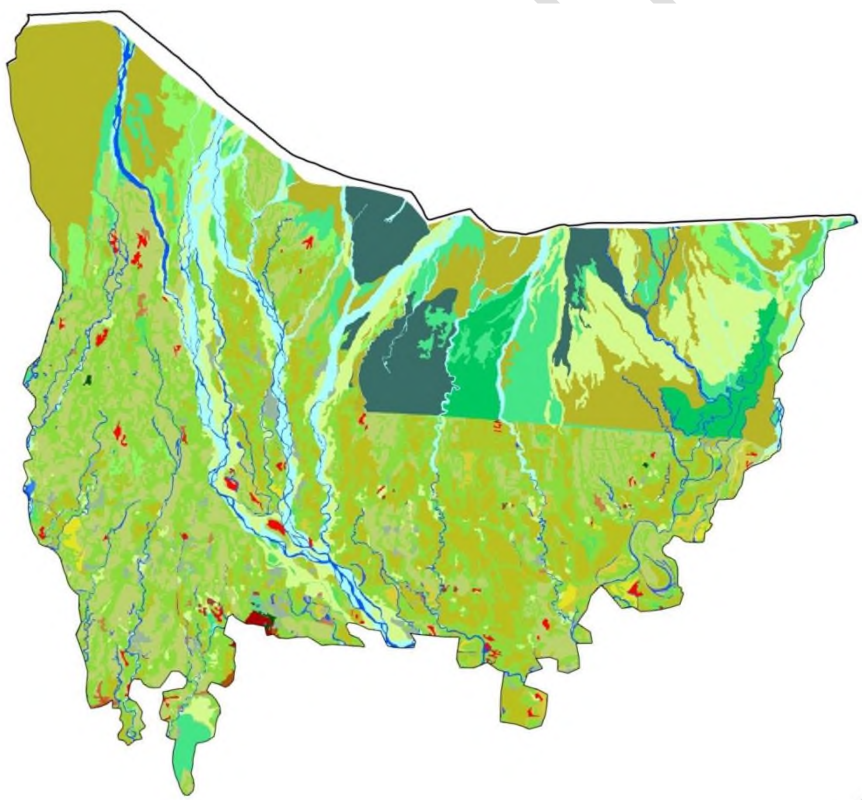
DRAFT
DISTRICT SURVEY REPORT
OF
CHIRANG DISTRICT, ASSAM
(For sand or river bed mining)



CPC Environment Solution Pvt. Ltd.

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Table of Content

EXECUTIVE SUMMARY

PREFACE

The need for a District Survey Report (DSR) has been mandated by the Ministry of Environment, Forest, and Climate Change (MoEF&CC) through Notification No. 125 (Extraordinary, Part II Section 3, Sub- section ii), S.O. 141 (E), dated 15th January 2016. This notification introduced amendments to the EIA Notification 2006, aimed at improving legislative control. As part of these changes, district- level committees were introduced, and the preparation of DSRs became a requirement.

Subsequently, Notification No. 3611 (E), dated 25th July 2018, expanded the DSR's scope to include "Minerals Other than Sand" and provided a specific format for its preparation. The DSR's purpose is to identify areas with mineral potential where mining activities can be permitted, as well as to flag areas where mining should be restricted due to proximity to infrastructure, erosion-prone zones, or environmentally sensitive regions.

The preparation of the DSR involves both primary and secondary data collection. Primary data includes site inspections, surveys, and ground truthing, while secondary data comes from authenticated sources and satellite imagery studies. The secondary data covers information such as the district profile, local geology, mineralization, and other relevant activities, often compiled from disparate sources.

Key Aspects of District Survey Report (DSR)

Assessment of Resources: The DSR provides a comprehensive evaluation of the mineral resources available in riverbeds within the district. It includes detailed data on the quantity, quality, and distribution of sand and other minor minerals, helping to prevent over-extraction and resource depletion through accurate estimation.

Environmental Impact Analysis: The report analyzes the environmental effects of riverbed mining, addressing changes in river morphology, hydrology, and impacts on aquatic ecosystems and biodiversity. This analysis is vital for mitigating harmful environmental impacts and conserving riverine habitats.

Regulation and Compliance: The DSR serves as a regulatory tool for riverbed mining, outlining standards and guidelines to ensure compliance with national and state environmental laws. It helps curb illegal mining activities and promotes regulated, lawful mining operations.

Sustainable Mining Practices: The DSR advocates for sustainable mining practices that reduce environmental degradation. Recommendations may include controlled mining depths, designated extraction zones, and periodic studies to maintain the ecological balance of river systems.

Socio- Economic Considerations: The report addresses the socioeconomic implications of riverbed mining, such as employment generation and local government revenue. It also considers the negative impacts on communities, including displacement and loss of livelihoods.

Data- Driven Decision Making: The DSR provides a scientific foundation for decisions regarding riverbed mining. Incorporating geospatial data, remote sensing images, and field surveys enhances the accuracy and reliability of the report, supporting informed policy-making and resource management.

Stakeholder Involvement: The preparation of the DSR involves consultations with various stakeholders, such as government bodies, local communities, environmentalists, and industry representatives. This inclusive approach ensures diverse perspectives are considered, promoting balanced and equitable mining practices.

1. Introduction of District Survey Report (DSR) of Chirang District

1.1 Introduction

The District Survey Report (DSR) of Chirang District has been prepared following the guidelines of the Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India. This report aligns with the MoEF&CC Notification S.O.-1533(E) dated 14th September 2006 and subsequent notification S.O. 141(E) dated 15th January 2016. It aims to ensure the scientific and systematic utilization of natural resources for the benefit of present and future generations. Furthermore, MoEF&CC's notification S.O. 3611(E) dated 25th July 2018 recommends the format for preparing the DSR.

The main objective of the DSR is to identify areas of aggradation where mining can be allowed, and areas of erosion where mining should be restricted. It also involves the calculation of the annual replenishment rate to maintain ecological balance. Additionally, the DSR includes assessing the development potential of in-situ minor minerals.

Objectives of the DSR:

1. Identification and quantification of minor mineral resources for optimal utilization.
2. Regulation of river bed mining, and reduction of demand- supply gaps.
3. Use of Information Technology (IT) for surveillance of river bed mining activities.
4. Facilitation of environmental clearance for clusters of mines.
5. Restriction of illegal mining.
6. Reduction of flood occurrences in the area.
7. Preservation of aquatic habitats.
8. Protection of groundwater by limiting extraction to above base flow levels.
9. Maintenance of data records related to mineral resources, leases, and revenue generation.
10. Creation of a scientific mining plan, including ultimate pit limit estimation.
11. Development of comprehensive guidelines for mining minor minerals.

The DSR includes secondary data on the district's geology, climate, mineral resources, and other relevant factors, compiled from published and unpublished reports, as well as government websites.

1.2 Statutory Framework

The MoEF&CC has issued several notifications and guidelines over the years to regulate mining and formulate DSRs for each district. Below is a summary of the legal framework:

Year	Particulars
1994	The MoEF&CC issued the Environmental Impact Assessment (EIA) Notification for major minerals covering areas over 5 hectares.
2006	EIA Notification SO 1533 (E) made it mandatory to obtain environmental clearance (EC) for minor minerals exceeding 5 hectares.
2012	The Hon'ble Supreme Court mandated EC for minor minerals, even for areas under 5 hectares.
2016	"Sustainable Sand Mining Guidelines (SSMG)" introduced, requiring EC for all minor minerals and district-level monitoring.
2018	MoEF&CC issued notification S.O. 3611(E) with a recommended DSR format for identifying aggradation areas, replenishment rates, and protected zones.
2020	The "Enforcement and Monitoring Guidelines for Sand Mining (EMGSM)" introduced for improved regulatory enforcement and technological monitoring of sand mining activities.

Enforcement & Monitoring Guidelines, 2020

These guidelines address illegal mining, directing states to implement monitoring mechanisms like river audits, aerial surveys, and drone- based surveillance.

1.3 Utilization and Demand of the minerals

River bed minerals like sand, gravel, stone etc. plays an essential role in construction and is widely used in concrete production, glass manufacturing, road base formation, and many more. River bed mining is a prevalent practice in Chirang District, mainly for construction. The rise in real estate and government infrastructure projects has significantly increased the demand for sand and bricks. The minor minerals of Chirang district comes under B- category mining and it is included in sub- category B2. All the available minerals are of Y- schedule.

Uses of minerals:

1. **Construction**: Sand, gravel, silt, clay and ordinary earth are key ingredients in concrete, mortar and asphalt.
2. **Industrial**: Used in glass production and abrasives.
3. **Environmental**: The minerals can improve traffic safety by providing grip on icy roads, and it helps in soil conditioning for agriculture.
4. **Decorative**: Sand, gravel and stones are used in candles, aquariums, and for enhancing aesthetic appeal in landscaping.
5. **Flood Protection**: Proper management of sand mining helps maintain river flood discharge capacity, reducing the risk of floods.

This DSR aims to provide a well-rounded, data-driven approach for sustainable mineral resource management, ensuring compliance with environmental guidelines and promoting socio-economic benefits for the district.

1.4 Methodology of DSR Preparation

The District Survey Report (DSR) preparation follows a systematic methodology to ensure accuracy and comprehensiveness. The steps involved in the preparation of the DSR are described in detail in the following sections.

a. Data Source Identification

The DSR is based on both primary and secondary data collected from reliable and authoritative sources. Identifying authentic data sources is critical for compiling accurate data. The primary data sources for the DSR are collected through field surveys and replenishment studies. Secondary data sources include publicly available information from government publications, reports, and reputable journals.

- **District Profile**: Information related to the district's demographics and basic statistics is sourced from the **District Census Report, 2011** and the **District Statistical Handbook** published by the Government of Assam.
- **Mineral Resources**: The potential mineral resources of the district are described based on reports published by the **Geological Survey of India (GSI)** or other government agencies
- **Mining Data**: Information on mining leases, lease holders, lease areas, resource allocations, and revenue generation is collected from the **Forest Department.**
- **Satellite Images**: Satellite imagery is utilized to prepare maps related to the district's physiography and land use/land cover.

b. Data Analysis and Map Preparation

After collecting data, a detailed analysis is conducted to extract relevant insights. This involves analyzing spatial data and preparing maps that depict:

- Geomorphology of the district
- Topography
- Land use patterns
- Mineral resource distribution

These maps help visualize the key characteristics of the district and identify potential mining areas.

c. Primary Data Collection

Primary data is essential for preparing a comprehensive DSR. Fieldwork is conducted across the district to assess mineral resources. This field study provides a detailed understanding of the mineral composition and their distribution in the area.

d. Replenishment Study

A key aspect of sustainable mining is ensuring that the amount of sediment removed from riverbeds is replenished naturally. Therefore, replenishment studies are conducted to assess the annual rate of replenishment of riverbed sand. This helps avoid the adverse impacts of excessive sand extraction.

- Physical surveys of the riverbed are carried out using **GPS/DGPS** to define the topography, contours, and offsets.
- The surveys provide a detailed depiction of important features in and around the river, including nearby civil structures and other key landmarks.
- This information helps define the spatial area eligible for sand mining and estimate the sand reserves.

e. Report Preparation

The DSR covers various aspects of the district, including:

- **General Profile**: A brief overview of the district, including demographics, land use patterns, and economic activities.
- **Geomorphology and Geology**: An assessment of the district's physical landscape, including its geological structure.
- **Mineral Resources**: A detailed account of riverbed sands and other minor minerals in the district, including their distribution and potential for extraction.
- **Mining Block Delineation**: Identification of potential mining blocks and mineral reserves within the district.

- **Production Trends**: An analysis of recent trends in the production of minor minerals and the revenue generated from the mining sector.
- **Replenishment Estimation**: The annual replenishment rate of riverbed sand, based on field surveys.
- **Environmental Impact and Mitigation**: An evaluation of the potential environmental impacts of mining activities, along with proposed mitigation measures.
- **Risk Assessment and Disaster Management**: A strategy for managing risks associated with mining and minimizing the impact of any potential disasters.
- **Reclamation Strategy**: A plan for the reclamation of already mined-out areas to restore the ecological balance.

This structured approach ensures that the DSR not only identifies mineral resources but also emphasizes sustainable mining practices and environmental preservation.

2. Overview of mining activity in the district

In the Chirang district collection of sand, clay/silt etc. from river- bed is considered as one of the main minor mineral sources of the district. These materials are primarily utilized for construction purpose.

3. List of existing mining leases of the districts

a. Details of List of existing mining leases of the districts are furnished in the following table:

Sl. No.	Name of Mahal	Name of the lessee	Location and area of mining lease	Period of lease	Status (working/ closed)
1	Ashapuka Sand, Gravel & Boulder river Mahal	Phungha Narzary	Ashapuka 3.51 Ha		Existing
2	Champa Sand, Gravel river Mahal No.2	Achinta Narzary	Champabati 3.32 Ha		Existing
3	Champa Sand, Gravel river Mahal No.3	Alongbar Basumatary	Champabati 4.85 Ha		Existing
4	Champa Sand, Gravel river Mahal No.4	Janen Brahma	Champabati 2.44 Ha		Existing
5	Champa Sand, Gravel river Mahal No.6	Anjan Basumatary	Champabati 1.86 Ha		Existing
6	Kanamakra Sand Gravel & Boulder River Mahal No.1	Gilard Basumatary	Kanamakra 4.11 Ha		Existing
7	Sand & Gravel Mahal at Basugaon Champa Bridge to Bhutiapara	Jayanta Brahma	Champabati 3.65 Ha		Existing
8	Choraikhosra Champabati River Sand & Gravel Mahal	Alongbar Basumatary	Champabati 2.46 Ha		Existing
9	Tilokgaon Champa River Sand & Gravel Mahal	Amar Narzary	Champabati 3.82 Ha		Existing
10	Champa River Sand & Gravel Mahal khuashakati Sashanghat to	Baranda Basumatary	Champabati 2.0 Ha		Existing

	Nalbari Tower at Khagrabari village				
11	Champa river Sand & Gravel Mahal No.1	Bipul Wary	Champabati 4.54 Ha		Existing
12	Sand, Sandgravel, Boulder & Chips Hakuwa River Mahal at Bhatamari	Ranjan Narzary	Hakuwa River 1.35 Ha		Existing
13	Taklai Makra River bed Sand & Gravel mahal at Sissobari (Narayanpur)	Nujakhang Brahma	Taklai Makra River 4.0 Ha		Existing
14	Sand, Gravel & Boulder mahal at Huthuti River (Balagari village)	Tameswar Basumatary	Huthuti River 5.6 Ha		Existing
15	Huthuti River Sand, Gravel & Boulder Mahal at South Gandabil	Hemanta Basumatary	Huthuti River 4.79 Ha		Existing
16	Sandgravel, Gravel & Sand Aie- River Mahal at Dologaon	Mwikhwm Owary	Aie-River 2.0 Ha		Existing
17	Kanamakra Kaliagaon No.2 River Sand 7 Gravel Mahal	Tulunga Narzary	Kanamakra River 4.0 Ha		Existing
18	Kanamakra River Bed Sand, Gravel & Stone Mahal at Kanamakra Rajapara	Probonath Borgoyary	Kanamakra River 3.9 Ha		Existing
19	Kanamakra Sand, Gravel Mahal No.2	Jeet Paul	Kanamakra River 3.3 Ha		Existing

20	Kanamakra River Sand & Gravel Mahal at Kanamakra (Lakhipur to Bhabanipur Muslim Basti)	Raju Basumatary	Kanamakra River 4.0 Ha		Existing
21	Nagaibhanga Manikpur Stone, Sandgravel, Sand & chips Aggregates Mahal at South Palangshuguri	M/S Priyangi Enterprise Prop- Priyanka Basumatary	Nangaibhanga River 4.0 Ha		Existing
22	Nangalbhanga Huthuti Sand and Gravel River Mahal	Amar Narzary	Nangaibhanga River 3.5 Ha		Existing
23	Makra River Sand-Gravel & stone Mahal at 9Patalmari) Rajapara area	Jocob Narzary	Kanamakra River 4.25 Ha		Process ongoing
24	Agrong Sand, Gravel River Mahal	Samar Muchahary	Agrong 4.6 Ha		Process ongoing (Tender Process completed)
25	Champa Sand,Garvel river Mahal No.5	Narza Basumatary	Champabati 3.51 Ha		Do
26	Aie-Ghat Sand,Gravel River Mahal	Shyam Kr. Brahma	Aie-river 4.88 Ha		Do

b. List of Patta Lands / Khatedari land

Sl. No.	**Name of Mahal**	**Name of the lessee**	**Location and area of mining lease**	**Period of lease**	**Status (working/ closed)**
1	M/S PRJC Group of Industries Stone Crusher Unit	Chikaru Brahma	Khagrabari, Chirang		

2	M/S Aashi Manas Aggrgates Stone Crusher Unit.	Nikunj Harlaka	Kherdanda, Chirang		
3	M/s N.I Stone Crusher Unit	Nabibar Islam	No.2 Chikapara, Chirang		
4	M/S Maidangshri Stone Crusher unit	Dhwnsri Mushahary	Shyamthibari, Chirang		
5	M/S Stone India Stone Crusher Unit	Sri Kamala Kanta Khaklary	Dorogaon, Chirang		

4. Details of revenue generated from mineral sector during last three years

Revenue generated for last 3 years in Chirang District is furnished in the following table:

Table: District revenue generation from mineral sector (In INR)

Year	Revenue Collection (Rs.)	Remarks
2021-22	134522395.00	
2022-23	149059084.00	
2023-24	158191800.00	
2024-25	43318829.00	Up to August/2024

5. Detail of Production of Sand or Bajri or minor mineral in last three years

Sl. No	Financial Year	Production(Cum)
1	2022-23	
2	2021-22	
3	2020-21	

6. Process of Deposition of Sediments in the rivers of the District of Chirang:

Many rivers originate from the Himalayan and Shivalik regions which supply water in down streams. The greatest sediment yields are generally associated with rivers draining areas of intensive tectonic activity therefore, Himalayan rivers cause tremendous erosion and carry large amounts of sediment. Sediment load can be divided into bed load and suspended load based on the mode of transport. Bed load is transported close to the bed where particles move by rolling, sliding, or jumping transport in natural rivers is a complicated phenomenon. Its movement is quite uneven in both the transverse and longitudinal directions, which varies considerably. Some sediment particles roll or slide along the bed intermittently and some others state (hopping or bouncing along the bed).

The sediment of a river is commonly considered to be aesthetically displeasing and environmentally degrading. Conversely, part of the sediment (sand and gravel) may represent a natural resource for use by society. The potential usefulness of the sediment is enhanced when it is composed of particle sizes found in deposits on the river- bed that would be replenished by newly transported sediment after mining. As such, river deposits become renewable resources, periodically replaced by sediment transport in the river.

Sediment transport is the movement of organic and inorganic particles by water. In general, the greater the flow, the more sediment that will be conveyed. Water flow can be strong enough to suspend particles in the water column as they move downstream, or simply push them along the bottom of a water way. Transported sediment may include mineral matter, chemical sand pollutants, and organic material. Another name for sediment transport is sediment load. The total load includes all particles moving as bed load, suspended load, and wash load. Sediment deposition is the process of settling down of suspended particles to the bottom of a body of water. This settling often occurs when water flow slows down or stops, and heavy particles can no longer be supported by the bed turbulence. Sediment deposition can be found anywhere in a water system, from high mountain streams, to rivers, lakes, delta, floodplains.

Sediment transport is critical to understanding how rivers work because it is the set of processes that mediates between the flowing water and the channel boundary. Erosion involves removal and transport of sediment (mainly from the boundary) and deposition involves the transport and placement of sediment on the boundary. Erosion and deposition are what form the channel of any alluvial river as well as the flood plain through which it moves. The amount and size of sediment moving through a river channel are determined by three fundamental controls:

competence, capacity and sediment supply. Competence refers to the largest size (diameter) of sediment particle or grain that the flow is capable of moving; it is a hydraulic limitation. If a river is

sluggish and moving very slowly it simply may not have the power to mobilize and transport sediment of a given size even though such sediment is available to transport. So a river may be

competent or incompetent with respect to a given grain size. If it is incompetent it will not transport sediment of the given size. If it is competent it may transport sediment of that size if such sediment is available (that is, the river is not supply- limited). Capacity refers to the maximum amount of sediment of a given size that a stream can transport in traction as bed load. Given a supply of sediment, capacity depends on channel gradient, discharge and the caliber of the load (the Presence of fines may increase fluid density and increase capacity; the presence of large particles may obstruct the flow and reduce capacity). Capacity transport only occurs when sediment supply is abundant (non- limiting). Sediment supply refers to the amount and size of sediment available for sediment transport. Capacity transport for a given grain size is only achieved if the supply of that caliber of sediment is not limiting (that is, the maximum amount of sediment in stream is capable of transporting is actually available). Because of these two different potential constraints (hydraulic sand sediment supply) distinction is often made between supply- limited and capacity- limited transport.

Much of the material supplied to a stream is so fine (silt and clay) that provided it can be carried in suspension, almost any flow will transport it. Although there must be an upper limit to the capacity of the stream to transport such fines, it is probably never reached in natural channels and the amount moved is limited in supply. In contrast, transport of coarser material (say, coarser than fine sand) is largely capacity limited.

