<i>Marsilea quqdrifolia</i>
6.	<i>Polypodium sp.</i>
7.	<i>Sellaginella sp.</i>
8.	<i>Lycopodium selago</i>
9.	<i>Adiantum caudatum</i>
10.	<i>Pyrrisia sp.</i>
11.	<i>Pyrrisia sp.</i>
12.	<i>Iygodium sp.</i>
13.	<i>Gleichania montana</i>
14.	<i>Gleichania lineris</i>
15.	<i>Cyathea Khasiana</i>
16.	<i>Pteris semipinata</i>
17.	<i>Stenocleana palustre</i>
18.	<i>Adiantum philippensis</i>
19.	<i>Brynia sinsignis</i>
20.	<i>Chilentea sp.</i>
21.	<i>Salvinia sp.</i>
22.	<i>Azolla sp.</i>

#### 3.7.4 Mammals

The wild life in the Upper Dihing reserved forest is listed in the following **Table 3.18**. Some of these animals stray in the block area due to disturbance in their pathway or habitats by humans.

**Table 3.18: List of Mammals Observed in the Block**

Scientific Name	Local Name
1. <i>Nycticebus coucang</i>	Slow ioris
2. <i>Macaca assamesensis</i>	Assamese macaque
3. <i>Macaca mulatta</i>	Rhesus macaque
4. <i>Tachypithecus pileatus</i>	Capped langur
5. <i>Hylobates hoolock</i>	Hoolock gibbon
6. <i>Elephas maximusmuj</i>	Elephant
7. <i>Sus scrofa</i>	Wild boar
11. <i>Felis chaus</i>	Jungle cat
12. <i>Felis Bengalensis</i>	Leopard cat
13. <i>Viverra zibtha</i>	Large Indian civet
14. <i>Viverricula indica</i>	Small Indian civet
15. <i>Herpestes edwardsi</i>	Common mongoose
16. <i>Herpestes auropunctatus</i>	Small Indian mongoose
17. <i>Canis aureus</i>	Jackel
18. <i>Vulpes bengalensis</i>	Indian fox
19. <i>Ratufa biclour</i>	Malayan giant squirrel
20. <i>Funambulus palmuram</i>	Three-striped palm squirrel
21. <i>Muntiacus muntjak</i>	Barking deer
22. <i>Lutra lutra</i>	Common otter
23. <i>Manis crassiaudata</i>	Indian pangolin
24. <i>Hystrix indica</i>	Indian porcupine
25. <i>Pteropus giganteus</i>	Indian flying fox
26. <i>Ratus ratus</i>	Rat
27. <i>Mus musculus</i>	House mouse
28. <i>Cannomys badius</i>	Bay bamboo rat
29. <i>Bandicota bengalensis</i>	Indian mole rat
30. <i>Ory ctolagus coniculus</i>	Rabbit
31. <i>Canis familiaris</i>	Common dog
32. <i>Felis domesticus</i>	Domestic cat

### 3.7.5 Avifauna:

The lists of avifauna observed in the Upper Dihing reserved forest is given in the **Table 3.19**. Some of these birds are also observed in the block.