Modes of Sediment Transport: The sediment load of a river is transported in various ways although these distinctions are to some extent arbitrary and not always very practical in the sense that not all of the components can be separated in practice.

The modes are: 1. Dissolved Load.
2. Suspended Load.
3. Intermittent Suspension (Siltation) Load
4. Wash Load
5. Bed Load

7. General Profile of the district

a) General Information

The district started functioning with effect from 4th June, 2004 with its head quarter at Kajalgaon. This district is having one civil sub- division with its head quarter at Bijni and one sadar sub- division with its head quarter at Kajalgaon. The Chirang district possesses a plain topography. It also has undulating areas and the northern parts of the district lie on the foothills of Bhutan that has slightly higher elevation, which is decreasing towards the southern parts of the district. The four types of soil found here are entisols, inceptisols, alfisols and ultisols. The district comes under lower Brahmaputra valley agro- climatic zone. The climate is sub- tropical in nature with warm and humid summer followed by dry and cool winter. The pre and post-monsoon months are unpredictable and experience erratic rainfall. Champamati, Aie and Manas rivers flow through the district and join the Brahmaputra river. Many other tributaries, small rivulets and streams flow through this district.

The word "Chirang" has been derived from garo word -"*chi*" means water and "*rang*" means wealth. Chirang district is one of the four districts of bodoland territorial area district (btad) under the govt. Of assam, created vide notification no. Gag (b). 137/2002/pt/117 dtd. 30/10/2003 within Assam under clause 6 of article 332 by the 90th amendment act, 2003 of the constitution of India under the provision of the sixth schedule. It was carved out of the districts of Kokrajhar, Bongaigaon and Barpeta.

The district is situated in North- West side of Assam surrounded by international boundary of Bhutan in North, Bongaigaon district and a little portion of Kokrajhar district in South, Kokrajhar district in West and Baksa district in East. The geographical area of the district is 1468.42 sq. km. The district is located between 26.28 N and 26.54 N longitudes and 89.42 E and 90.06 E latitudes. The district has a total population of 4,82,162 with 2,37,302 being males and 73,215 being females respectively. The distinguishing factor among the demography in both the blocks in the district is the proportion of general and obc population and SC and ST population. In Sidli the block is dominated by SC and ST population while in Borobazar almost half the population belongs to general and obc category. As per the 2011 census it is the second least populous district in the state, after Dima Hasao. Chirang district is generally divided into five blocks i.e. Sidli, Dangtal (part), Borobajar, Manikpur|(part) and Kokrajar(part). The main inhabitants of this region are the Boro people. Other communities living in the region are Assamese, Muslim, Rabha, Santali, Nepali, Kuki, Rajbangsi, Bengali, Bihari, etc. Chirang is one of the major districts of Assam situated at the Northern part of Brahmaputra river under lower Brahmaputra valley zone of Assam. Chirang is one of the four districts of Bodoland Territorial Area District (BTAD) created within Assam under clauses 6 of article 332 by the 90th Amendment Act 2003 of constitution of India. The district was curved out of existing district of Kokrajhar, Bongaigaon and Barpeta.

Transport:

By Road: Kajalgaon, the head quarter of Chirang district, through which National Highway 31C passes. So, buses are available and easily catchable to go to Guwahati,Cooch Bihar and Bongaigaon. Chapaguri is the main point to catch all the private and public vehicles.

→National Highway No. 27 (via Rangya, Chapaguri Chariali)

→Distance from to Guwahati to Kajalgaon: 184 KM(approx)

→Distance from to Cooch Bihar to Kajalgaon: 136 KM(approx)

By Train: Two Railaway stations where both local and express trains stop

→Basugaon Railway Station

→Bijni Railway Station

By Air: The International airport LGBI is around 191 km away from the district Head Quater and the nearest one is Rupsi Airport,which is around 102 km away.VIP helicopters land in the BGR field of Chirang.

Administrative setup-

Table: Administrative Divisions

Administrative Division	LAD
District Headquarter	Kajalgaon
Number of Sub- Divisions	2
Lok Sabha Constituency	Kokrajhar (ST) (HPC-1)
Legislative Assembly Constituency	2 (19- Sidli Chirang LAC, 20- Bijni LAC)
Number of Revenue Circles	3
Number of Educational Blocks	3
Number of Municipality Boards	3
Number of Developmental Blocks	3
Number of Gaon Panchayats	74 Nos. of VCDC
Number of Villages	496
Number of Revenue Villages	479
Number of Forest Villages	22
Number of Police Stations	7
Number of Police Outpost	7
Number of Municipality Board	3
Total Population	4,82,162

Table: Health Setup

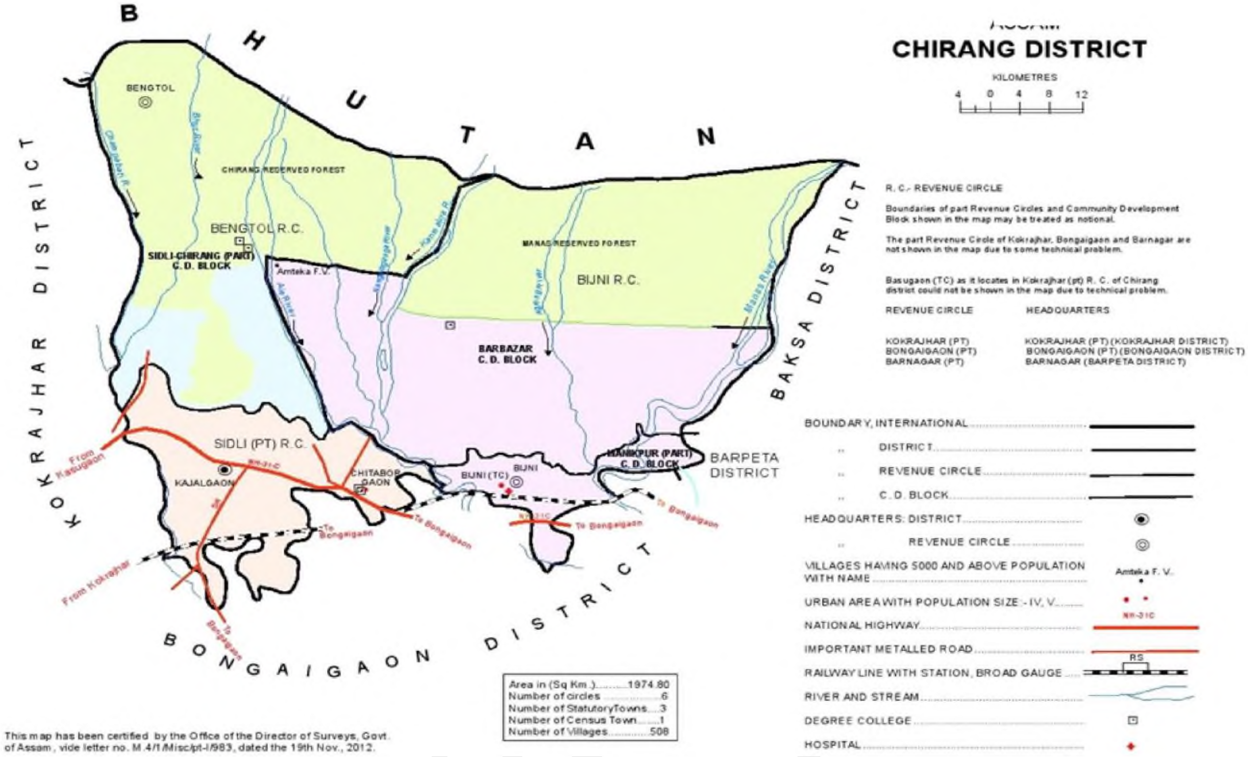
Number of District Hospitals	1
Number of Community Health Centres	4
Number of Primary Health Centres	3
Number of Sub Centres	87

Table: Educational Setup

Number of Univetsity	Bodoland University,Kokrajhar (Nearest)
Number of Engineering Collage	CIT Kokrajhar (Nearest)
Number of Degree College	6
Number of Higher Secondary School	10
Upper Primary (Govt)	88
Number of High Schools	44
Lower Primary (Govt)	777

(As per census 2011)

Total Area	1468.42 Sq Km
Total Population	482,162
Rural Population	446,825
Urban Population	35,337
Population Growth (%)	11.34
Average Literacy (%)	63.55
Density	251/sq. Km
Total Household	97,395



Map: Administrative Map of Chirang District

Agro ecology:

Agro ecology is an ecological approach to agriculture that views agricultural areas as ecosystems and is concerned with the ecological impact of agricultural practices. It refers to the study of agricultural ecosystems and their components as they function in themselves as a part of the larger ecosystem. Agro ecology involves examining climate, water, soil, flora and fauna of the concerned area. A systematic study of agro ecology is important for planning appropriate land use. Study of agro-ecological regions is necessary to determine yield potentialities of different crops, and crop combinations in the agro-ecological regions in the future. On the basis of information on physiography, soils, farming systems, crop and cropping systems and hydrological information, the district Chirang has been classified in to five agro- ecological situations, which are as follows –

i) Foot hills old mountain valley
ii) Flood free riverine old alluvial plain
iii) Flood prone riverine alluvial plain
iv) Beels
v) Char land

Sl No.	*Agro ecological situation*	*Characteristics*
i.	Foot hill old mountain valley alluvial plain	The northern part of the district comprising this situation contains old Mountain valley alluvial soils (Alfisol & Ultisol). It is build up of alluvial materials washed down from the hill slops. The surface soil is light yellow to pale brown, compact, sticky and plastic. Generally, medium to heavy in soil texture. The elevation is higher towards foot hills which gradually slop towards south.
ii.	Flood prone recent riverine alluvial plain	Recent riverine alluvial (Entisol), sandy to sandy loam in soil texture. This situation is represented by an almost flat topography which often experiences flood hazard. Apart from some natural depressions, some Riverine islands are also in existence.
iii.	Flood free riverine alluvial iv.plain	Old riverine alluvial type (Inceptisol). The texture of the surface soils ranges from sandy loam to loam, silty clay loam, silty clay and clay. The topography is almost plain.
iv.	Chav.r land	New alluvial plains, neutral in reaction, sandy-siltyclayee, sandy-silty and sandy in soil texture (Entisol). Chronically flood affected areas except the stable chars.
v.	Beels	Entisols, usually peaty in nature and texturally these are silty and clay. Low lying waste land areas.

b) Climate Condition

The district enjoys a sub-tropical humid climate with a hot summer and moderate winter. The maximum temperature is generally experienced in June, July and August every year. January is the coldest month and July/August is the warmest months. The winter temperature drops to 10° C and summer temperature goes up to 35° C. South West monsoon activates from June and continues up to September-October. The climate of the district is sub-tropical in nature with warm and humid summer followed by dry and cool winter. The average annual rainfall is about 1951 mm per annum of which 75% is received during monsoon month (June - September). The monsoon months are wet and winter is dry. Both pre and post monsoon months have unpredicted and erratic rainfall. South West monsoon activates from May and continues up to September- October. Most of the rainfall is received during monsoon season.

- **Summer:** April - July (Max- 42°C, Min- 28°C)
- **Monsoon:** August - October (Max- 35°C, Min- 22°C)
- **Winter:** November - March (Max- 23°C, Min- 11°C)

Temperature: The mean maximum and minimum temperature varies from 33° to 38 $^{\circ}$C and 9° to 10 $^{\circ}$C. The average radiation is highest during March to April, while overcast sky reduces the solar radiation to the least during July. The maximum temperature is generally experienced in June, July and August every year. January is the coldest month and July/August is the warmest months. The winter temperature drops to 10° C and summer temperature goes up to 35° C.

c) Drainage System

Number of perennial streams flow through the district from north to south and join the Brahmaputra River. The major streams that drain the area are Champabati, Ai, Buri Ai, Manas, Kanamkara and Arang Rivers. The Irrigation Department has taken up 14 (fourteen) schemes in total both new as well as renovated/improved old schemes in Chirang District, out of which 13 (thirteen) schemes are directly related to supplying of irrigation water for cultivation and 1 (one) scheme is not irrigation oriented. Out of 13 (thirteen) schemes, 10 (ten) schemes have been completed and a total potential of 1,172 ha for Kharif Crops have been so far created through the achievement of these schemes. The remaining 3 (three) schemes are also in progress.

d) Stream ordering

The stream order hierarchy was officially proposed in 1952 by Arthur Newell Strahler, a geoscience professor at Columbia University in New York City, in his article “Hypsometric (Area Altitude) Analysis of Erosional Topology”. The article, which appeared in the Geological Society of America Bulletin outlined the order of streams as a way to define the size of perennial (a stream with water in its bed continuously throughout the year) and recurring (a stream with water in its bed only part of the year) streams. When using stream order to classify a stream, the sizes range from a first-order stream all the way to the largest, a 12th- order stream.

A first- order stream is the smallest of the world's streams and consists of small tributaries. These are the streams that flow into and "feed" larger streams but do not normally have any water flowing into them. In addition, first and second- order streams generally form on steep slopes and flow quickly until they slow down and meet the next-order waterway.

First through third- order streams are also called headwater streams and constitute any waterways in the upper reaches of the watershed. It is estimated that over 80% of the world’s waterways are these first through third- order, or headwater streams. Going up in size and strength, streams that are classified as fourth through sixth order are medium streams while anything larger (up to 12th order) is considered a river.

The world's largest river, the Amazon in South America, is considered a 12th- order stream. Unlike the smaller order streams, these medium and large rivers are usually less steep and flow slower. They do however tend to have larger volumes of runoff and debris as it collects in them from the smaller waterways flowing into them.

This method of classifying stream size is important to geographers, geologists, hydrologists and other scientists because it gives them an idea of the size and strength of specific waterways within stream networks- an important component of water management. In addition, classifying stream order allows scientists to more easily study the amount of sediment in an area and more effectively use waterways as natural resources. Stream order also helps people like biogeographers and biologists in determining what types of life might be present in the waterway. This is the idea behind the River Continuum Concept, a model used to determine the number and types of organisms present in a stream of a given size. Different types of plants for example can live in sediment- filled, slower-flowing rivers like the lower Ganges than can live in a fast- flowing tributary of the same river. Field investigation depicts that order of all the rivers is of 1st order nature: drainage pattern is dendritic; drainage density is very low.

e) Irrigation

The facility of irrigation through canal is available in the district with 16,170 hectares of land under the command area of canals. There has been no assessment of availability of ground water in Chirang district by Central Ground Water Board and hence the potential/ availability of ground water in the district cannot be commented upon. Among the ground water sources, 3090 shallow tube wells are available in the district.

The gross irrigated area in Sidli and Borobazar blocks is 5865 ha. and 7605 ha. respectively. Majority of the net irrigated area lies in Borobazar block with 7605 hectares that comprise 54.58% of the total net irrigated area in Chirang district. Rainfed area is also more in Borobazar with 48,000 ha. block compared to Sidli block that has 32,262 ha. 9.66% of the total area sown in Sidli is irrigated and 90.33% is completely or partially irrigated or rainfed.

Similarly, in Borobazar 7.94% of the total area sown is irrigated and 92.05% remains partially irrigated or rainfed. So in terms of irrigation status both blocks are nearly at the same position.

Table 2.9: Irrigated and rainfed area in Chirang.

Irrigated (Area in ha)		**Rainfed (Area in ha)**	
Gross Irrigated Area	**Net Irrigated Area**	**Partially Irrigated/Protective Irrigation**	**Un- Irrigated or Totally Rainfed**
99,705.61	8,620	10,823	80,262.61

Source: Agriculture Department, Chirang

Table 2.10: Block-wise irrigated and rainfed area

Block	**Irrigated (Area in ha)**		**Rainfed (Area in ha)**	
Sidli	**Gross Irrigated Area**	**Net Irrigated Area**	**Partially Irrigated/Protective Irrigation**	**Un- Irrigated or Totally Rainfed**
Borobazar	99,705.61	8,620	10,823	80,262.61

f) Soil resources

The major soil classes in the district are entisols, inceptisols, alfisols and utisols. Soil in greater parts of the district is sandy and silty loam, or clayey loam. The soils of the alluvium are partly new or recent and partly old. The variation in composition is mainly a result of the varying composition of the river borne materials deposited at different times and under different conditions. The younger alluvial soil has a high phosphorous content whereas in Older Alluvial soils, the content is very low. In general, the soil is acidic to slightly alkalaine in nature and is moderately permeable and characterised by the presence of low organic carbon and low soluble salts. Soils restricted to inselberg areas are more clayey, lateritic and less permeable and are highly acidic in nature. From agricultural point of view, the soils in major part of the district are suitable for all sorts of crops.

Table:Soil Profile

Block	Soil Type
Borobazar	Entisols(recent alluvium)
	Inceptisols(old alluvium)
	Alfisols(Mountain valley)
	Utisols(Laterised red)
Sidli	Entisols(recent alluvium)
	Inceptisols(old alluvium)
	Alfisols(Mountain valley)
	Utisols(Laterised red)
Dangtol	Entisols(recent alluvium)
	Inceptisols(old alluvium)
	Alfisols(Mountain valley)
	Utisols(Laterised red)

Source: Agriculture Department, Chirang

Soil in greater parts of the district is sandy and silty loam, or clayey loam. The soils of the alluvium are partly new or recent and partly old. The variation in composition is mainly a result of the varying composition of the river borne materials deposited at different times and under different conditions. The younger alluvial soil has a high phosphorous content whereas in Older Alluvial soils, the content is very low. In general, the soil is acidic to slightly alkalaine in nature and is moderately permeable and characterised by the presence of low organic carbon and low soluble salts. Soils restricted to inselberg areas are more clayey, lateritic and less permeable and are highly acidic in nature. From agricultural point of view, the soils in major part of the district are suitable for all sorts of crops

Major Soils in district

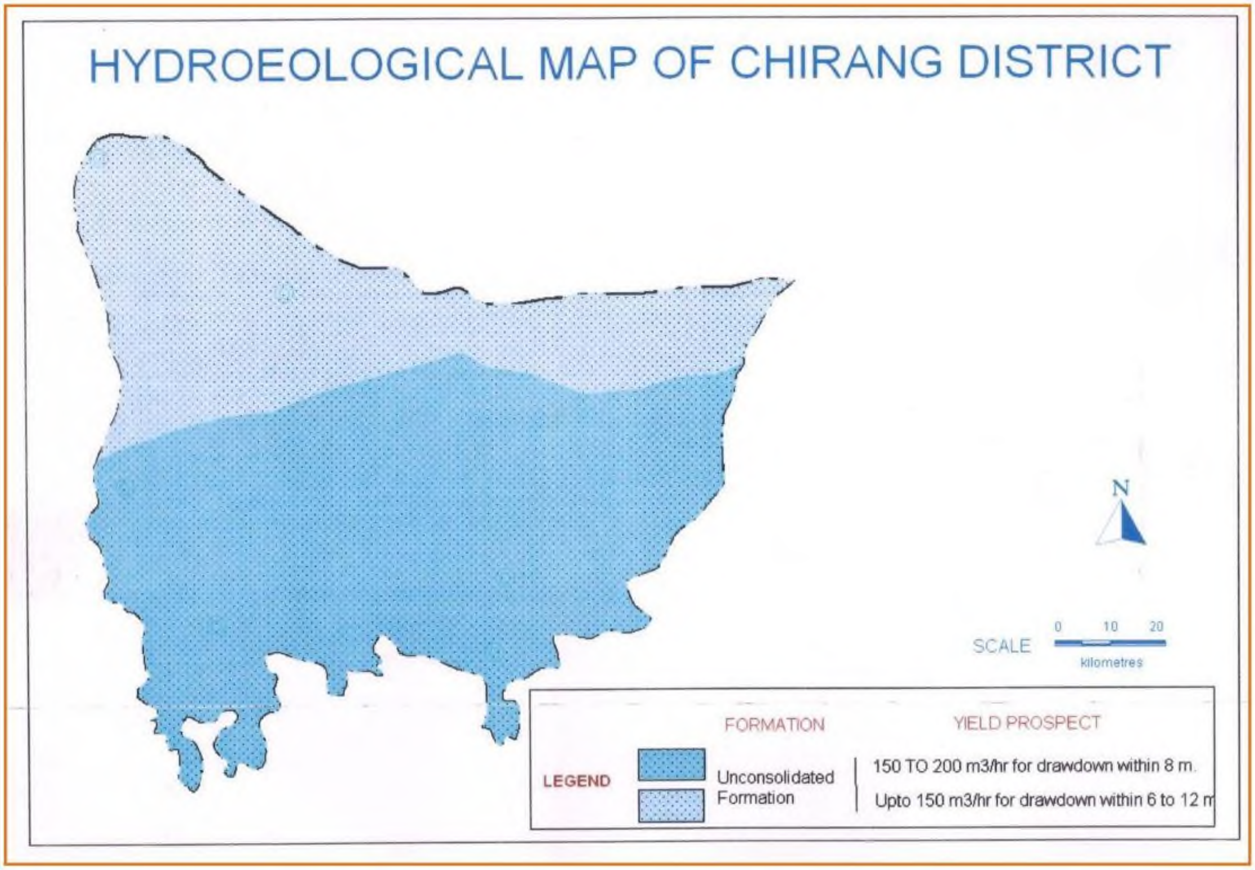
Major Soils	**Soil Description**
Light grey soil	Sandy loam to silty loam in texture
Red soil(mixed|)	High in Fe & Al oxides and well drained
Sandy soil	Light textured soils
Sandy loam soil	Medium textured soils
Clay loam soil	Heavy textured soil & poor external as well as internal drainage

Source: Agriculture Contingency Plan: Chirang District (2015)

g) Groundwater prospects in the district

Based on the behaviour and occurrence of ground water, the regional ground water flow system of district has been described under following categories. i. Shallow aquifer group occurring within 50 m depth. ii. Deeper aquifer group beyond a depth of 50 m and down to 200 m bgl. i. Shallow Aquifer Group: It constituted of a mixture of boulders, gravel, sand, silt and clay. The thickness of the aquifer varies from 15 to 40 m. Ground water in this aquifer generally occurs under water table to semi-confined conditions. The development of ground water from this aquifer for both domestic and irrigation purposes is by open wells and shallow tube wells. The boulders are restricted mostly to the northern parts of the district. They occur between GL to 50 m bgl and thickness varies from 20 - 30 m. The thickness increases from south to north. The water level in the major part of the district generally lies between 2 to 4 m bgl. The northern most part occupied by the piedmont zones and the areas adjoining to the inselbergs are having deeper water level. The movement of ground water is southerly towards Brahmaputra River. The water table contour follows the topography of the area and lies more or less parallel to the Brahmaputra River. The hydraulic gradient becomes gentler towards the south. ii. Deeper Aquifer Group It constituted of coarse to medium sand with intercalation of clay. Ground water occurs under water table to semi-confined conditions. Detailed hydrogeological surveys aided by exploratory drilling revealed the existence of two to three promising aquifer zones down to the depth of maximum 200 m bgl. Aquifer displays various degree of lateral and vertical variation of aquifer indicating various degree of depositional environment both in space and time. The piezometric surface is highly variable and the movement of ground water is towards the south.

The ground water of the district is both slightly acidic and alkalaine in nature with pH values ranging from 6.82 to 7.21. Ground water has low content of dissolved minerals. The iron content is generally high for drinking purposes in some areas, the range being from 1.02 - 3.0 ppm. But, in most of the sources, it is within permissible limit as per BIS (1991) standard of 1.0 ppm and as such, it does not pose any serious health hazards. High iron concentration has been observed in and around Runikhata area. Except high iron content, the ground water of the district is suitable and safe for drinking and other uses. The water is soft and has low bi-carbonate content. The formation water of both shallow and deep aquifers is suitable for most of the irrigational and industrial purposes. Ground water is having a little higher concentration of iron but can be used after treatment.



Map: Hydrogeological Map of the District.

8. Land and land use pattern:

Land resource is one the most important and valuable free gift of the nature and its proper utilization by the inhabitants is of great value. Land should be fully used as per its capability. Lack of proper or profitable use means wastage of land resource and it results loss of productivity. It therefore requires proper and timely use of this kind of asset.

The following table indicates the pattern of land use under various classification of land in Chirang

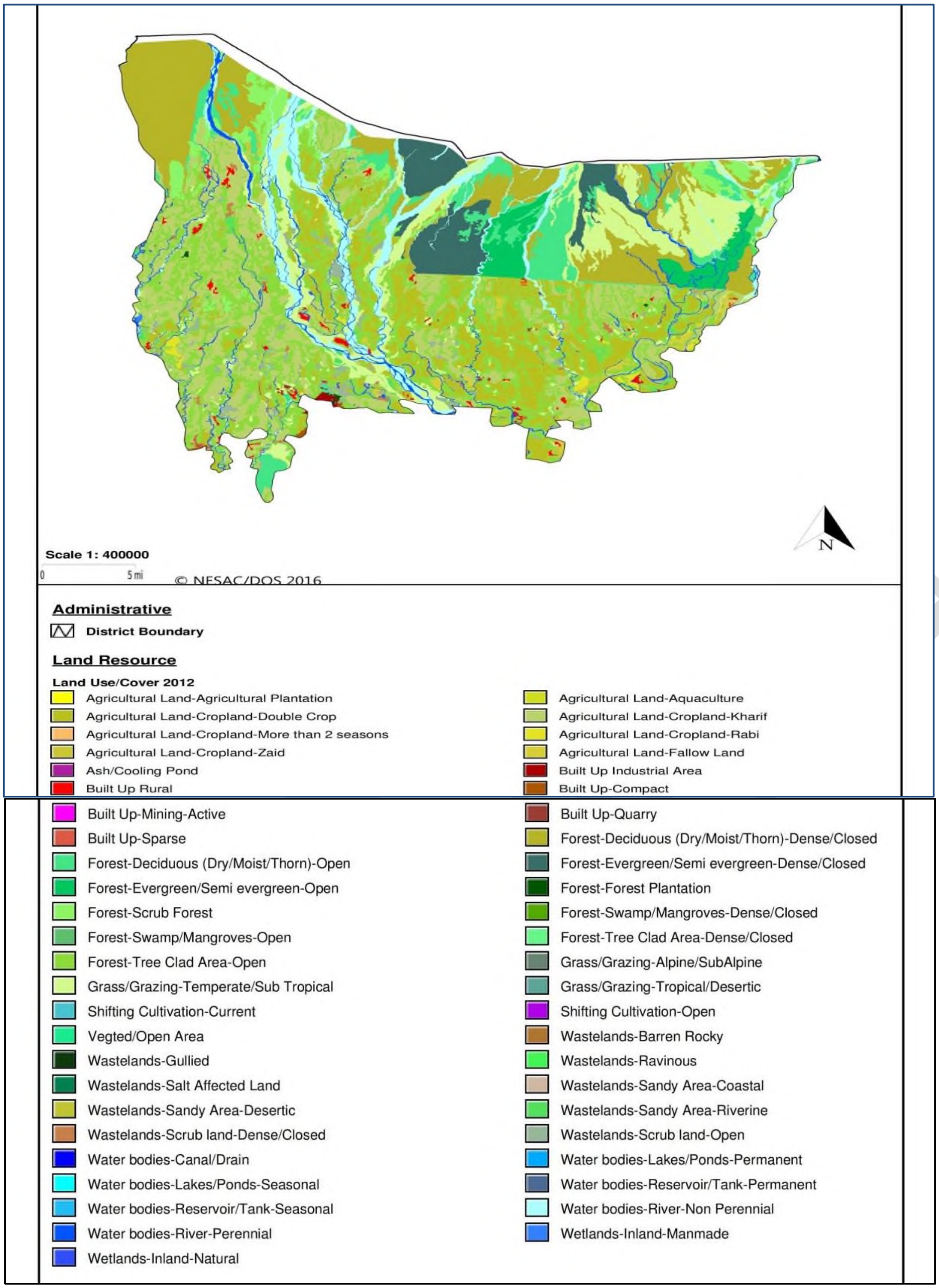


Fig: Map showing Land Use and Land Cover, Chirang District.

9. Physiography of the District

The district forms a part of the vast alluvial plains of Brahmaputra River system and sub-basin of River Manas. Physiographically, it is characterised by the different land forms a) inselbergs and b) alluvial plains. The inselbergs are Archaean inliers occurring in the form of disconnected hillocks in the alluvial plains. They are found occurring in the south-eastern part of the district. The hillocks are covered by a thick lateritic mantle and are occupied by evergreen mixed forests. The alluvial plains are comprised of Older and Newer alluvium. The Older alluvium occupies the piedmont zone towards the north of the district bordering Bhutan. The high narrow zone at the Himalayan foothill is known as the Bhabar zone and supports dense forests. To the south of the Bhabar zone and parallel to it, there lies the flat Terai zone where the ground remains damp and sometimes springs oozes out. Tall grasses cover the Terai zone. The formation is comprised of sand, clay with mixtures of pebble, cobble and boulders. The Newer alluvium includes sand, gravel, pebble with silt and clay.

10. Rainfall

The average annual rainfall recorded from 2011 to 2021 of I.M.D is 1295.42 mm. Rainfall during January to April contributes nearly 14.41% to the total rainfall whereas the rainy season which commences from May and continues up to September contributes 79.74%. October to December rainfall is only 5.8%. December receives least rainfall.

Table: Monthly rainfall distribution of Chirang district, Assam

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F
2018	4	39.4	114.1	125.7	647.8	934.2	721	312.1	1063.6	91.8	28	20.6
2019	0.6	73	45.2	158.4	429	538.6	1401.4	254.5	488.4	126.6	10.4	0
2020	6.8	15	36.6	58.8	842.4	1114.2	1552	422.9	1237.4	121.2	2	4
2021	16	2.8	32.6	104.4	250.6	840	617.4	563.2	237	261	1.4	0
2022	31.2	72	36.7	422.2	604.8	1817	273	460.8	270.4	208.4	0	0

11. a) Geology

(i) Regional Geology:

Shillong plateau (covering approx. 47614 sq. km.) is the singular representative of Precambrian cratonic block of northeast India tectonically detached from the mainland of Indian Peninsula. The cratonic block is girdled by dextrally moving Dauki fault to the south, Brahmaputra lineament to the north, Garo- Rajmahal graben, Dhuburi/Madhupur lineament to the west and belt of schuppen to the east. It consists of high to medium grade Paleoproterozoic basement gneisses and schist designated as Basement Gneissic Group (BGG) overlain by Mesoproterozoic metasediments and metavolcanics of the Shillong Group, both being intruded by Neoproterozonic acidic intrusives such as Myllem pluton, South Khasi pluton, Umroi granite, Nongpoh and a few others enlisted by Mazumdar (76); Ghosh*et. al*. (2005); Devi and Sharma (2006, 2010).

The Paleocene to Eocene continental shelf of the Indian plate which became emergent and which is being over-thrust by the Himalayas on the north-northwest and by the Naga hills on the southeast comes under the upper Assam shelf.

The present-day Assam Basin, a cratonic margin, reflects three distinct tectonic phases. The earliest was Late Cretaceous to Eocene block faulting and development of a southeasterly dipping shelf. Duringthe second phase, in Oligocene time, uplift and erosion occurred north of the many basement faults were reactivated; and many basement-controlled structures became prominent.

The Eocene Sylhet Formation was deposited in a range of environments and was subdivided into the members which generally represents these different depositional environments. The lower Lakadong member was deposited in a lagoonal environment consists of more than 350m of thin sandstones and interbedded shales and coals in it basal parts . The environment of the Lakadong member typically consists of the thick sands of barrier- bar. The members of upper part of the Lakadong Formation are calcareous sandstone of a restricted shallow water platform.

The gneissic groups of rocks are well exposed in the western, northern and north eastern part of the Shillong plateau. Towards the southern boundary it is covered by Cretaceous –Tertiary sedimentary sequences and within the plateau about 2500 sq. km. (approx.) area is occupied by intracratonic basin sediments. Orthogneiss and paragneiss are the two major components of basement gneissic complex. The main characteristic features of the banded gneiss are of bimodal character. Other constituents are migmatite, augen gneiss, BIF, amphibolites, pyroxene granulite, calc granulite, high grade sillimanite bearing metapelite with characteristic cordierite, corundum, spinel and sappherine, lamprophyre, diorite, granodiorite, mafic intrusion, pegmatite and other vein rocks.

(ii) Local Geology

i) **Consolidated formations**: Precambrian gneissic complex projecting abruptly above the vast stretch of alluvium as isolated hills, referred in here as 'inselbergs' form consolidated formations in the district. These rock formations have been subjected to faulting and fracturing at several places, through which water percolates to facilitate weathering. Occurrence of ground water is limited in these formations and is confined to topographic lows and weathered residuum. The movement of ground water is controlled by the presence of fractures and fissures. Extractions of ground water in these zones are possible through large diameter dug wells and bore wells in hydrogeologically suitable places. Ground water occurs under water table conditions in the weathered zone. There are at present no borewells in the inselberg zone. However, yield of dugwells is adequate to meet the domestic needs.

ii) Unconsolidated formations: More than 80% of the district is underlain by unconsolidated formations, represented by the alluvial deposits of Recent age. It comprises the alluvial sediments of the foot hill belt (Bhabar) in the north and the valley covering the central and southern part. The behaviour of ground water in the piedmont sediments is naturally different from that in the alluvial areas further south.

Bhabar-Terai belt: This zone consists of the terrace deposits in the foot hill regions of the Himalayas composed of talus fans. The material is a heterogeneous admixture of boulders, pebbles, cobbles with the interstices filled by sand and silt. These sediments are highly permeable with very retentive capacity. Thus, the streams in this region are devoid of any appreciable surface flow, although there are evidences of sub- surface flow. Behaviour of ground water in the further south is less erratic. Here, ground water occurs under water table conditions. The depth to water level is high.

Older Alluvium: Ground water occurs under water table conditions in the elevated flattopped areas of Older alluvial sediments. These areas are usually forested. It comprises sand, 4 gravel and silt with more proportion of clay. Ground water in this zone occurs under unconfined to confined conditions. Newer Alluvium: The district is mostly covered by Newer alluvium and the formation is comprised of sand, gravel and pebble with silt and clay. Ground water in this zone occurs under unconfined condition.

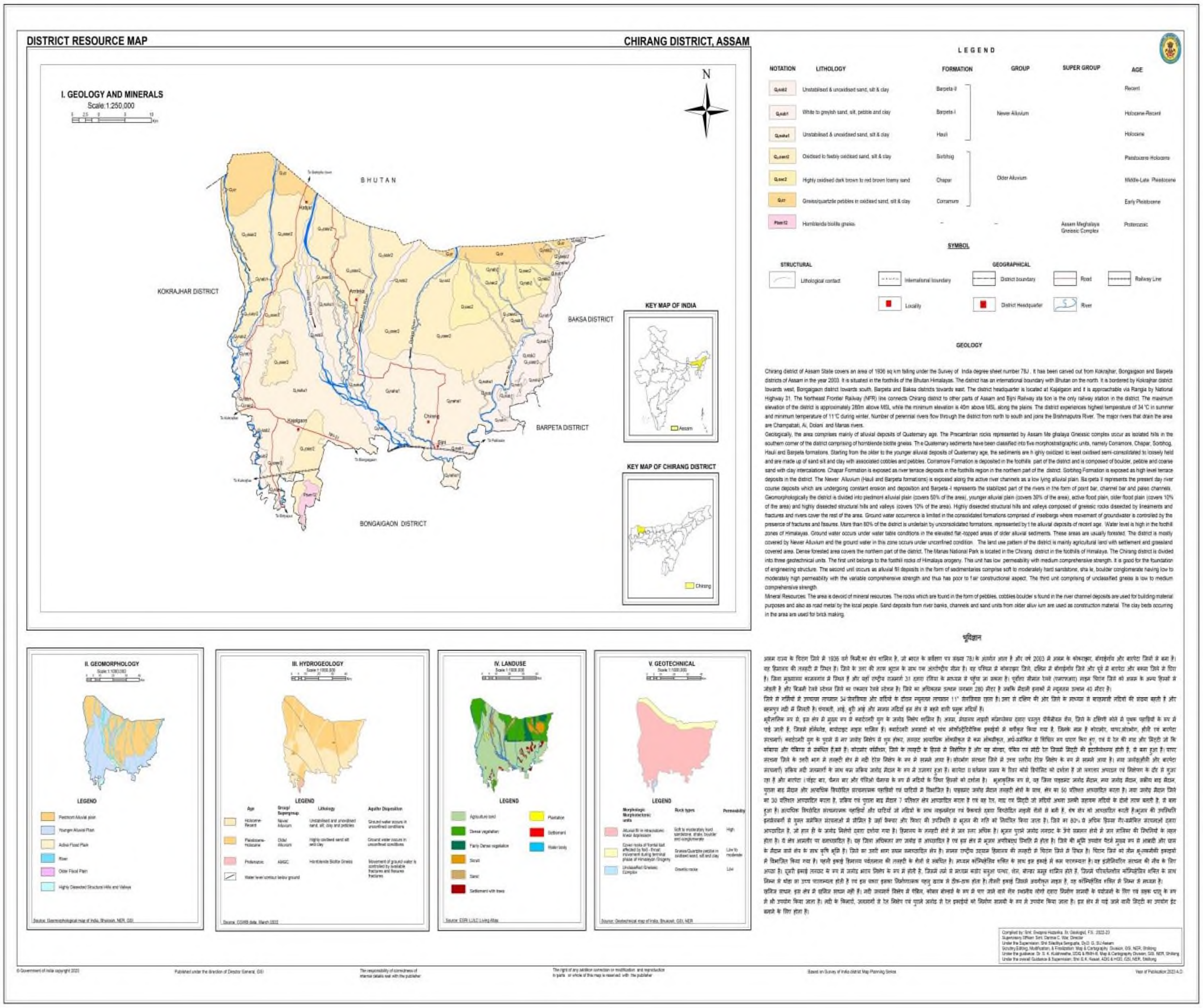


Figure: Geological Map of Chirang [District Resource Map, Geological Survey of India, 2023]

11. b) Mineral Wealth

ii. Overview of mineral resources:

The geological formation of Chirang District indicates the presence of minor minerals.

iii. Details of Sand and other riverbed minerals Resources:

The mineral resources of the district whose categorization and estimation have been done are furnished in this section.

12. (a) District wise detail of river or stream and other sand source

i) Drainage system with description of main rivers

S. No.	Name of the river	Area drained (sq. m)	% Area drained in the district
1			
2			
3			

Salient features of important rivers and streams:

S. No.	Name of the river or stream	Total length in the district (in km)	Place of origin	Altitude at origin
1				
2				
3				

(b) District wise availability of sand or gravel or aggregate resources

i) Annual deposition

S. No	River/ stream	Portion of the river/ stream recommended for mineral concession	Length of area recommended for mineral concession (in km)	Average width of area recommended for mineral concession (in m)	Area recommended for mineral concession (in sq. m)	Mineable mineral potential (in metric T) (60% of total mineral potential)
Total for the district						

ii) Mineral potential

Sand (MT)	Total mineable mineral potential (MT)

13. Replenishment Study

Replenishment study for a river solely depends on estimation of sediment load for any river system and the estimation is a time consuming and should be done over a period. The process in general is very slow and hardly measurable on season-to-season basis except otherwise the effect of flood is induced which is again a cyclic phenomenon. Usually, replenishment or sediment deposition quantities can be estimated in the following ways as given below:

A. Replenishment study based on satellite imagery involves demarcation of sand bars potential for riverbed mining. Both pre and post monsoon images need to be analyzed to established potential sand bars. Volume estimation of sand is done by multiplying Depth and Area of the sand bar. The sand bars are interpreted with the help of satellite imagery. Ground truthing has been done for 100% of the total identified sand bars. During ground truthing, width and length of each segment were physically measured. It has also been observed that in few cases, sand bars have attained more than 3 meters height from the average top level of the river beds. Considerations of sand resources have been restricted within 3 meters from the average top surface of the river bed.

B. Direct field measurement of the existing leases involving estimation of the volume difference of sand during pre and post-monsoon period. With systematic data acquisition, a model has developed for calculation of sediment yield and annual replenishment with variable components.

C. The replenishment estimation based on a theoretical empirical formula with the estimation of bed-load transport comprising of analytical models to calculate the replenishment estimation.

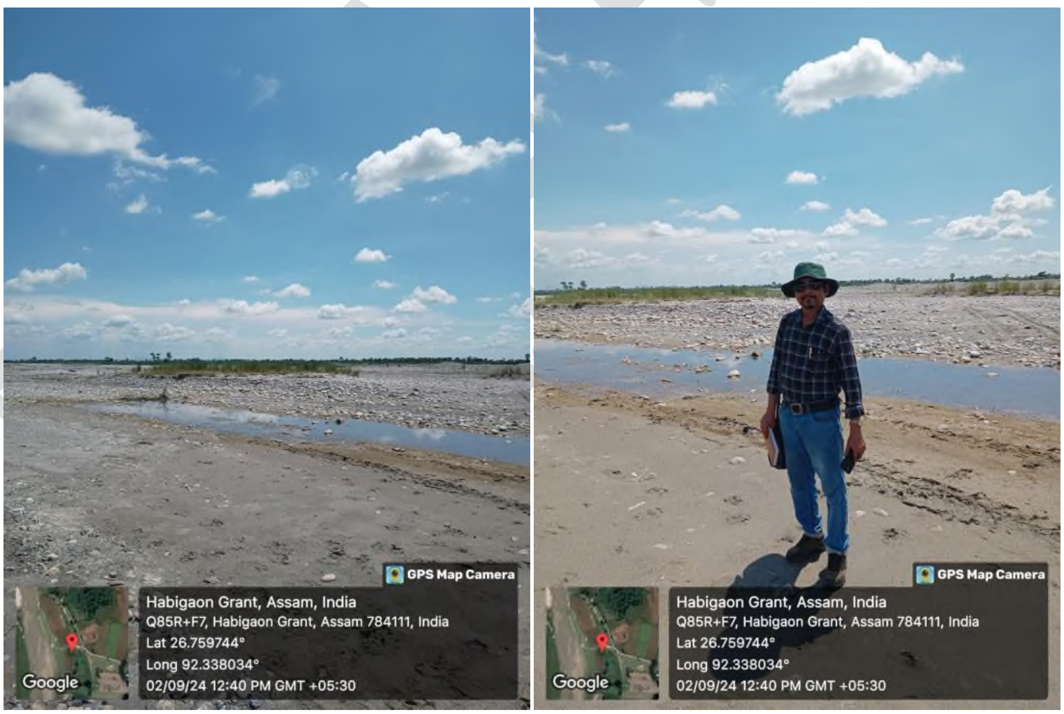
Field data collation:

Secondary data were collected for pre- monsoon period and during September 2024 post-monsoon data were collected for the river banks. The relative elevation levels were captured through GPS/DGPS. Thickness of the sand bars was measured through sectional profiles.