**Table 3.19: List of Avifauna Observed in the Block**

<b>Scientific Name</b>	<b>Common Name</b>
1. <i>Acridotheres tristis</i>	Common myna
2. <i>Acridotheres fuscus</i>	Jungle myna
3. <i>Sturnus contra</i>	Pied myna
4. <i>Gracula religiosa</i>	Hill myna
5. <i>Corvus splendens</i>	House crow
6. <i>Corvus macrohynchos</i>	Jungle crow
7. <i>Passer domesticus</i>	House sparrow
8. <i>Dicrurus adsimilis</i>	Black drongo
9. <i>Dicrurus remifer</i>	Lesser racket-tailed drongo
10. <i>Dicrurus paradiseus</i>	Greater racket-tailed drongo
11. <i>Pycnonotus jocosus</i>	Red-whiskered bulbul
12. <i>Pycnonotus cafer bengalensis</i>	Red ventured bulbul
13. <i>Pycnonotus melaniclerus flaviventris</i>	Black cavorted yellow bulbul
14. <i>Halcyon smyrnesis</i>	White breasted kingfisher
15. <i>Alcedo atthis</i>	Blue kingfisher
16. <i>Micropternus brachyurus</i>	Rufus woodpecker
17. <i>Gecinulus grantia</i>	Pale-headed woodpecker
18. <i>Dinopium javanense</i>	Golden-beaked three-toed woodpecker
19. <i>Trichastoma tickelli</i>	Tickell's babbler
20. <i>Turdoides striatus</i>	Jungle babbler
21. <i>Motacilla flava</i>	Yellow wagtail
22. <i>Motacilla cinerea</i>	Gray wagtail
23. <i>Nectarinia asiatica</i>	Purple sunbird
24. <i>Estrilda amandava</i>	Red munia
25. <i>Oriolus oriolus</i>	Golden oriole
26. <i>Oriolus xanthornus</i>	Black hooded oriole
27. <i>Magalaima franklinii</i>	Golden throated barbet
28. <i>Anthracoceros albirustris</i>	Indian pied hornbill
29. <i>Bucerus bicornis</i>	Great pied hornbill
30. <i>Upupa epops</i>	Hoopoe
31. <i>Coracias bengalensis</i>	Indian roller
32. <i>Merops orientalis</i>	Green beceater
33. <i>Apus affinis</i>	House swift
34. <i>Cuculus sparverioides</i>	Cuckoo

Scientific Name	Common Name
35. <i>Psittacula krameri</i>	Ruse-ringed parakeet
36. <i>Psittacula alexndri</i>	Red breasted parakeet
37. <i>Streptopelia chinensis</i>	Spotted dove
38. <i>Treron apicauda</i>	Pin-tainted green pigeon
39. <i>Metopidius indicus</i>	Bronze winged jacana
40. <i>Gallus gallus</i>	Red jungle fowl
41. <i>Lophura leucomelanos lathami</i>	Kaleej pheasant
42. <i>Spliornis cheela</i>	Crested-serpent eagle
43. <i>Milvus migrans lineatus</i>	Pariah kite
44. <i>Circus melanoleucos</i>	Pied harrier
45. <i>Ardeola grayjee</i>	Pond heron
46. <i>Bubulcus ibis</i>	Cattle egret
47. <i>Ardea alba</i>	Large egret
48. <i>Egretta intermedia</i>	Small egret
49. <i>Egretta garzetta</i>	Little egret
50. <i>Anhinga melanugaster</i>	Snake bird
51. <i>Phalacrocorax carbo</i>	Large cormorant
52. <i>Phalacrocorax niger</i>	Little cormorant
53. <i>Pericrocotus flammeus</i>	Scarlet minivet
54. <i>Eudynamys scolopacea</i>	Koel

### 3.8 The Socio-Economic Environment

To assess the anticipated impacts of the proposed activities on the socio-economic aspects of people, it is necessary to study the existing socio-economic status of the local population, which will be helpful for making efforts to further improve the quality of life in the area.

The sociological aspects of this study include human settlements, demography and social strata and literacy levels besides infrastructure facilities available in the area.

The economic aspect includes occupational structure of people. The baseline demographic and socio-economic characteristics with regards to demography, literacy and occupational status have been described based on the data obtained from Census of India, 2001.

#### 3.8.1 Demographic Aspect:

The demographic aspects of the study area are given in **Table 3.20**. The names of villages falling in the block are Ketetang, Mannogaon, Longgoan, Bansbari, Ulupmani, Khathangpani and Tokopathar. The only town of the block area Margareta is located on the south west corner of the block.

**Table 3.20: Demographic Features of the Area**

District	Population	
Tinsukia	Total	1,150,062
	Rural	926, 105
	Urban	223, 957
	Males	601, 099
	Females	548, 963

Source: Census of India 2001, Assam

Tinukia district has 2.72 % of SC and 5.85 % of ST population. The sex ratio is 913 females per 1000 males. The population density is 303 persons per sq. Km.