References:

1. https://chirang.assam.gov.in/about
2. https://www.cgwb.gov.in/old_website/District_Profile/Assam/Chirang.pdf

Photoplates:



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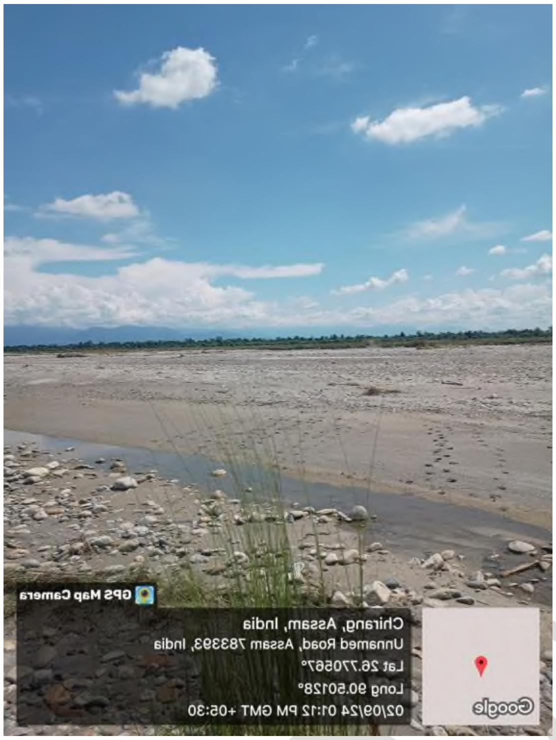

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DRAFT
DISTRICT SURVEY REPORT
OF
CHIRANG DISTRICT, ASSAM
(For Minor minerals other than sand or riverbed mining)

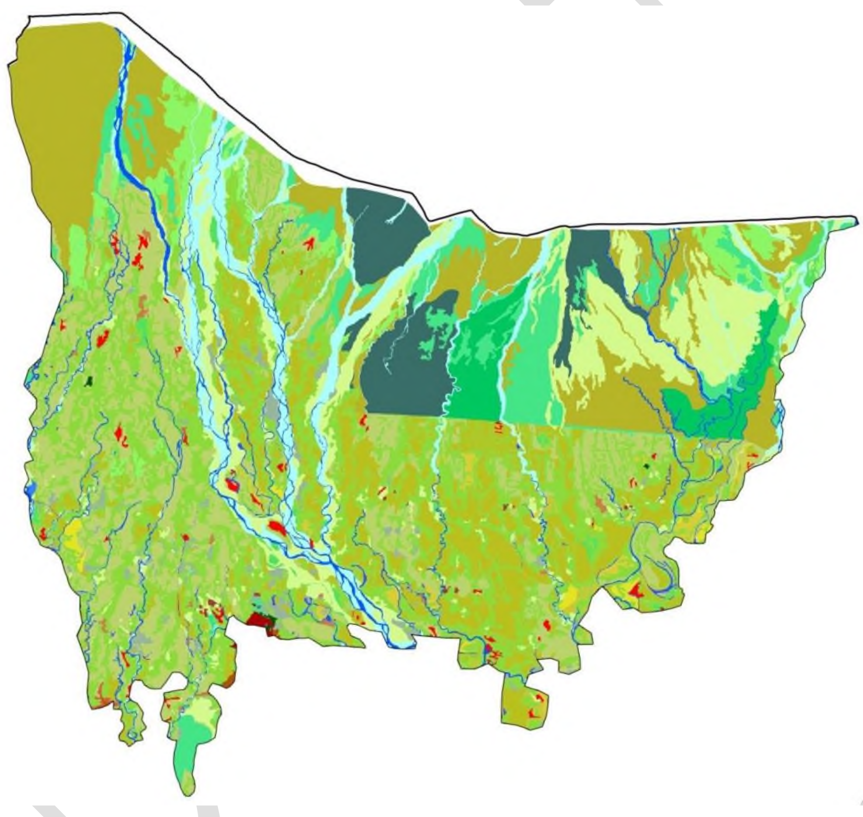

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Table of Content

EXECUTIVE SUMMARY

PREFACE

The need for a District Survey Report (DSR) has been mandated by the Ministry of Environment, Forest, and Climate Change (MoEF&CC) through Notification No. 125 (Extraordinary, Part II Section 3, Sub-section ii), S.O. 141 (E), dated 15th January 2016. This notification introduced amendments to the EIA Notification 2006, aimed at improving legislative control. As part of these changes, district-level committees were introduced, and the preparation of DSRs became a requirement.

Subsequently, Notification No. 3611 (E), dated 25th July 2018, expanded the DSR's scope to include "Minerals Other than Sand" and provided a specific format for its preparation. The DSR's purpose is to identify areas with mineral potential where mining activities can be permitted, as well as to flag areas where mining should be restricted due to proximity to infrastructure, erosion-prone zones, or environmentally sensitive regions.

The preparation of the DSR involves both primary and secondary data collection. Primary data includes site inspections, surveys, and ground truthing, while secondary data comes from authenticated sources and satellite imagery studies. The secondary data covers information such as the district profile, local geology, mineralization, and other relevant activities, often compiled from disparate sources.

Key Aspects of District Survey Report (DSR)

Assessment of Resources: The DSR provides a comprehensive evaluation of the mineral resources available in riverbeds within the district. It includes detailed data on the quantity, quality, and distribution of sand and other minor minerals, helping to prevent over-extraction and resource depletion through accurate estimation.

Environmental Impact Analysis: The report analyzes the environmental effects of riverbed mining, addressing changes in river morphology, hydrology, and impacts on aquatic ecosystems and biodiversity. This analysis is vital for mitigating harmful environmental impacts and conserving riverine habitats.

Regulation and Compliance: The DSR serves as a regulatory tool for riverbed mining, outlining standards and guidelines to ensure compliance with national and state environmental laws. It helps curb illegal mining activities and promotes regulated, lawful mining operations.

Sustainable Mining Practices: The DSR advocates for sustainable mining practices that reduce environmental degradation. Recommendations may include controlled mining depths, designated extraction zones, and periodic studies to maintain the ecological balance of river systems.

Socio-Economic Considerations: The report addresses the socioeconomic implications of riverbed mining, such as employment generation and local government revenue. It also considers the negative impacts on communities, including displacement and loss of livelihoods.

Data-Driven Decision Making: The DSR provides a scientific foundation for decisions regarding riverbed mining. Incorporating geospatial data, remote sensing images, and field surveys enhances the accuracy and reliability of the report, supporting informed policy-making and resource management.

Stakeholder Involvement: The preparation of the DSR involves consultations with various stakeholders, such as government bodies, local communities, environmentalists, and industry representatives. This inclusive approach ensures diverse perspectives are considered, promoting balanced and equitable mining practices.

1. Introduction of District Survey Report (DSR) of Chirang District

1.1 Introduction

The District Survey Report (DSR) of Chirang District has been prepared following the guidelines of the Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India. This report aligns with the MoEF&CC Notification S.O.-1533(E) dated 14th September 2006 and subsequent notification S.O. 141(E) dated 15th January 2016. It aims to ensure the scientific and systematic utilization of natural resources for the benefit of present and future generations. Furthermore, MoEF&CC's notification S.O. 3611(E) dated 25th July 2018 recommends the format for preparing the DSR.

The main objective of the DSR is to identify areas of aggradation where mining can be allowed, and areas of erosion where mining should be restricted. It also involves the calculation of the annual replenishment rate to maintain ecological balance. Additionally, the DSR includes assessing the development potential of in-situ minor minerals.

Objectives of the DSR:

1. Identification and quantification of minor mineral resources for optimal utilization.
2. Regulation of river bed mining, and reduction of demand-supply gaps.
3. Use of Information Technology (IT) for surveillance of river bed mining activities.
4. Facilitation of environmental clearance for clusters of mines.
5. Restriction of illegal mining.
6. Reduction of flood occurrences in the area.
7. Preservation of aquatic habitats.
8. Protection of groundwater by limiting extraction to above base flow levels.
9. Maintenance of data records related to mineral resources, leases, and revenue generation.
10. Creation of a scientific mining plan, including ultimate pit limit estimation.
11. Development of comprehensive guidelines for mining minor minerals.

The DSR includes secondary data on the district's geology, climate, mineral resources, and other relevant factors, compiled from published and unpublished reports, as well as government websites.

1.2 Statutory Framework

The MoEF&CC has issued several notifications and guidelines over the years to regulate mining and formulate DSRs for each district. Below is a summary of the legal framework:

Year	**Particulars**
1994	The MoEF&CC issued the Environmental Impact Assessment (EIA) Notification for major minerals covering areas over 5 hectares.
2006	EIA Notification SO 1533 (E) made it mandatory to obtain environmental clearance (EC) for minor minerals exceeding 5 hectares.
2012	The Hon'ble Supreme Court mandated EC for minor minerals, even for areas under 5 hectares.
2016	"Sustainable Sand Mining Guidelines (SSMG)" introduced, requiring EC for all minor minerals and district-level monitoring.
2018	MoEF&CC issued notification S.O. 3611(E) with a recommended DSR format for identifying aggradation areas, replenishment rates, and protected zones.
2020	The "Enforcement and Monitoring Guidelines for Sand Mining (EMGSM)" introduced for improved regulatory enforcement and technological monitoring of sand mining activities.

Enforcement & Monitoring Guidelines, 2020

These guidelines address illegal mining, directing states to implement monitoring mechanisms like river audits, aerial surveys, and drone-based surveillance.

1.3Utilization and Demand of the minerals

River bed minerals like sand, gravel, stone etc. plays an essential role in construction and is widely used in concrete production, glass manufacturing, road base formation, and many more. River bed mining is a prevalent practice in Chirang District, mainly for construction. The rise in real estate and government infrastructure projects has significantly increased the demand for sand and bricks. The minor minerals of Chirang district come under B-category mining and it is included in sub-category B2. All the available minerals are of Y-schedule.

Uses of minerals:

1. **Construction**: Sand, gravel, silt, clay and ordinary earth are key ingredients in concrete, mortar and asphalt.
2. **Industrial**: Used in glass production and abrasives.
3. **Environmental**: The minerals can improve traffic safety by providing grip on icy roads, and it helps in soil conditioning for agriculture.
4. **Decorative**: Sand, gravel and stones are used in candles, aquariums, and for enhancing aesthetic appeal in landscaping.
5. **Flood Protection**: Proper management of sand mining helps maintain river flood discharge capacity, reducing the risk of floods.

This DSR aims to provide a well-rounded, data-driven approach for sustainable mineral resource management, ensuring compliance with environmental guidelines and promoting socio-economic benefits for the district.

1.4 Methodology of DSR Preparation

The District Survey Report (DSR) preparation follows a systematic methodology to ensure accuracy and comprehensiveness. The steps involved in the preparation of the DSR are illustrated in Figure 2.1 and are described in detail in the following sections.

a. Data Source Identification

The DSR is based on both primary and secondary data collected from reliable and authoritative sources. Identifying authentic data sources is critical for compiling accurate data. The primary data sources for the DSR are collected through field surveys and replenishment studies. Secondary data sources include publicly available information from government publications, reports, and reputable journals.

- **District Profile**: Information related to the district's demographics and basic statistics is sourced from the **District Census Report, 2011** and the **District Statistical Handbook** published by the Government of Assam.
- **Mineral Resources**: The potential mineral resources of the district are described based on reports published by the **Geological Survey of India (GSI)** or other government agencies
- **Mining Data**: Information on mining leases, lease holders, lease areas, resource allocations, and revenue generation is collected from the **Forest Department.**
- **Satellite Images**: Satellite imagery is utilized to prepare maps related to the district's physiography and land use/land cover.

b. Data Analysis and Map Preparation

After collecting data, a detailed analysis is conducted to extract relevant insights. This involves analyzing spatial data and preparing maps that depict:

- Geomorphology of the district
- Topography
- Land use patterns
- Mineral resource distribution

These maps help visualize the key characteristics of the district and identify potential mining areas.

c. *Primary Data Collection*

Primary data is essential for preparing a comprehensive DSR. Fieldwork is conducted across the district to assess mineral resources. This field study provides a detailed understanding of the mineral composition and their distribution in the area.

d. *Replenishment Study*

A key aspect of sustainable mining is ensuring that the amount of sediment removed from riverbeds is replenished naturally. Therefore, replenishment studies are conducted to assess the annual rate of replenishment of riverbed sand. This helps avoid the adverse impacts of excessive sand extraction.

- Physical surveys of the riverbed are carried out using **GPS/DGPS** to define the topography, contours, and offsets.
- The surveys provide a detailed depiction of important features in and around the river, including nearby civil structures and other key landmarks.
- This information helps define the spatial area eligible for sand mining and estimate the sand reserves.

e. *Report Preparation*

The DSR covers various aspects of the district, including:

- **General Profile**: A brief overview of the district, including demographics, land use patterns, and economic activities.
- **Geomorphology and Geology**: An assessment of the district's physical landscape, including its geological structure.
- **Mineral Resources**: A detailed account of riverbed sands and other minor minerals in the district, including their distribution and potential for extraction.
- **Mining Block Delineation**: Identification of potential mining blocks and mineral reserves within the district.

- **Production Trends**: An analysis of recent trends in the production of minor minerals and the revenue generated from the mining sector.
- **Replenishment Estimation**: The annual replenishment rate of riverbed sand, based on field surveys.
- **Environmental Impact and Mitigation**: An evaluation of the potential environmental impacts of mining activities, along with proposed mitigation measures.
- **Risk Assessment and Disaster Management**: A strategy for managing risks associated with mining and minimizing the impact of any potential disasters.
- **Reclamation Strategy**: A plan for the reclamation of already mined-out areas to restore the ecological balance.

This structured approach ensures that the DSR not only identifies mineral resources but also emphasizes sustainable mining practices and environmental preservation.

2. Overview of mining activity in the district

In the Chirang district collection of sand, gravel, stone, clay/silt etc. from river- bed is considered as one of the main minor mineral sources of the district. These materials are primarily utilized for construction purpose.

3. General profile of the district

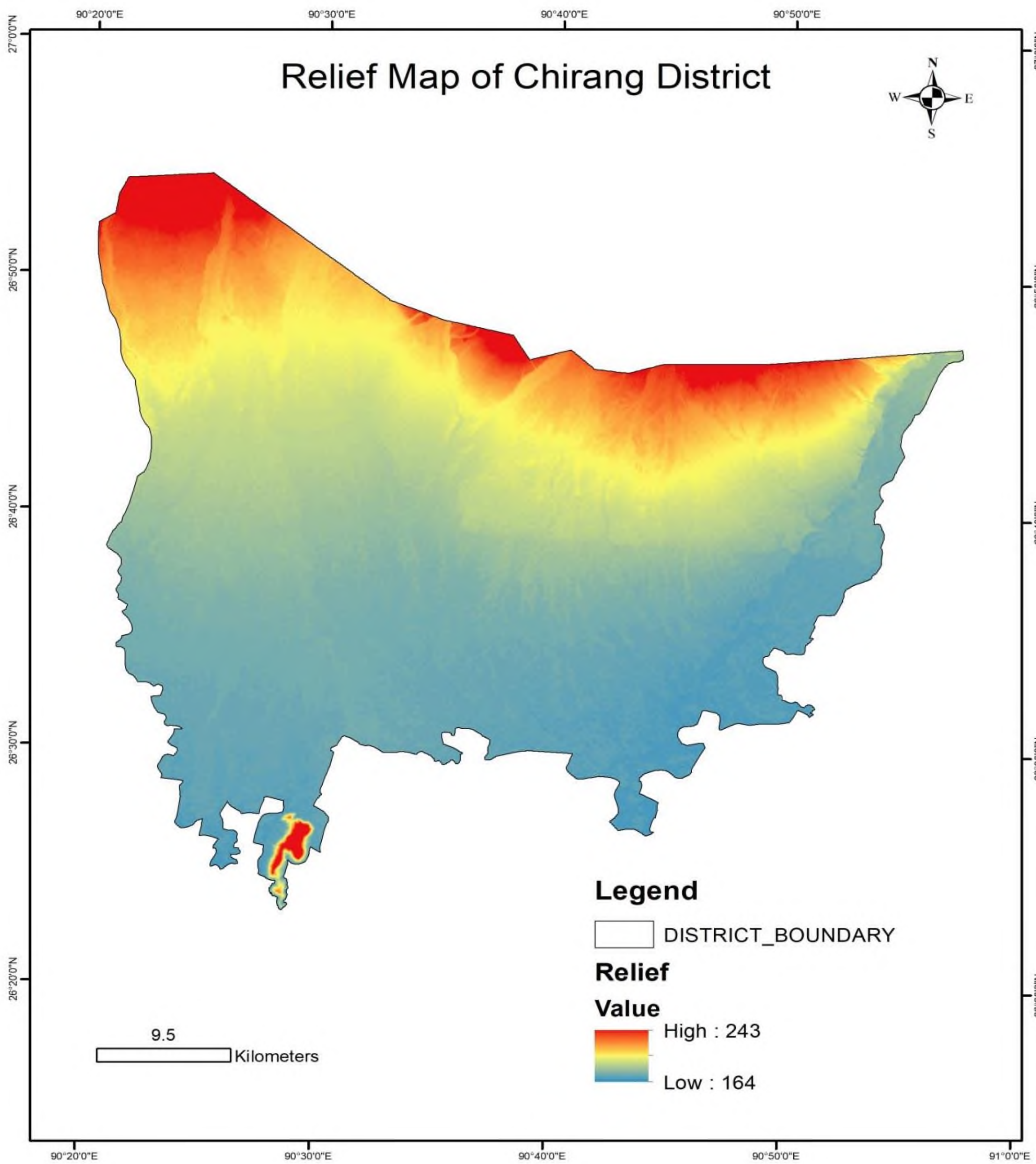
- **General Information**

The district started functioning with effect from 4th June, 2004 with its head quarter at Kajalgaon. This district is having one civil sub- division with its head quarter at Bijni and one sadar sub- division with its head quarter at Kajalgaon. The Chirang district possesses a plain topography. It also has undulating areas and the northern parts of the district lie on the foothills of Bhutan that has slightly higher elevation, which is decreasing towards the southern parts of the district. The four types of soil found here are entisols, inceptisols, alfisols and ultisols. The district comes under lower Brahmaputra valley agro- climatic zone. The climate is sub- tropical in nature with warm and humid summer followed by dry and cool winter. The pre and post-monsoon months are unpredictable and experience erratic rainfall. Champamati, Aie and Manas rivers flow through the district and join the Brahmaputra river. Many other tributaries, small rivulets and streams flow through this district.

The word "Chirang" has been derived from garo word -"*chi*" means water and "*rang*" means wealth. Chirang district is one of the four districts of bodoland territorial area district (btad) under the govt. Of assam, created vide notification no. Gag (b). 137/2002/pt/117 dtd. 30/10/2003 within Assam under clause 6 of article 332 by the 90th amendment act, 2003 of the constitution of India under the provision of the sixth schedule. It was carved out of the districts of Kokrajhar, Bongaigaon and Barpeta.

The district is situated in North- West side of Assam surrounded by international boundary of Bhutan in North, Bongaigaon district and a little portion of Kokrajhar district in South, Kokrajhar district in West and Baksa district in East. The geographical area of the district is 1468.42sq. km. The district is located between 26.28 N and 26.54 N longitudes and 89.42 E and 90.06 E latitudes. The district has a total population of 4,82,162 with 2,37,302 being males and 73,215 being females respectively. The distinguishing factor among the demography in both the blocks in the district is the proportion of general and obc population and SC and ST population. In Sidli the block is dominated by SC and ST population while in Borobazar almost half the population belongs to general and obc category. As per the 2011 census it is the second least populous district in the state, after Dima Hasao. Chirang district is generally divided into fiveblocks i.e. Sidli, Dangtal (part), Borobajar, Manikpur|(part) and Kokrajar(part). The main inhabitants of this region are the Boro people. Other communities living in the region are Assamese, Muslim, Rabha, Santali, Nepali, Kuki, Rajbangsi, Bengali, Bihari, etc. Chirang is one of the major districts of Assam situated at the Northern part of Brahmaputra river under lower Brahmaputra valley zone of Assam. Chirang is one of the four districts of Bodoland Territorial Area District (BTAD) created within Assam under clauses 6 of article 332 by the 90th Amendment Act 2003 of constitution of India. The district was curved out of existing district of Kokrajhar, Bongaigaon and Barpeta.

b



Transport:

By Road: Kajalgaon, the head quarter of Chirang district, through which National Highway 31C passes. So, buses are available and easily catchable to go to Guwahati,Cooch Bihar and Bongaigaon. Chapaguri is the main point to catch all the private and public vehicles.

→National Highway No. 27 (via Rangya, Chapaguri Chariali)

→Distance from to Guwahati to Kajalgaon: 184 KM(approx)

→Distance from to Cooch Bihar to Kajalgaon: 136 KM(approx)

By Train: Two Railaway stations where both local and express trains stop

→Basugaon Railway Station

→Bijni Railway Station

By Air: The International airport LGBI is around 191 km away from the district Head Quater and the nearest one is Rupsi Airport,which is around 102 km away.VIP helicopters land in the BGR field of Chirang.

Administrative setup-

Administrative Division	LAD
District Headquarter	Kajalgaon
Number of Sub- Divisions	2
Lok Sabha Constituency	Kokrajhar (ST) (HPC-1)
Legislative Assembly Constituency	2 (19- Sidli Chirang LAC, 20- Bijni LAC)
Number of Revenue Circles	3
Number of Educational Blocks	3
Number of Municipality Boards	3
Number of Developmental Blocks	3
Number of Gaon Panchayats	74 Nos. of VCDC
Number of Villages	496
Number of Revenue Villages	479
Number of Forest Villages	22
Number of Police Stations	7
Number of Police Outpost	7
Number of Municipality Board	3
Total Population	4,82,162

(to be updated)

Table: Health Setup

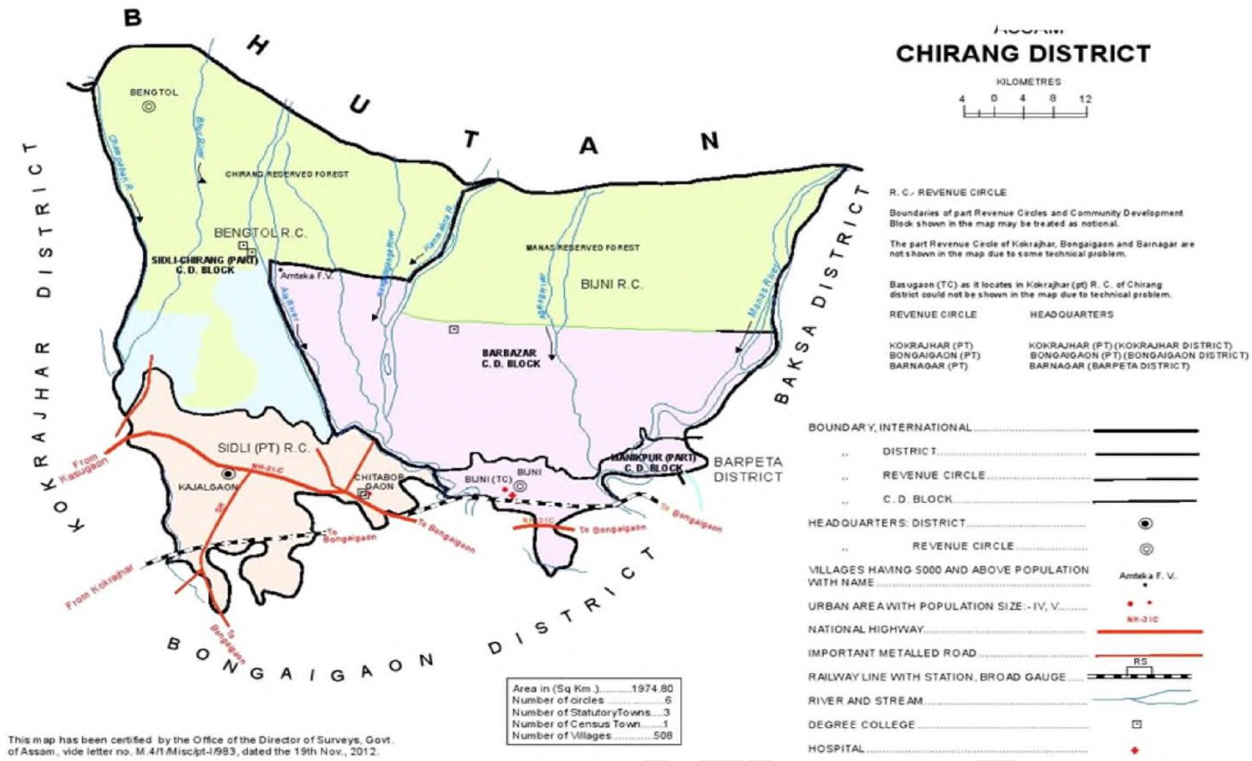
Number of District Hospitals	1
Number of Community Health Centres	4
Number of Primary Health Centres	3
Number of Sub Centres	87

Table: Educational Setup

Number of Univetsity	Bodoland University,Kokrajhar (Nearest)
Number of Engineering Collage	CIT Kokrajhar (Nearest)
Number of Degree College	6
Number of Higher Secondary School	10
Upper Primary (Govt)	88
Number of High Schools	44
Lower Primary (Govt)	777

(As per census 2011)

Total Area	1468.42 Sq Km
Total Population	482,162
Rural Population	446,825
Urban Population	35,337
Population Growth (%)	11.34
Average Literacy (%)	63.55
Density	251/sq. Km
Total Household	97,395



Map: Administrative Map of Chirang District

Agro ecology:

Agro ecology is an ecological approach to agriculture that views agricultural areas as ecosystems and is concerned with the ecological impact of agricultural practices. It refers to the study of agricultural ecosystems and their components as they function in themselves as a part of the larger ecosystem. Agro ecology involves examining climate, water, soil, flora and fauna of the concerned area. A systematic study of agro ecology is important for planning appropriate land use. Study of agro-ecological regions is necessary to determine yield potentialities of different crops, and crop combinations in the agro-ecological regions in the future. On the basis of information on physiography, soils, farming systems, crop and cropping systems and hydrological information, the district Chirang has been classified in to five agro- ecological situations, which are as follows –

- Foot hills old mountain valley
- Flood free riverine old alluvial plain
- Flood prone riverine alluvial plain
- Beels
- Char land

Sl No.	*Agro ecological situation*	*Characteristics*
i.	Foot hill old mountain valley alluvial plain	The northern part of the district comprising this situation contains old Mountain valley alluvial soils (Alfisol & Ultisol). It is build up of alluvial materials washed down from the hill slops. The surface soil is light yellow to pale brown, compact, sticky and plastic. Generally, medium to heavy in soil texture. The elevation is higher towards foot hills which gradually slop towards south.
ii.	Flood prone recent riverine alluvial plain	Recent riverine alluvial (Entisol), sandy to sandy loam in soil texture. This situation is represented by an almost flat topography which often experiences flood hazard. Apart from some natural depressions, some Riverine islands are also in existence.
iii.	Flood free riverine alluvial plain	Old riverine alluvial type (Inceptisol). The texture of the surface soils ranges from sandy loam to loam, silty clay loam, silty clay and clay. The topography is almost plain.
iv.	Char land	New alluvial plains, neutral in reaction, sandy-silty clay, sandy-silty and sandy in soil texture (Entisol). Chronically flood affected areas except the stable chars.
v.	Beels	Entisols, usually peaty in nature and texturally these are silty and clay. Low lying waste land areas.

4. a) Geology

(i) Regional Geology:

The Shillong Plateau (approx. 47,614 sq. km) is a Precambrian cratonic block in Northeast India, tectonically separated from the Indian Peninsula. It is bordered by:

- Dauki Fault to the south (dextral strike-slip fault),
- Brahmaputra Lineament to the north,
- Garo-RajmahalGrabenandDhuburi/Madhupur Lineament to the west,
- Belt of Schuppen to the east.

This block is made up of high- to medium-grade Paleoproterozoic basement gneisses and schists, which are classified as the **Basement Gneissic Group (BGG)**. These are overlain by Mesoproterozoicmetasediments and metavolcanics of the **Shillong Group**, intruded by Neoproterozoic acidic intrusives such as:

- Myllem pluton
- South Khasi pluton
- Umroi granite
- Nongpoh pluton

The plateau is composed mainly of orthogneiss and paragneiss with the following geological units:

- Banded gneiss (bimodal character)
- Migmatite
- Augen gneiss
- Banded Iron Formation (BIF)
- Amphibolites
- Pyroxene granulite
- Calc granulite
- High-grade sillimanite-bearing metapelite with cordierite, corundum, spinel, sapphirine
- Intrusives like lamprophyre, diorite, granodiorite, mafic intrusions, andpegmatite veins.

Towards the southern boundary of the Shillong Plateau, Cretaceous–Tertiary sedimentary sequences overlay these basement rocks. The plateau also contains an intracratonic basin (approx. 2,500 sq. km) with sedimentary cover.

The Assam Basin to the north represents the cratonic margin with three main tectonic phases:

1. Late Cretaceous to Eocene block faulting and development of a southeasterly dipping shelf.
2. Oligocene uplift and erosion, during which basement faults reactivated.
3. Post-Oligocene phases, marked by sedimentation and structural developments.

The Eocene Sylhet Formation is significant for its varied depositional environments:

- The Lakadong Member (lagoonal environment) contains thin sandstone and interbedded shale and coal.
- The upper part of the Lakadong Formation represents calcareous sandstones formed in a shallow water platform.

(ii) Local Geology

i) **Consolidated formations**: Precambrian gneissic complex projecting abruptly above the vast stretch of alluvium as isolated hills, referred in here as 'inselbergs' form consolidated formations in the district. These rock formations have been subjected to faulting and fracturing at several places, through which water percolates to facilitate weathering. Occurrence of ground water is limited in these formations and is confined to topographic lows and weathered residuum. The movement of ground water is controlled by the presence of fractures and fissures. Extractions of ground water in these zones are possible through large diameter dug wells and bore wells in hydrogeologically suitable places. Ground water occurs under water table conditions in the weathered zone. There are at present no borewells in the inselberg zone. However, yield of dugwells is adequate to meet the domestic needs.

ii) Unconsolidated formations: More than 80% of the district is underlain by unconsolidated formations, represented by the alluvial deposits of Recent age. It comprises the alluvial sediments of the foot hill belt (Bhabar) in the north and the valley covering the central and southern part. The behaviour of ground water in the piedmont sediments is naturally different from that in the alluvial areas further south.

Bhabar-Terai belt: This zone consists of the terrace deposits in the foot hill regions of the Himalayas composed of talus fans. The material is a heterogeneous admixture of boulders, pebbles, cobbles with the interstices filled by sand and silt. These sediments are highly permeable with very retentive capacity. Thus, the streams in this region are devoid of any appreciable surface flow, although there are evidences of sub- surface flow. Behaviour of ground water in the further south is less erratic. Here, ground water occurs under water table conditions. The depth to water level is high.

Older Alluvium: Ground water occurs under water table conditions in the elevated flattopped areas of Older alluvial sediments. These areas are usually forested. It comprises sand, 4 gravel and silt with more proportion of clay. Ground water in this zone occurs under unconfined to confined conditions. Newer Alluvium: The district is mostly covered by Newer alluvium and the formation is comprised of sand, gravel and pebble with silt and clay. Ground water in this zone occurs under unconfined condition.

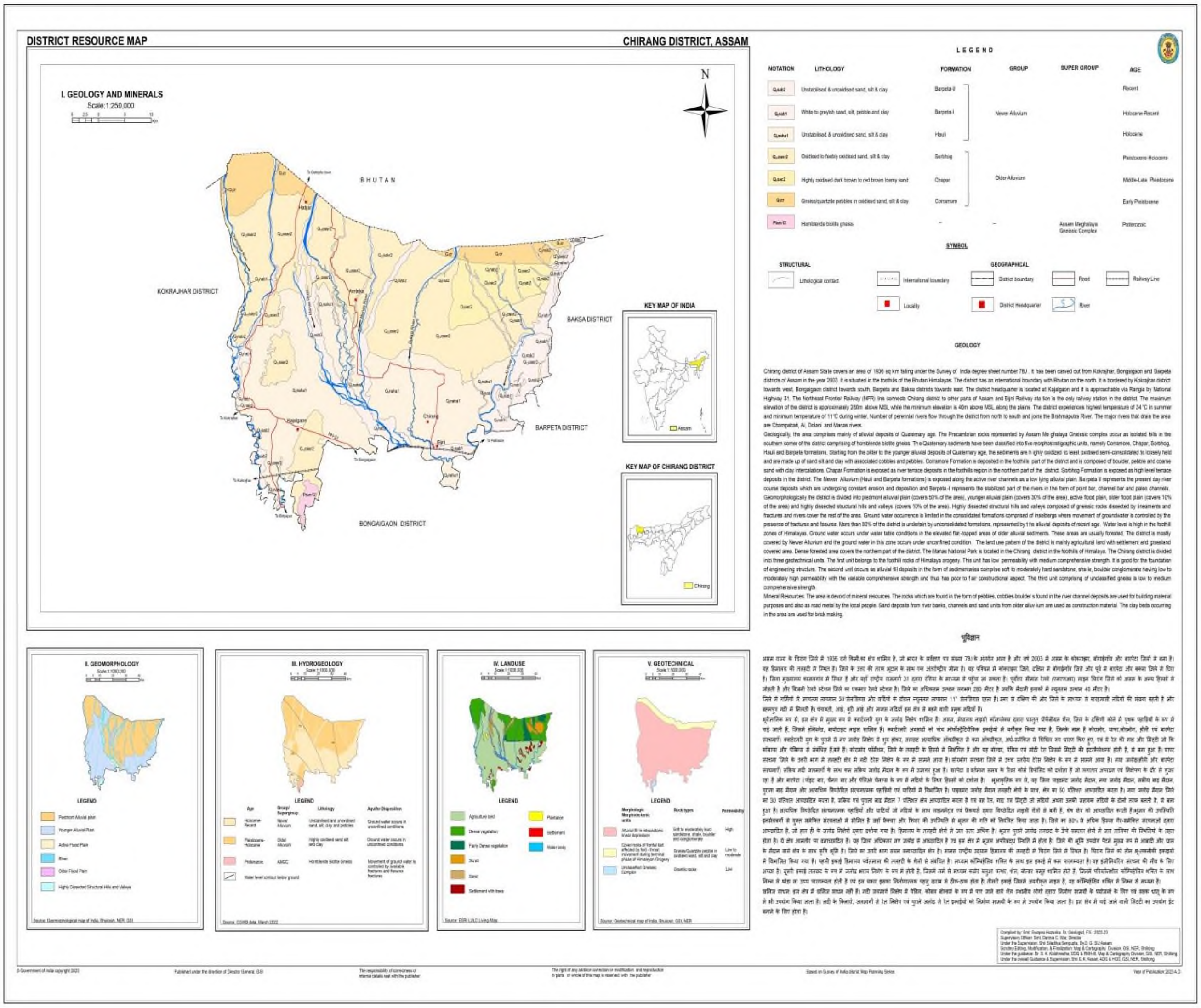


Figure: Geological Map of Chirang [District Resource Map, Geological Survey of India, 2023]

5. Drainage of irrigation pattern

Number of perennial streams flow through the district from north to south and join the Brahmaputra River. The major streams that drain the area are Champabati, Ai, Buri Ai, Manas, Kanamkara and Arang Rivers. The Irrigation Department has taken up 14 (fourteen) schemes in total both new as well as renovated/improved old schemes in Chirang District, out of which 13 (thirteen) schemes are directly related to supplying of irrigation water for cultivation and 1 (one) scheme is not irrigation oriented. Out of 13 (thirteen) schemes, 10 (ten) schemes have been completed and a total potential of 1,172 ha for Kharif Crops have been so far created through the achievement of these schemes. The remaining 3 (three) schemes are also in progress.

Stream ordering

The stream order hierarchy was officially proposed in 1952 by Arthur Newell Strahler, a geoscience professor at Columbia University in New York City, in his article "Hypsometric (Area Altitude) Analysis of Erosional Topology". The article, which appeared in the Geological Society of America Bulletin outlined the order of streams as a way to define the size of perennial (a stream with water in its bed continuously throughout the year) and recurring (a stream with water in its bed only part of the year) streams. When using stream order to classify a stream, the sizes range from a first order stream all the way to the largest, a 12th- order stream.

A first- order stream is the smallest of the world's streams and consists of small tributaries. These are the streams that flow into and "feed" larger streams but do not normally have any water flowing into them. In addition, first and second- order streams generally form on steep slopes and flow quickly until they slow down and meet the next-order waterway.

First through third- order streams are also called headwater streams and constitute any waterways in the upper reaches of the watershed. It is estimated that over 80% of the world's waterways are these first through third- order, or headwater streams. Going up in size and strength, streams that are classified as fourth through sixth order are medium streams while anything larger (up to 12th order) is considered a river.

The world's largest river, the Amazon in South America, is considered a 12th- order stream. Unlike the smaller order streams, these medium and large rivers are usually less steep and flow slower. They do however tend to have larger volumes of runoff and debris as it collects in them from the smaller waterways flowing into them.

This method of classifying stream size is important to geographers, geologists, hydrologists and other scientists because it gives them an idea of the size and strength of specific waterways within stream networks- an important component of water management. In addition, classifying stream order allows scientists to more easily study the amount of sediment in an area and more effectively use waterways as natural resources. Stream order also helps people like biogeographers and biologists in determining what types of life might be present in the waterway. This is the idea behind the River Continuum Concept, a model used to determine the number and types of organisms present in a stream of a given size. Different types of plants for example can live in sediment- filled, slower-flowing rivers like the lower Ganges than can live in a fast- flowing tributary of the same river. Field investigation depicts that order of all the rivers is of 1st order nature: drainage pattern is dendritic; drainage density is very low.

Irrigation

The facility of irrigation through canal is available in the district with 16,170 hectares of land under the command area of canals. There has been no assessment of availability of ground water in Chirang district by Central Ground Water Board and hence the potential/ availability of ground water in the district cannot be commented upon. Among the ground water sources, 3090 shallow tube wells are available in the district.

The gross irrigated area in Sidli and Borobazar blocks is 5865 ha. and 7605 ha. respectively. Majority of the net irrigated area lies in Borobazar block with 7605 hectares that comprise 54.58% of the total net irrigated area in Chirang district. Rainfed area is also more in Borobazar with 48,000 ha. block compared to Sidli block that has 32,262 ha. 9.66% of the total area sown in Sidli is irrigated and 90.33% is completely or partially irrigated or rainfed.

Similarly, in Borobazar 7.94% of the total area sown is irrigated and 92.05% remains partially irrigated or rainfed. So in terms of irrigation status both blocks are nearly at the same position.

Table 2.9: Irrigated and rainfed area in Chirang.

Irrigated (Area in ha)		**Rainfed (Area in ha)**	
Gross Irrigated Area	**Net Irrigated Area**	**Partially Irrigated/Protective Irrigation**	**Un- Irrigated or Totally Rainfed**
99,705.61	8,620	10,823	80,262.61

Source: Agriculture Department, Chirang

Table 2.10: Block-wise irrigated and rainfed area

Block	**Irrigated (Area in ha)**		**Rainfed (Area in ha)**	
Sidli	**Gross Irrigated Area**	**Net Irrigated Area**	**Partially Irrigated/Protective Irrigation**	**Un- Irrigated or Totally Rainfed**
Borobazar	99,705.61	8,620	10,823	80,262.61

6. Land utilization pattern in the district:

Land resource is one the most important and valuable free gift of the nature and its proper utilization by the inhabitants is of great value. Land should be fully used as per its capability. Lack of proper or profitable use means wastage of land resource and it results loss of productivity. It therefore requires proper and timely use of this kind of asset.