### 3.8.2 Household Size

The district has average family of 5 persons per household. This is considered to be normal family size. But considering the area, the population density is 303 persons per sq. Km. Type of household detail are given below in Table 3.31.

**Table 3.21 Type of Household**

S. No.	Households	Number
1.	Number of Households	218, 885
2.	<b>Type of Households</b>	<b>% of Household Occupy</b>
a.	Permanent	33.6
b.	Semi-permanent	25.6
c.	Temporary	40.8

### 3.8.3 Literacy and Educational level

The literacy rate and educational level is shown in the **Table 3.22** below.

**Table 3.22 Literacy rate in the block area**

Number of Literates	
Persons	588, 302
Males	355, 444
Females	232, 858
Literacy Rate (%)	
Persons	60.95
Males	70.15
Females	50.78
Educational Level Attained	
Total	588, 302
Without Level	15, 110
Below Primary	166, 316
Primary	143, 102
Middle	109, 758
Matric/Higher Secondary/Diploma	129, 043
Graduation and above	24, 927

### 3.8.4 Occupational structure:

The occupational structure of the people in the block is studied with reference to the main workers and marginal workers. The occupational structure of the district is shown in **Table 3.23** below.

**Table 3.23: Occupational Structure of the District**

S. No.	Workers	Number of Persons
1.	Total Workers	466, 351
2.	Main Workers	349, 847
3.	Marginal Workers	116, 504
4.	Non – Workers	683, 711

### 3.8.5 Livestock And Pisciculture

Live stock rearing is a common practice of the entire tribal. It plays an important role in the socio-economic life of the tribal. Generally, animal and birds are reared for food as well as social and religious purposes. In the Tribal society, sometime, the number of livestock one possesses also assesses socio-economic status of a person or the family. Fishing is an alternative means of supply of food in these interior places.

### 3.8.6 Textile And Handicrafts:

The peoples are also expert in cane and bamboo handicrafts. Indeed, handloom and handicraft are the oldest cottage industries of the local people. The textile and handicrafts department provides yarn, tools and implements and others on subsidy basis, working sheds on nominal rate; impart training free of cost and selling of finished products of the entrepreneurs through sales emporium at reasonable prices.

### 3.8.7 Sericulture:

Sericulture industry occupies an important place in the rural economy of the state of Assam. Assam has time honoured silk tradition and rich serigenous fauna. Being situated on the border areas of Arunachal Pradesh, the soil texture and climatic conditions of Tinsukia district is more favorable for the growth of Sericulture industry. It is an effective tool for rural development as it generates income and employment. Out of the villages in the district of Tinsukia, sericulture is practiced in about 287 villages providing employment or indirectly to about 6079 most of whom are from the weaker sections of the society including schedule caste and schedule tribes.

### 3.8.8 Amenities and Infrastructural facilities

The details of the infrastructure facilities in Tinsukia district is shown in Table 3.24 below.

**Table 3.24: Amenities and Infrastructural facilities**

S. No.	Amenities Available in the Villages	No. of Villages
1.	Total inhabitant villages	1, 107
2.	Drinking water facility	1, 107
3.	Safe Drinking water facility	1, 104
4.	Electricity (Power Supply)	871



<b>S. No.</b>	<b>Amenities Available in the Villages</b>	<b>No. of Villages</b>
5.	Electricity (Domestic)	810
6.	Electricity (Agriculture)	11
7.	Primary School	936
8.	Middle School	246
9.	Secondary/Sr Secondary Schools	86
10.	College	7
11.	Medical Facility	198
12.	Primary Health Center	23
13.	Primary Health Sub-Center	69
14.	Post, Telegraph and Telephone Facility	222
15.	Bus Services	400
16.	Paved Approach Road	694
17.	Mud Approach Road	1,032