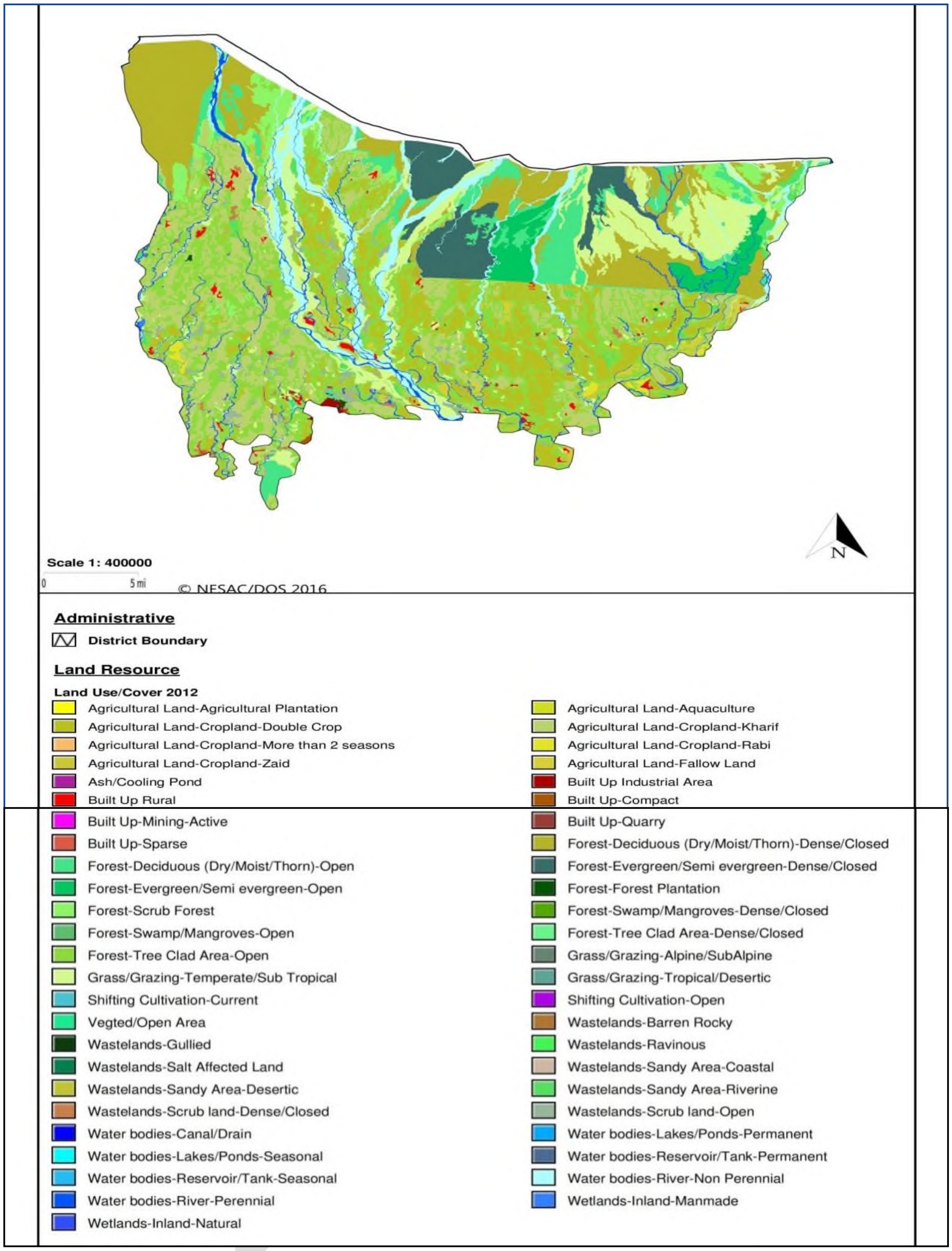
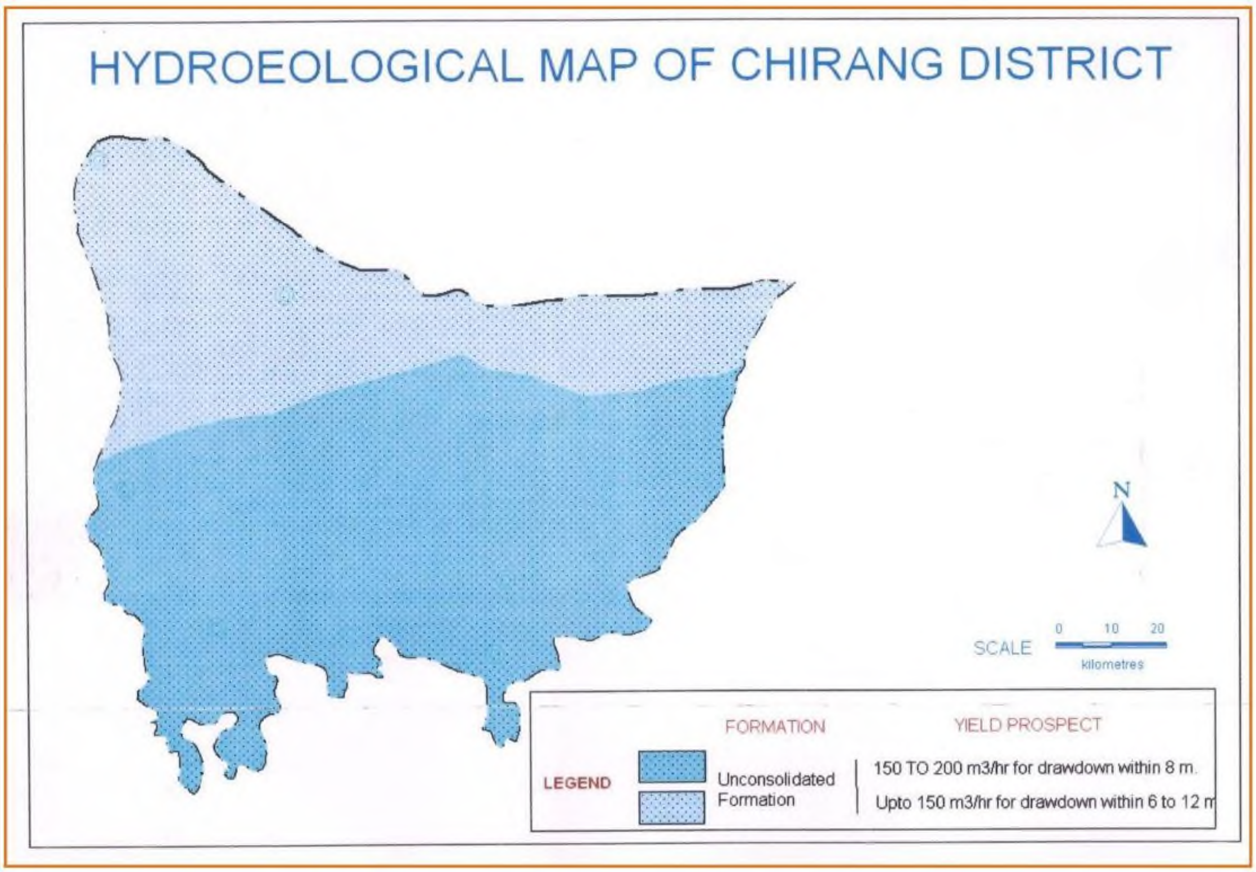


Fig: Map showing Land Use and Land Cover, Chirang District.

7. Surface and Groundwater scenario of the district:

Number of perennial streams flow through the district from north to south and join the Brahmaputra River. The major streams that drain the area are Champabati, Ai, Buri Ai, Manas, Kanamkara and Arang Rivers. The Irrigation Department has taken up 14 (fourteen) schemes in total both new as well as renovated/improved old schemes in Chirang District, out of which 13 (thirteen) schemes are directly related to supplying of irrigation water for cultivation and 1 (one) scheme is not irrigation oriented. Out of 13 (thirteen) schemes, 10 (ten) schemes have been completed and a total potential of 1,172 ha for Kharif Crops have been so far created through the achievement of these schemes. The remaining 3 (three) schemes are also in progress.

Based on the behaviour and occurrence of ground water, the regional ground water flow system of district has been described under following categories. i. Shallow aquifer group occurring within 50 m depth. ii. Deeper aquifer group beyond a depth of 50 m and down to 200 m bgl. i. Shallow Aquifer Group: It constituted of a mixture of boulders, gravel, sand, silt and clay. The thickness of the aquifer varies from 15 to 40 m. Ground water in this aquifer generally occurs under water table to semi-confined conditions. The development of ground water from this aquifer for both domestic and irrigation purposes is by open wells and shallow tube wells. The boulders are restricted mostly to the northern parts of the district. They occur between GL to 50 m bgl and thickness varies from 20 - 30 m. The thickness increases from south to north. The water level in the major part of the district generally lies between 2 to 4 m bgl. The northern most part occupied by the piedmont zones and the areas adjoining to the inselbergs are having deeper water level. The movement of ground water is southerly towards Brahmaputra River. The water table contour follows the topography of the area and lies more or less parallel to the Brahmaputra River. The hydraulic gradient becomes gentler towards the south. ii. Deeper Aquifer Group It constituted of coarse to medium sand with intercalation of clay. Ground water occurs under water table to semi-confined conditions. Detailed hydrogeological surveys aided by exploratory drilling revealed the existence of two to three promising aquifer zones down to the depth of maximum 200 m bgl. Aquifer displays various degree of lateral and vertical variation of aquifer indicating various degree of depositional environment both in space and time. The piezometric surface is highly variable and the movement of ground water is towards the south. The ground water of the district is both slightly acidic and alkalaine in nature with pH values ranging from 6.82 to 7.21. Ground water has low content of dissolved minerals. The iron content is generally high for drinking purposes in some areas, the range being from 1.02 - 3.0 ppm. But, in most of the sources, it is within permissible limit as per BIS (1991) standard of 1.0 ppm and as such, it does not pose any serious health hazards. High iron concentration has been observed in and around Runikhata area. Except high iron content, the ground water of the district is suitable and safe for drinking and other uses. The water is soft and has low bi-carbonate content. The formation water of both shallow and deep aquifers is suitable for most of the irrigational and industrial purposes. Ground water is having a little higher concentration of iron but can be used after treatment.



Map: Hydrogeological Map of the District.

8. Rainfall of the district and climatic condition

Rainfall

The average annual rainfall recorded from 2011 to 2021 of I.M.D is 1295.42 mm. Rainfall during January to April contributes nearly 14.41% to the total rainfall whereas the rainy season which commences from May and continues up to September contributes 79.74%. October to December rainfall is only 5.8%. December receives least rainfall.

Table: Monthly rainfall distribution of Chirang district, Assam

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F	R/F
2018	4	39.4	114.1	125.7	647.8	934.2	721	312.1	1063.6	91.8	28	20.6
2019	0.6	73	45.2	158.4	429	538.6	1401.4	254.5	488.4	126.6	10.4	0
2020	6.8	15	36.6	58.8	842.4	1114.2	1552	422.9	1237.4	121.2	2	4
2021	16	2.8	32.6	104.4	250.6	840	617.4	563.2	237	261	1.4	0
2022	31.2	72	36.7	422.2	604.8	1817	273	460.8	270.4	208.4	0	0

Climatic condition

The district enjoys a sub-tropical humid climate with a hot summer and moderate winter. The maximum temperature is generally experienced in June, July and August every year. January is the coldest month and July/August is the warmest months. The winter temperature drops to 10° C and summer temperature goes up to 35° C. South West monsoon activates from June and continues up to September-October. The climate of the district is sub-tropical in nature with warm and humid summer followed by dry and cool winter. The average annual rainfall is about 1951 mm per annum of which 75% is received during monsoon month (June - September). The monsoon months are wet and winter is dry. Both pre and post monsoon months have unpredicted and erratic rainfall. South West monsoon activates from May and continues up to September- October. Most of the rainfall is received during monsoon season.

- **Summer:** April - July (Max- 42°C, Min- 28°C)
- **Monsoon:** August - October (Max- 35°C, Min- 22°C)
- **Winter:** November - March (Max- 23°C, Min- 11°C)

Temperature: The mean maximum and minimum temperature varies from 33° to 38 °C and 9° to 10 °C. The average radiation is highest during March to April, while overcast sky reduces the solar radiation to the least during July. The maximum temperature is generally experienced in June, July and August every year. January is the coldest month and July/August is the warmest months. The winter temperature drops to 10° C and summer temperature goes up to 35° C.

9. Details of the mining leases in the district as per the following:

Sl No	Name Of the Mineral	Name of the Lessee	Address & Contact No. Of Lessee	Mining lease Grant Order No. & date	Area of Mining lease (ha)	Period mining lease (Initial)		Period of Mining lease 1st/2nd.. renewal)		Date of commencement of Mining Operation	Status Working/Non-Working/temp. Working for dispatch etc.)	Captive/ Non-Captive	Obtained Environmental Clearance (Yes/No), If Yes Letter no with date of grant of EC	Location of the Mining lease (Latitude & Longitude)	Method of Mining (Opencast/underground)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Sand, Sand Gravel, earth	Eyakub Ali,	Vill- Nepalpara Dist - Chirang												
2	Sand Gravel	Dhono Ch. Ray	Vill- Kaliagaon Dist - Chirang												
3	Sand Gravel , Boulder	Sanjay Singha	Vill- 1 no. Chikapara Dist- Chirang												
4	Boulder, gravel, sandgravel, sand	Khogen Hajoary	Vill- Khanibhur Dist – Chirang												
5	Sand, Sand Gravel ,	Narendra Sarma	Vill- Lakhipur Dist- Chirang												
6	Sand Gravel & Boulder	Samuel Marak	Vill- 1 No. Dongsiapara Dist- Chirang												
7	Sand Gravel	Amar Narzary	Vill- Khagrabari Dist -												

			Chirang												
8	Sand & Stone	Lachit Brahma	Vill-Choraikosra Dist-Chirang												
9	Sand gravel, earth & Stone	Sattar Ali	Vill-Simlaguri Dist-Chirang												
10	Sand gravel	Harendra Daimary	Vill – Deulguri Dist-Chirang												
11	Sand Grave, Clay & Stone	Birhang Narzary	Vill-Chotto Nilibari Dist-Chirang												
12	Sand gravel, Stone & Boulder	Prabin Champramary	Vill-Ranisundari Dist-Chirang												
13	Sand gravel, stone & earth	Sanjoufu Basumatary	Vill – Simlaguri Dist - Chirang												
14	Sand Gravel	Modaram Basumatary	Vill – Choraikosra Dist-Chirang												
15	Sand gravel, earth & stone	Sanjoufu Basumatary	Vill-Khagrabari Dist - Chirang												

10. **Details of Royalty of last 3 years**:

Year	Revenue Collection (Rs.)	Remarks
2021-22	134522395.00	
2022-23	149059084.00	
2023-24	158191800.00	
2024-25	43318829.00	Up to August/2024

11. Details of production of last 3 years

(To be Provided)

12. **Mineral Map of the District**

13. **List of Letter of Intent (LOI) Holders in the District along with its validity**

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of Letter of Intent Holder	Letter of Intent Grant Order No. & date	Area of Mining lease to be allotted	Validity of LoI	Use (Captive/ NonCaptive)	Location of the Mining lease (Latitude & Longitude)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

14. Total Mineral Reserve available in the District
15. Quality /Grade of Mineral available in the District
16. Use of Mineral
17. Demand and Supply of the Mineral in the last three years
18. Maps showing Mining leases of the district;

19. Details of the area of where there is a cluster of mining leases

20. Details of Eco-Sensitive Area, if any, in the District

21. Impact on the Environment due to mining activity

The demand for sand and gravel continues to increase for the construction of roads and buildings. The impact of mining on environment can occur at local, regional, and global scales through direct and indirect mining practices. Impact on Environment due to mining activities varies based on amount of production rate. Mining can cause erosion, sinkholes, loss of biodiversity, or the contamination of soil, groundwater, and surface water by chemicals emitted from mining processes. These processes also affect the atmosphere through carbon emissions which contributes to climate change. The different activities involved before & during mining can impact the environment. The high growth in population speeds- up economic activities. Meanwhile, it also deteriorates environment as for the high level of economic development, plenty of natural resources are exploited. Similarly, mining activities have considerable impacts on environment.

Excessive instream sand- gravel mining causes the degradation of rivers. Instream mining lowers the stream bottom, which may lead to bank erosion. Depletion of sand in the streambed and along coastal areas causes the deepening of rivers and estuaries, and the enlargement of river mouths and coastal inlets. It may also lead to saline- water intrusion from the nearby sea. The effect of mining is compounded by the effect of sea level rise. Any volume of sand exported from streambeds and coastal areas is a loss to the system.

Excessive instream sand mining is a threat to bridges, river banks and nearby structures. Sand mining also affects the adjoining groundwater system and the uses that local people make of the river. River bed mining impacts include bed degradation, bed coarsening, lowered water tables near the streambed, and channel instability. These physical impacts cause degradation of riparian and aquatic biota and may lead to the undermining of bridges and other structures. Continued extraction may also cause the entire streambed to degrade to the depth of excavation. River bed mining can have other costly effects beyond the immediate mine sites. Many hectares of fertile streamside land are lost annually, as well as valuable timber resources and wildlife habitats in the riparian areas. Degraded stream habitats result in loss of fisheries productivity, biodiversity, and recreational potential. Severely degraded channels may lower land and aesthetic values.

Native species in streams are uniquely adapted to the habitat conditions that existed before humans began large-scale alterations. These have caused major habitat disruptions that favoured some species over others and caused overall declines in biological diversity and productivity.

In most streams and rivers, habitat quality is strongly linked to the stability of channel bed and banks. Unstable stream channels are inhospitable to most aquatic species.

Sand mining generates extra vehicle traffic, which negatively impairs the environment. Where access roads cross riparian areas, the local environment may be impacted.

Degradation of land is one of the significant impacts arising out of mining and quarrying activity which is mainly in the form of alternation of land structure due to excavation, stacking of top soil and loss of the land due to dumping of mine waste and overburden soil. Stone and sand quarrying causes damage to property, depletion of ground water, loss of fertile top soil, degradation of forest land, adverse effect on the biodiversity and public health

Mining and quarrying, either open cast or underground, destroys landscape and forest ecosystems. Air pollution, due to dust from the mines, is a common environmental problem in mines and quarries especially open cast operations.

Immediate impact of stone quarrying is land degradation. It causes landscape alternation due to excavation, water induced soil erosion due to surface runoff water in quarrying site, dumping of waste rock causes loss of land or generation of waste land, over burned soil etc. Soil erosion and soil contamination are common in quarrying sites. In current study area, in many places waste land were generated due to stone quarrying activities. Waste stones are dumped in many places causes blockage of drainage channels. In many sites of the quarry area waste water were stored. This decrease aesthetic value of the site. In many areas, plants are unable to grow and some land completely lost their ability for cultivation because of soil contamination by stone quarrying activities.

Noise pollution occurs due to blasting operation in quarry, noise emitted by stone crusher and transport of stone material by truck, dumper, tractor etc. Loss of peace, fear due to loud noise and vibration, increased heartbeat, headache, development of cracks on houses etc. are various effects of quarrying related noise pollution. Stone quarrying activities also goes during night. Stone quarrying occupation is not a suitable alternative livelihood like agriculture, service, business etc. because of its uncertainty nature. Massive transport of truck and dumper are not safe and there is always chance of accident. Due to short time, seasonal and uncertainty nature, it is not possible to formulate any future planning for employment generation in this field.

Noise pollution is associated with many types of equipment used in mining operations, but blasting is considered as the major source. It also affects stability of infrastructures, building and houses of people living near to these working sites. In this regard, noise pollution may include noise from vehicle engines, power generation, and other sources. Mining operations impact the environment in several ways, and water pollution is a major concern in such operations. For instance quarry dust can change the chemistry of water resources by dissolving in them, it can also settle in water bodies and cause pollution. Furthermore, these operations disrupt the existing movement of surface water and groundwater; they interrupt natural water recharge and can lead to reduced quantity and quality of drinking water for residents and wildlife near or down streams from a quarry site.

As far as impact on surface water is concerned, during mining and transportation, the chances of contamination of surface water resources (pond, well etc.) with dust or by other means.

The labourers working in stone mining come from nearby districts and colonies in the surrounding areas with inadequate facilities for waste disposal. This, in due course, leads to disposal of various things into surface water bodies which in due course of time results into surface water contamination through misuse/mismanagement and decomposition of the trash.

22. Remedial Measures to mitigate the impact of mining on the Environment;

23. Reclamation of Mined out area :

Reclamation entails the re- establishing of viable soils and vegetation at a mine site. Although regulatory agencies may require complex reclamation designs, simple approaches can be very effective. One simple approach depends on adding lime or other materials that will neutralize acidity plus a cover of top soil or suitable growth medium to promote vegetation growth. Modifying slopes and other surfaces and planting vegetation as part of the process stabilizes the soil material and prevents erosion and surface water infiltration. Even this simple approach is likely to cost a few thousand dollars per acre to implement. Where soils have a sustained high acidity, the costs of using this approach can increase, sometimes to tens of thousands of dollars per acre. The challenge to find cost-effective reclamation approaches continues.

Promising reclamation options in the future may include using sludge, “biosolids,” from municipal waste water treatment processes as an organic soil amendment, and growing plant species that are more tolerant of acidic conditions.

Soil Treatment

High levels of metals in soils, not just acidity, can be harmful to plants, animals, and, in some cases, people. A common to specially designed repositories. This approach can be very expensive and controversial, but it is sometimes required. With this approach, the volume and toxicity of the soil is not reduced, the soil is just relocated. Effective soil treatment approaches in the future depend upon better understanding of the risks associated with metals in mine wastes. These "natural" metals in minerals may not be as readily available in the biosphere, and therefore, they may not be as toxic as the metals in processed forms, such as lead in gasoline.

Future approaches may include:

- Using chemical methods to stabilize metals in soils, making them less mobile and biologically available.
- Using bacteriacides that stop the bacterial growth that promotes the oxidation of pyrite and the accompanying formation of sulfuric acid.
- Using bioliners, such as low permeability and compacted manure, as barriers at the base of waste piles.
- Permanently flooding waste materials containing pyrite to cut off the source of oxygen, stop the development of acidic conditions, and prevent mobilization of metals.

Water Treatment:

The most common treatment for acidic and metal-bearing waters is the addition of a neutralizing material, such as lime, to reduce the acidity. This "active" treatment process, which causes the dissolved metals to precipitate from the water, usually requires the construction of a treatment facility. The ongoing maintenance that such a plant requires makes this treatment technique very expensive.

Aside from the expense, some active treatment plants generate large amounts of sludge. Disposal of the sludge is a major problem. Because of the cost and the physical challenges of dealing with sludge, alternatives to active treatment facilities are needed. Some possible alternatives include:

- Using "passive" wetland systems to treat metal-bearing water. This approach has been successfully used where the volumes and acidity of the water are not too great. Passive wetland systems have the added advantage of creating desirable wildlife habitat.

- Using in-situ treatment zones where reactive materials or electric currents are placed in the subsurface so that water passing through them would be treated.
- Combining treatment with the recovery of useful materials from contaminated water.

24**. Risk Assessment & Disaster Management Plan:**

25**. Details of the Occupational Health issues in the District:**

The negative impacts of dust pollution due to quarrying activities on health revealed by respondent information were respiratory problem, eye infection, cough, sneezing, allergy , chest pain , headache , accumulation of dust on home , and slow growth of fodder for cattle and goats.Negative effects of dust pollution on crop productivity. Two major effects were reduction of agricultural yield due to deposition of dust on crop and secondly availability of ground water and water contamination. Another problem we noticed through interview was many agricultural labour were faced difficulty to work in dusty environment therefore resulting in reduction of agricultural yield indirectly. Many fruit trees also affected by dust pollution resulting in stunted growth and decreased fruit yields. There are also reductions in appearance of insect pollination like butterflies, bees, moths etc. due to dust pollution.

26. Plantation and Green Belt development in respect of leases already granted in the District;

Protect natural or semi-natural environments

- Improve air quality with inurban areas;
- Protect the unique character of rural communities that might otherwise be absorbed by expanding suburbs.
- Plants that grow fast should be preferred
- Preference for high canopy covers plants with local varieties
- Perennial and evergreen plants should be preferred
- Plants having a high Air pollution Tolerance Index (APTI) should be preferred.
-

Greenbelt Development & Plantation Programme

Plantation should be developed at **2M**x**2M** spacing, the rate of survival should be aimed at 80% by regular watering & fencing to keep plants safe from animal grazing. Local species will be planted in consultation with local horticulturist. Diseased plants should be replaced by planting new saplings.

Recommendation for green Belt Development

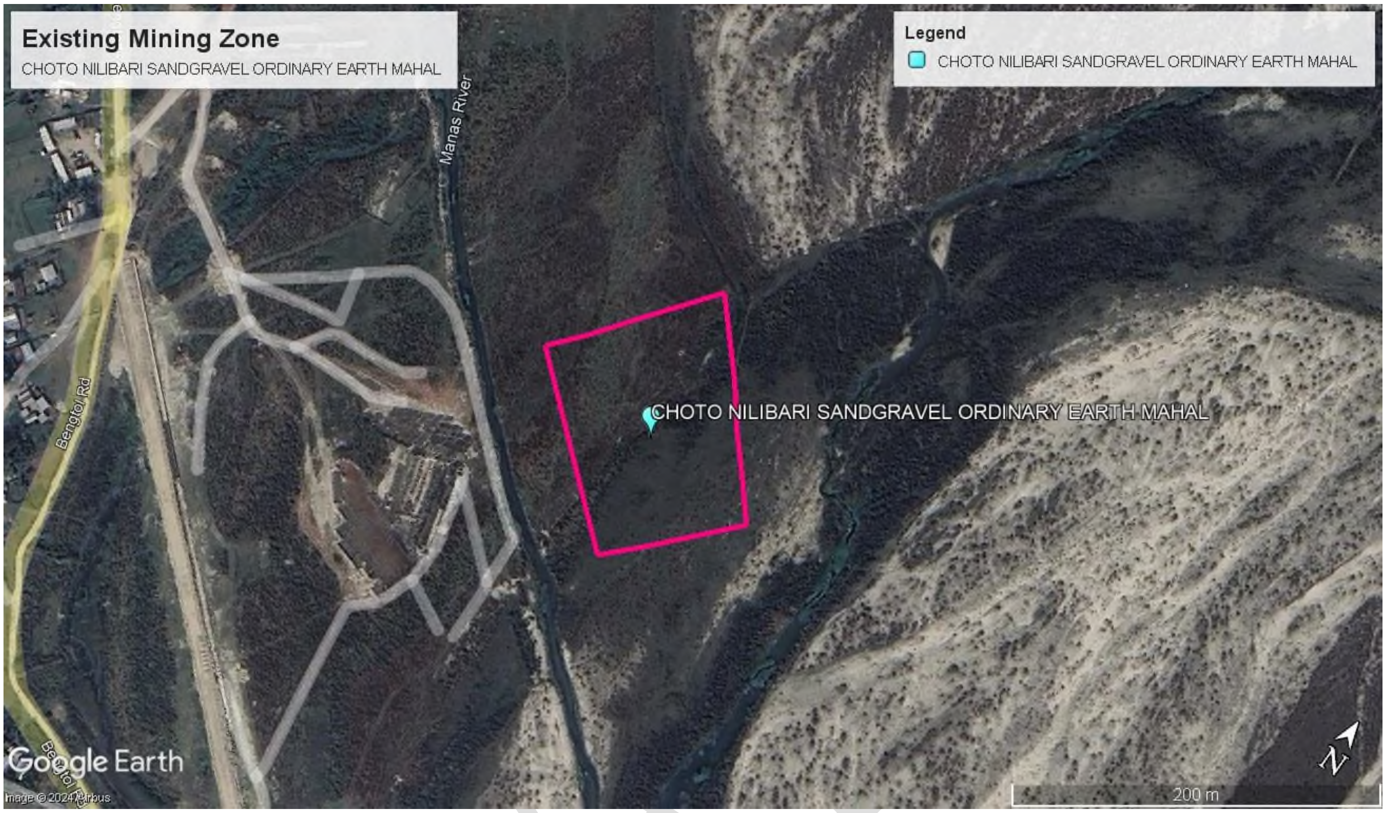
It is strongly recommended to create greenbelt around the project or incase lease failed the authority should take proper action to stop mining operation or
Revoke mining permission with necessary action.

Photoplates:


GPS Map Camera
Chirang, Assam, India
Unnamed Road, Assam 783393, India
Lat 26.770567°
Long 90.50128°
02/09/24 01:12 PM GMT +05:30
Google


Existing Mining Zone
CHORAIKONSRA SAND & GRAVEL MAHAL
Legend
CHORAIKONSRA SAND & GRAVEL MAHAL
CHORAIKONSRA SAND & GRAVEL MAHAL
Google Earth
100 m
N


Existing Mining Zone
CHORAIKOSRA SAND GRAVEL MAHAL
Legend
CHORAIKONSRA
CHORAIKOSRA SAND GRAVEL MAHAL
CHORAIKOSRA SAND GRAVEL MAHAL
Google Earth
Image © 2024 Airbus
70 m
N


Existing Mining Zone
CHOTO NILIBARI SANDGRAVEL ORDINARY EARTH MAHAL
Legend
CHOTO NILIBARI SANDGRAVEL ORDINARY EARTH MAHAL
Manas River
Bengtol Rd
CHOTO NILIBARI SANDGRAVEL ORDINARY EARTH MAHAL
Google Earth
200 m
N


Existing Mining Zone
DEULGURI SAND GRAVEL MAHAL
Legend
DEULGURI SAND GRAVEL MAHAL
Champabati River
DEULGURI SAND GRAVEL MAHAL
Google Earth
Image © 2024 Maxar Technologies
200 m
N


Existing Mining Zone
DONSIAPARA SAND GRAVEL MAHAL
Legend
DONSIAPARA SAND GRAVEL MAHAL
DONSIAPARA SAND GRAVEL MAHAL
Google Earth
Image © 2024 Airbus
100 m
N

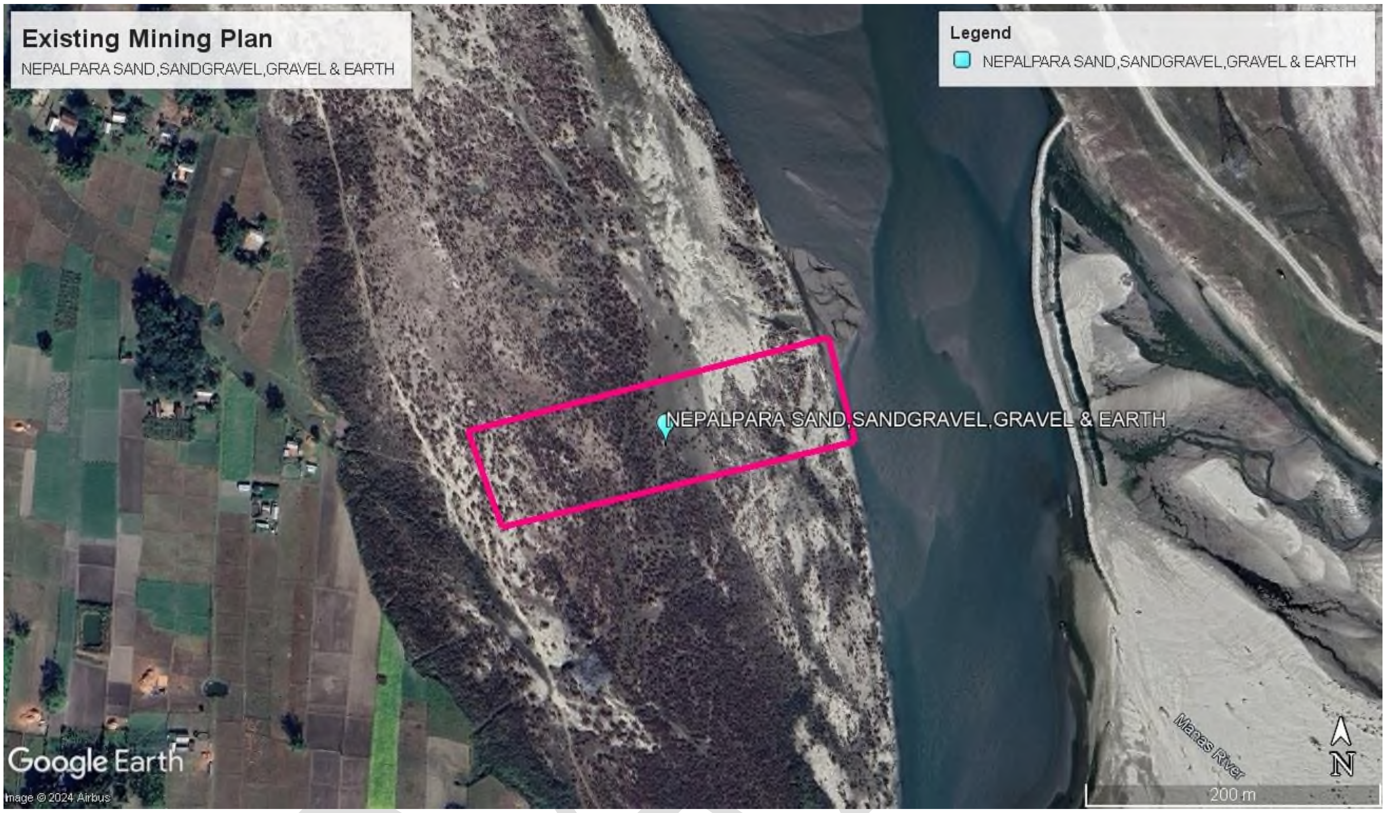

Existing Mining Zone
KALIAGAON SAND GRAVEL AND GRAVEL MAHAL
Legend
KALIAGAON SAND GRAVEL AND GRAVEL MAHAL
Koliya Gaon
KALIAGAON SAND GRAVEL AND GRAVEL MAHAL
Sikdar Store
Manas River
Gerukabari-Bijni-Amteka Rd
TULSHIJHORA ME SCHOOL
Google Earth
Image © 2024 Airbus
200 m
N


Existing Mining Zone
KHAGRABARI SAND & GRAVEL MAHAL
Legend
KHAGRABARI SAND GRAVEL
KHAGRABARI SAND GRAVEL
Champabati River
Google Earth
Image © 2024 Maxar Technologies
100 m
N


Existing Mining Zone
KHAGRABARI SAND GRAVEL MAHAL
Legend
KHAGRABARI SAND GRAVEL MAHAL
Almas Store
Mizan Enterprise
KHAGRABARI SAND GRAVEL MAHAL
Champabati River
Champabati River
Google Earth
Image © 2024 Maxar Technologies
200 m
N


Existing Mining Zone
KHANIPUR, BOULDER GRAVEL,SANDGRAVEL MAHAL
Legend
KHANIPUR BOULDER GRAVEL,SANDGRAVEL MAHAL
Manas River
KHANIPUR BOULDER GRAVEL,SANDGRAVEL MAHAL
Google Earth
Image © 2024 Airbus
N
300 m


Existing Mining Zone
KHANIPUR, BOULDER GRAVEL,SANDGRAVEL MAHAL
Legend
KHANIPUR BOULDER GRAVEL,SANDGRAVEL MAHAL
Manas River
KHANIPUR BOULDER GRAVEL,SANDGRAVEL MAHAL
Google Earth
Image © 2024 Airbus
N
300 m


Existing Mining Plan
NEPALPARA SAND,SANDGRAVEL,GRAVEL & EARTH
Legend
NEPALPARA SAND,SANDGRAVEL,GRAVEL & EARTH
NEPALPARA SAND,SANDGRAVEL,GRAVEL & EARTH
Google Earth
Image © 2024 Airbus
Manas River
N
200 m


Existing Mining Zone
NO.1 CHIKAPARA SAND GRAVEL
Legend
NO.1 CHIKAPARA SAND GRAVEL
NO.1 CHIKAPARA SAND GRAVEL
Google Earth
Image © 2024 Airbus
N
60 m

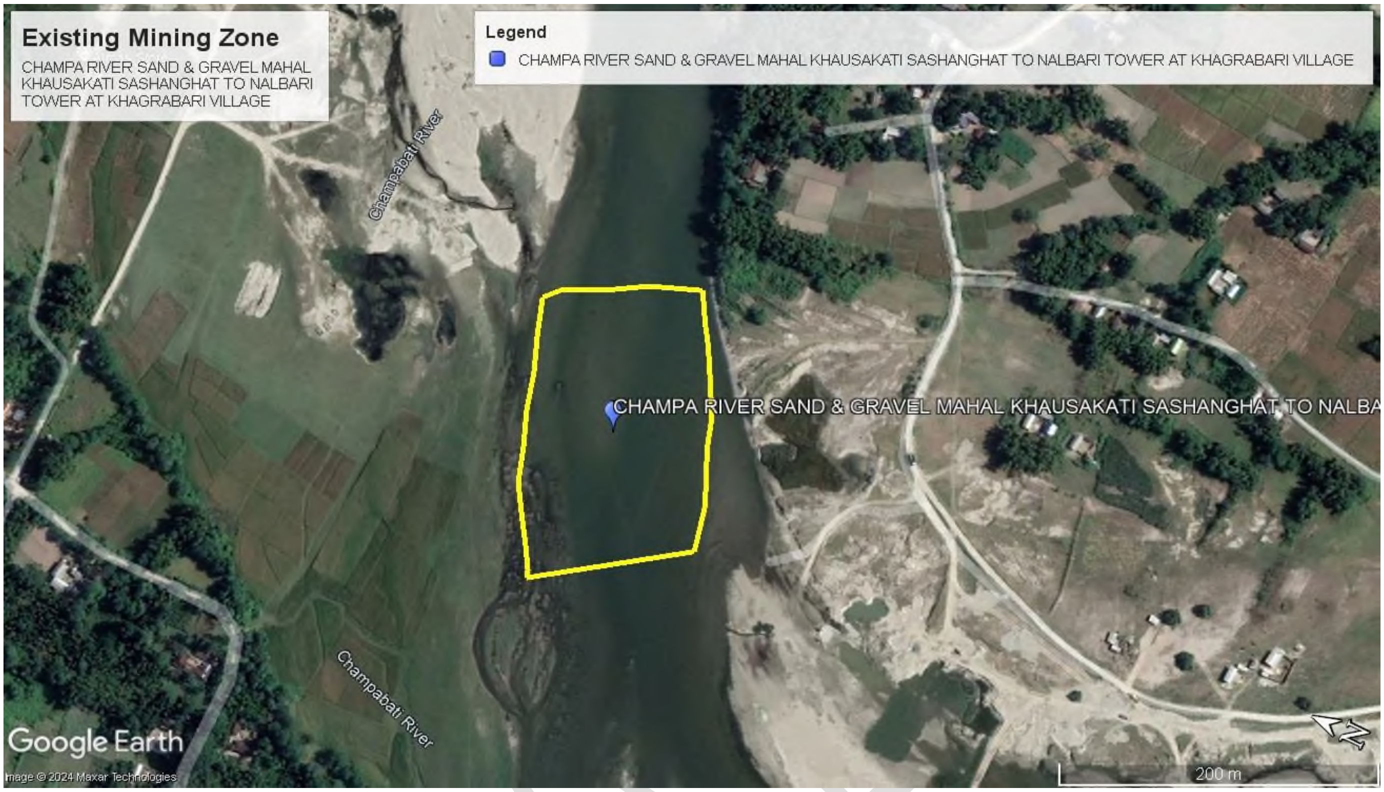

Existing Mining Zone
RANISUNDARI SAND GRAVEL MAHAL
Legend
RANISUNDARI
RANISUNDARI SAND GRAVEL MAHAL
Manas River
N
200 m
Google Earth
Image © 2024 Airbus


Existing Mining Zone
SIMLAGURI SAND GRAVEL MAHAL
Legend
SIMLAGURI SAND GRAVEL MAHAL
Manas River
as River
SIMLAGURI SAND GRAVEL MAHAL
N
200 m
Google Earth
Image © 2024 Airbus


Existing Mining Zone
SIMLAGURI SAND GRAVEL MAHAL
Legend
SIMLAGURI SAND GRAVEL MAHAL
SIMLAGURI SAND GRAVEL MAHAL
Manas River
Google Earth
200 m


Exixsting Mining Zone
AIE GHAT SAND, GRAVEL RIVER MAHAL
Legend
AIE GHAT SAND,GRAVEL RIVER MAHAL
Maa Motors Sale & Service
TULSHIJHORA JA
Hagram Hotel
Manas River
AIE GHAT SAND,GRAVEL RIVER MAHAL
Aie Valley Resort
Dwijing Festival Ground
Manas River
Aie River Valley Picnic Spo
Google Earth
400 m
N


Existing Mining Zone
ASHAPUKA SAND,GRAVEL & BOULDER RIVER MAHAL
Legend
ASHAPUKA SAND,GRAVEL & BOULDER RIVER MAHAL
UTTAR PARA JAMEE MASJID NO 1...
Beltoli navjyoti prathmik vidhyalaya
ASHAPUKA SAND,GRAVEL & BOULDER RIVER MAHAL
Sabdam Hussain
Google Earth
Image © 2024 Airbus
400 m
N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CHAMPA RIVER SAND & GRAVEL MAHAL KHAUSAKATI SASHANGHAT TO NALBARI TOWER AT KHAGRABARI VILLAGE
Legend
CHAMPA RIVER SAND & GRAVEL MAHAL KHAUSAKATI SASHANGHAT TO NALBARI TOWER AT KHAGRABARI VILLAGE
Champabati River
CHAMPA RIVER SAND & GRAVEL MAHAL KHAUSAKATI SASHANGHAT TO NALBA
Champabati River
Google Earth
Image © 2024 Maxar Technologies
200 m


Existing Mining Zone
CHAMPA RIVER SAND & GRAVEL MAHAL NO.1
Legend
CHAMPA RIVER SAND & GRAVEL MAHAL NO.1
CHAMPA RIVER SAND & GRAVEL MAHAL NO.1
Champabati River
Google Earth
Image © 2024 Airbus
N
300 m


Proposed Mining Zone
CHAMPA SAND GRAVEL RIVER MAHAL NO.5
Legend
CHAMPA SAND GRAVEL RIVER MAHAL NO.5
CHAMPA SAND GRAVEL RIVER MAHAL NO.5
Google Earth
Image © 2024 Airbus
200 m
N

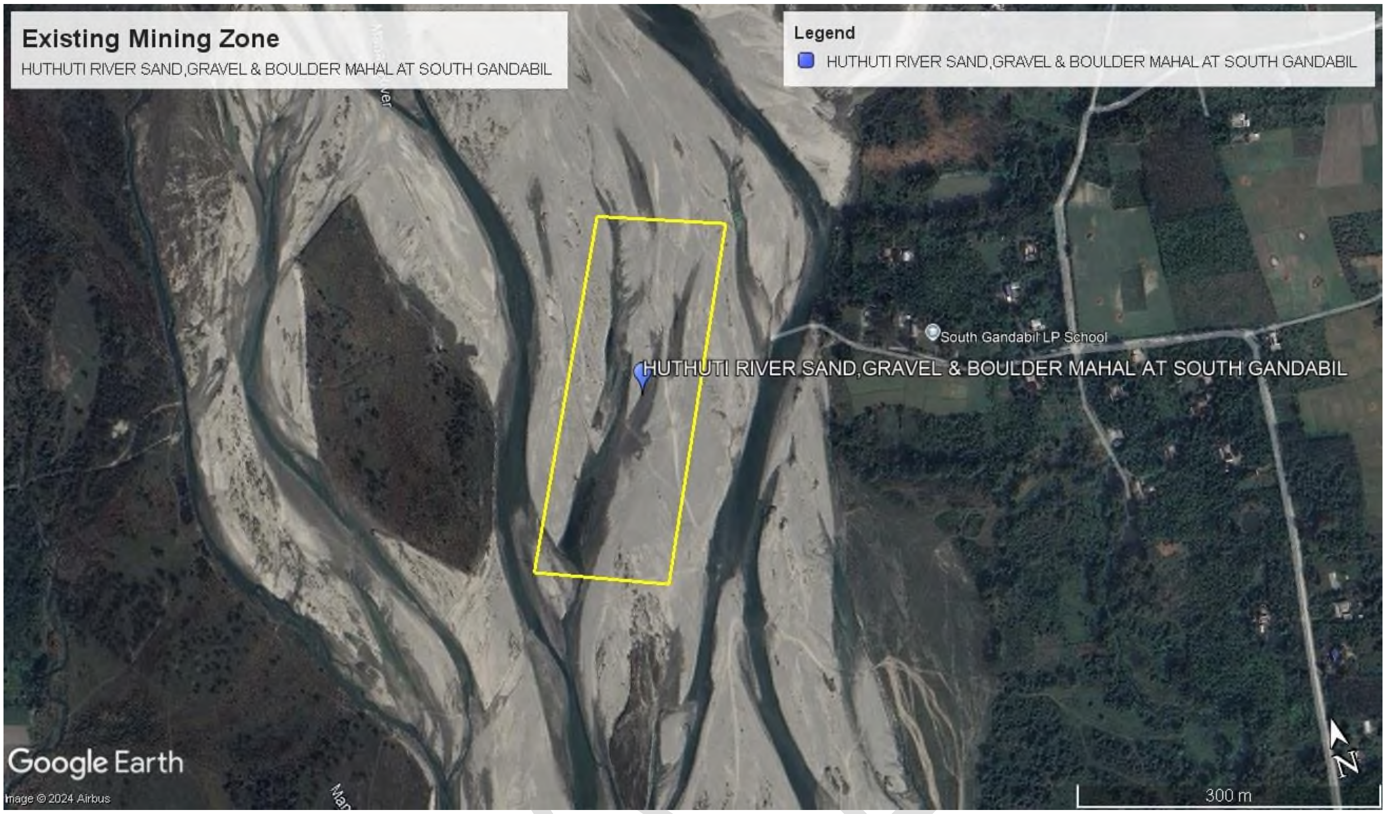

EXISTING MINING ZONE
CHAMPA SAND, GRAVEL RIVER MAHAL NO.2
Legend
CHAMPA SAND, GRAVEL RIVER MAHAL NO.2
Kauniabhasa L P School
Champabati River
CHAMPA SAND, GRAVEL RIVER MAHAL NO.2
Fakar kura beel
Chotto Mozabari JCB CAMP
Google Earth
Image © 2024 Maxar Technologies
300 m
N


Existing Mining Zone
CHAMPA SAND, GRAVEL RIVER MAHAL NO.3
Legend
CHAMPA 3 MAHAL
Champabati River
CHAMPA SAND, GRAVEL RIVER MAHAL NO.3
RAMJAN STORE
Champabati River
Google Earth
Image © 2024 Maxar Technologies
500 m
N


Existing Mining Zone
CHAMPA SAND, GRAVEL RIVER MAHAL NO.2
Legend
CHAMPA SAND, GRAVEL RIVER MAHAL NO.4
champabati view point
Kachudola Market
Balajan Basugaon Rd
Champabati River
kachudola New market
CHAMPA SAND, GRAVEL RIVER MAHAL NO.4
Google Earth
Image © 2024 Maxar Technologies
Image © 2024 Airbus
200 m
N


Existing Mining Zone
CHAMPA SAND, GRAVEL RIVER MAHAL NO.6
Legend
CHAMPA SAND, GRAVEL RIVER MAHAL NO.6
Champabati River
Champabati River
Champabati River
CHAMPA SAND, GRAVEL RIVER MAHAL NO.6
Google Earth
Image © 2024 Airbus
200 m
N


Existing Mining Zone
CHARAIKONSRA CHAMPABATI RIVER SAND & GRAVEL MAHAL
Legend
Assam Bulbul iskar ali moulobi
CHORAIKOSRA
CHARAIKONSRA CHAMPABATI RIVER SAND & GRAVEL MAHAL
Assam Bulbul iskar ali moulobi
Champabati River
Google Earth
Image © 2024 Airbus
100 m
N


Existing Mining Zone
HUTHUTI RIVER SAND,GRAVEL & BOULDER MAHAL AT SOUTH GANDABIL
Legend
HUTHUTI RIVER SAND,GRAVEL & BOULDER MAHAL AT SOUTH GANDABIL
South Gandabil LP School
HUTHUTI RIVER SAND,GRAVEL & BOULDER MAHAL AT SOUTH GANDABIL
Google Earth
Image © 2024 Airbus
300 m
N


Existing Mining Zone
KANAMAKRA KALIAGAON NO.2 RIVER SAND & GRAVEL MAHAL
Legend
KANAMAKRA KALIAGAON NO.2 RIVER SAND & GRAVEL MAHAL
Manas River
KANAMAKRA KALIAGAON NO.2 RIVER SAND & GRAVEL MAHAL
Gerukabari-Bijni-Amteka Rd
Google Earth
Image © 2024 Airbus
300 m
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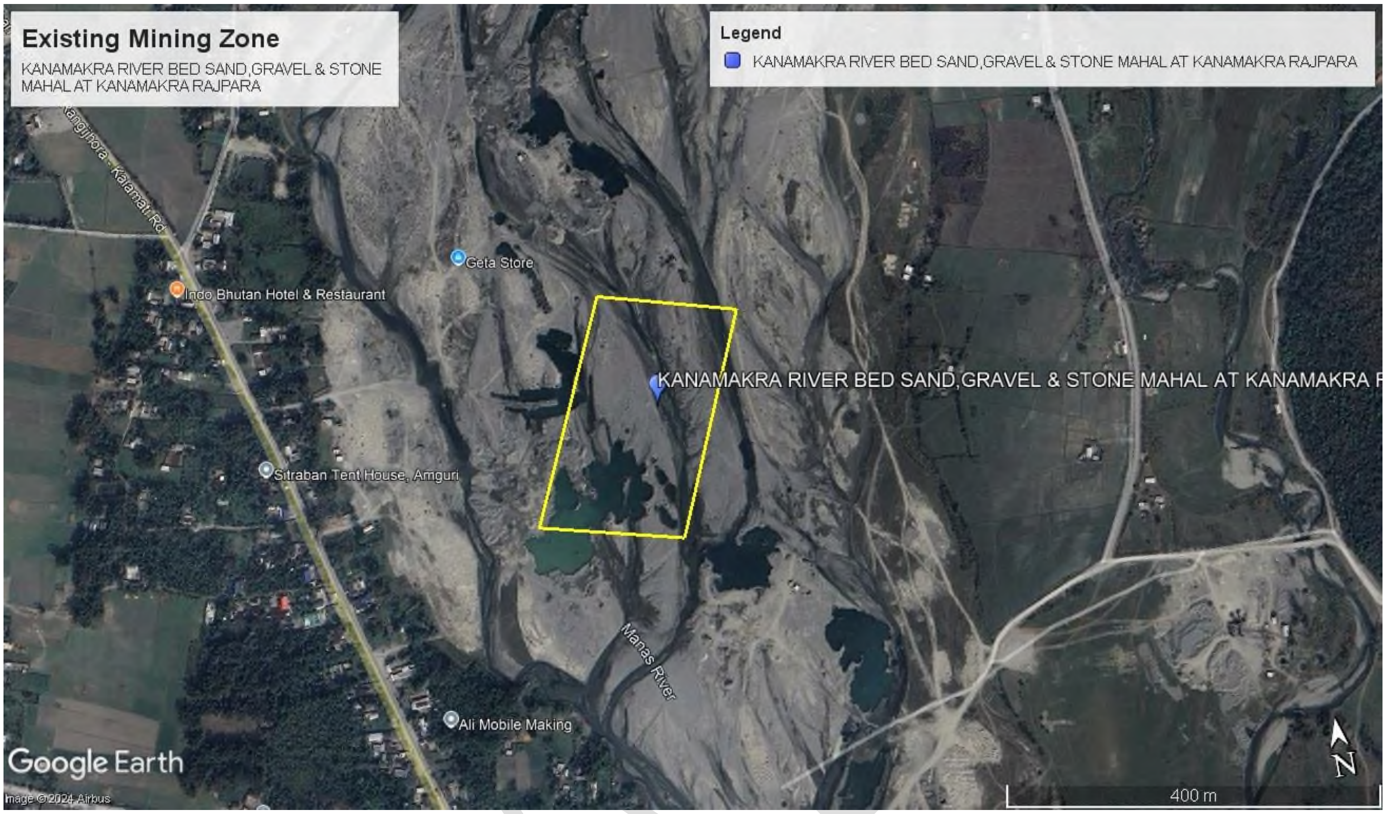
Existing Mining Zone
KANAMAKRA RIVER BED SAND,GRAVEL & STONE MAHAL AT KANAMAKRA RAJPARA
Legend
KANAMAKRA RIVER BED SAND,GRAVEL & STONE MAHAL AT KANAMAKRA RAJPARA
Geta Store
Indo Bhutan Hotel & Restaurant
Sitraban Tent House, Amguri
Ali Mobile Making
Manas River
Google Earth
Image © 2024 Airbus
400 m
N


Untitled Map
KANAMAKRA RIVER SAND & GRAVEL MAHAL AT KANAMAKRA(LAKIPUR TO BHABANIPUR MUSLIM BASTI)
Legend
KANAMAKRA RIVER SAND & GRAVEL MAHAL AT KANAMAKRA(LAKIPUR TO bHABANIPUR MUSLIM BASTI)
KANAMAKRA RIVER SAND & GRAVEL MAHAL AT KANAMAKRA(LAKIPUR
Koliagaon Jame Mosjid
Koliya Gaon
Sikdar Store
Gerukabari-Bijni-Amteka Rd
TULSHIJHORA ME SCHOOL
Google Earth
Image © 2024 Airbus
400 m
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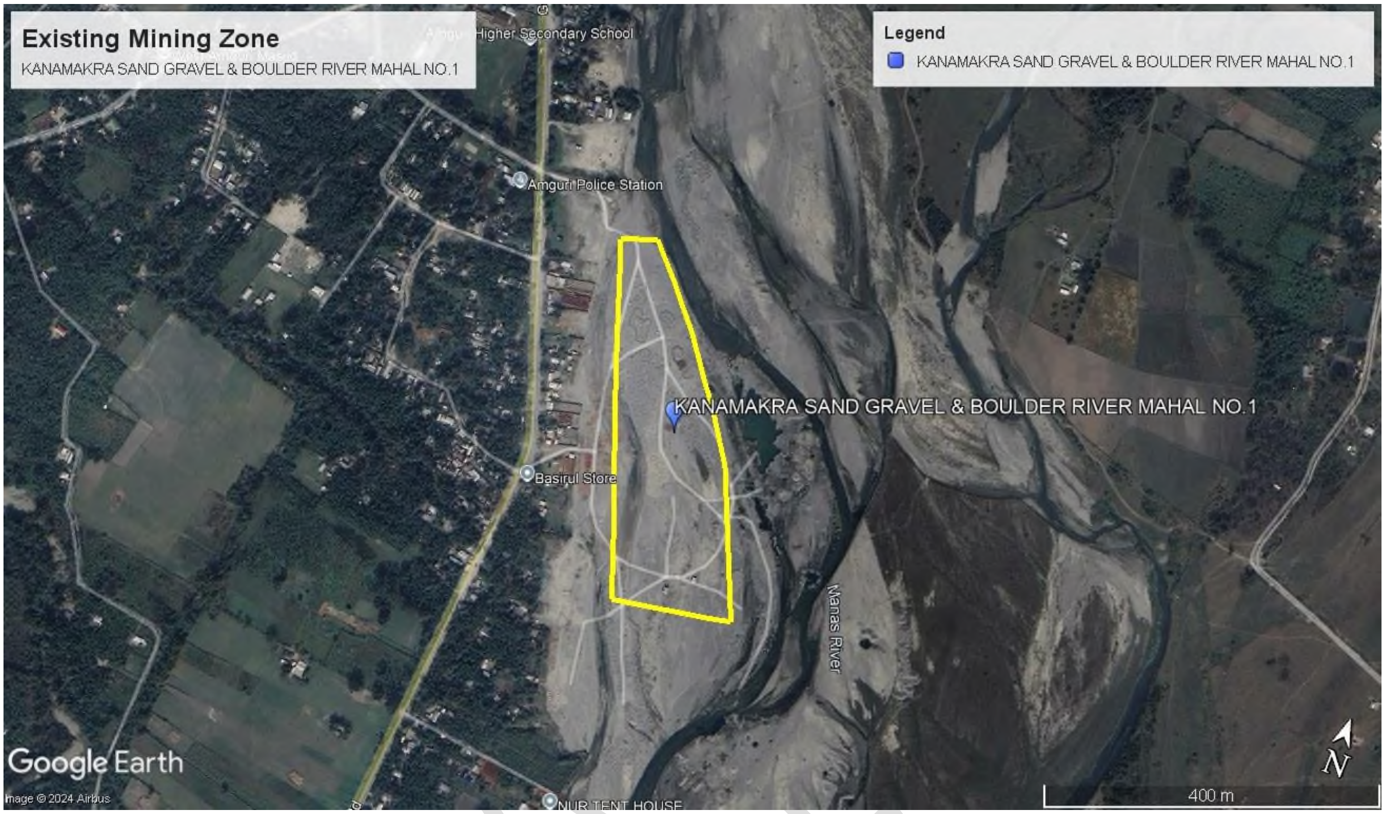

Existing Mining Zone
KANAMAKRA SAND GRAVEL & BOULDER RIVER MAHAL NO.1
Legend
KANAMAKRA SAND GRAVEL & BOULDER RIVER MAHAL NO.1
Higher Secondary School
Amguri Police Station
KANAMAKRA SAND GRAVEL & BOULDER RIVER MAHAL NO.1
Basirul Store
Manas River
NUR TENT HOUSE
Google Earth
Image © 2024 Airbus
N
400 m


Existing Mining Zone
KANAMAKRA SAND,GRAVEL MAHAL NO.2
Legend
MOHADEB
Manas River
Google Earth
Image © 2024 Airbus
N
200 m


Proposed Mining Zone
MAKRA RIVER SAND GRAVEL & STONE MAHAL AT (PATALMARI) RAJPARA AREA
Legend
MAKRA RIVER SAND GRAVEL & STONE MAHAL AT (PATALMARI) RAJPARA AREA
Manas River
Google Earth
Image © 2024 Airbus
300 m

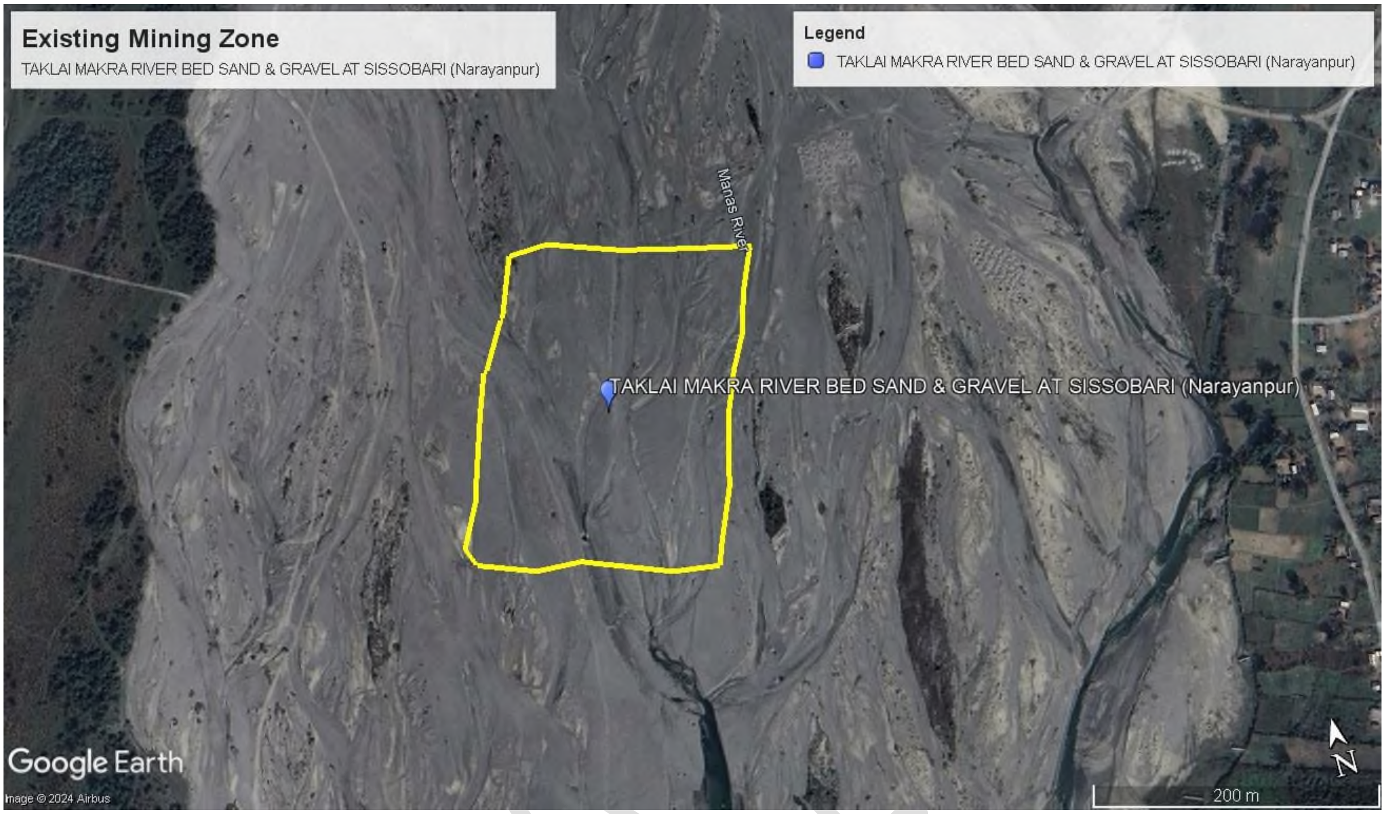

Existing Mining Zone
NANGALBHANGA HUTHUTHI SAND & GRAVEL RIVER MAHAL
Legend
NANGALBHANGA HUTHUTHI SAND & GRAVEL RIVER MAHAL
Manas River
NANGALBHANGA HUTHUTHI SAND & GRAVEL RIVER MAHAL
Google Earth
Image © 2024 Airbus
200 m


Existing Mining Plan
NANGALBHANGA MANIKPUR STONE,SAND GRAVEL,SAND & CHIPS AGGREGATES MAHAL AT SOUTH PALANGSHUGURI
Legend
NANGALBHANGA MANIKPUR STONE,SAND GRAVEL,SAND & CHIPS AGGREGATES MAHAL AT SOUTH PALANGSHUGURI
NANGALBHANGA MANIKPUR STONE,SAND GRAVEL,SAND & CHIPS AGGREGA
Google Earth
Image © 2024 Airbus
200 m
N


Existing Mining Zone
SAND GRAVEL & BOULDER MAHAL AT HUTHUTI RIVER(BALAGARI VILLAGE)
Legend
BALAGARI
Manas River
SAND GRAVEL & BOULDER MAHAL AT HUTHUTI RIVER(BALAGARI VILLAGE)
Google Earth
Image © 2024 Airbus
300 m
N


Existing Mining Zone
SAND,SAND GRAVEL BOULDER & CHIPS HAKUWA RIVER MAHAL AT BHATARMARI
Legend
SAND,SAND GRAVEL BOULDER & CHIPS HAKUWA RIVER MAHAL AT BHATARMARI
SAND,SAND GRAVEL BOULDER & CHIPS HAKUWA RIVER MAHAL AT BHATA
Google Earth
Image © 2024 Airbus
N
300 m


Existing Mining Zone
SANDGRAVEL,GRAVEL & SAND AIE RIVER MAHAL AT DOLOGAON
Legend
Manas River
SANDGRAVEL,GRAVEL & SAND AIE RIVER MAHAL AT DOLOGAON
Google Earth
Image © 2024 Airbus
N
300 m


Existing Mining Zone
TAKLAI MAKRA RIVER BED SAND & GRAVEL AT SISSOBARI (Narayanpur)
Legend
TAKLAI MAKRA RIVER BED SAND & GRAVEL AT SISSOBARI (Narayanpur)
Manas River
TAKLAI MAKRA RIVER BED SAND & GRAVEL AT SISSOBARI (Narayanpur)
Google Earth
Image © 2024 Airbus
200 m
N


Existing Mining Zone
TILOKGAON CHAMPA RIVER SAND & GRAVEL MAHAL
Legend
TILOKGAON 3
River
Safikul House Takuamari Rd
TILOKGAON CHAMPA RIVER SAND & GRAVEL MAHAL
Champabati River
Google Earth
Image © 2024 Airbus
400 m
N

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https://www.americangeosciences.org/critical-issues/faq/can-we-mitigate-environmental-impacts-mining