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DISTRICT SURVEY REPORT,ASSAM

TINSUKIA

As per Sustainable Sand Mining Management Guidelines, 2016 and Enforcement & Monitoring Guidelines for Sand Mining, 2020, Ministry of Environment, Forest and Climate Change (MoEF & CC)

SEPTEMBER 2024

Prepared by:

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CONFIDENTIALITY CLAUSE

This District Survey Report (DSR) of Tinsukia District has been prepared by RSP Green Development and Laboratories Pvt. Ltd., Howrah, West Bengal, India. The report covers diversified ranges of subject matters relevant to project objectives and survey based information/ data, therefore, this ‘Confidentiality Clause’ is a legally binding section that is anticipating that, any employee who are directly and/or indirectly involved in the project will not disclose any significant confidential information or any duplicate copies to any third parties without legalized written consent of ‘No Objection’ from company authority and Concerned department of Government of Assam, not even for the specific purpose for which the report has been prepared

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LIABILITY CLAUSE

Limitation of Liability

RSP Green Development & Laboratories PVT.LTD undertakes the technical responsibility for the entire report. All the authenticated Secondary data included in the report has been obtained from the Various Government departments and all the report verifying by Sub-Divisional Committee

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NABET

National Accreditation Board for Education and Training

Certificate of Accreditation

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*The organization is accredited as **Category-B** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –*

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3	Distilleries	22	5 (g)	B
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Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SAAC minutes dated May 6, 2022 and supplementary minutes dated July 8, 2022 posted on QCI-NABET website.

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Sr. Director, NABET
Dated: September 15, 2022

Certificate No.
NABET/EIA/2124/SA 0176

Valid up to
Feb 9, 2024

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QCI/NABET/ENV/ACO/24/3283   June 18, 2024

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Sub.: Extension of Validity of Accreditation till September 17, 2024– regarding
Ref.. 1. Certificate no NABET/EIA/2124/SA 0176
2. Request mail June 15, 2024

Dear Sir/Madam

This has reference to the accreditation of your organization under QCI-NABET EIA Scheme, the validity **RSP Green Development & Laboratories Pvt. Ltd.** is hereby extended till September 17, 2024, or completion of the assessment process, whichever is earlier.

The above extension is subject to the submitted documents/required information with respect to your application and timely submission and closure of NC/Obs during the process of assessment.

You are requested not to use this letter after the expiry of the above-stated date.

With best regards.

(A K Jha)
Sr. Director, NABET

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Extension of the NABET Certificate of the respected Consultant

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ABBREVIATION

ABBREVIATIONS & SYMBOLS USED	:	FULL FORMS
%	**:**	Percent
′	**:**	Minute
″	**:**	Second
<	**:**	less than (strict inequality)
=	**:**	Equal to (strict equality)
>	**:**	greater than (strict inequality)
≈	**:**	approximately equal
°	**:**	Degree
°C	**:**	Degree Centigrade
°F	**:**	Degree Fahrenheit
ArcGIS	**:**	ArcGIS is a GIS for working with maps and geographic information maintained by the ESRI.
CD blocks	**:**	Community development blocks
cm	**:**	Centimeter
cum	**:**	Cubic meter
Dec	**:**	December
DEIAA	**:**	District Level Environment Impact Assessment Authority
DSR	**:**	District Survey Report
E	**:**	East
e.g.,	**:**	*‘exempli gratia’*(Latin phrase) means ‘for example’
EC	**:**	Environmental Clearance
et.al.,	**:**	*‘et alia’* (Latin phrase) means ‘and others’
G:2 stage	**:**	General Exploration (stage of exploration as per UNFC norms)
G:3 stage	**:**	Prospecting (stage of exploration as per UNFC norms)
GIS	**:**	Geographical Information System
Govt.	**:**	Government
GPS	**:**	Global Positioning System
Ha	**:**	Hectare
i.e.,	**:**	*‘id est’* (Latin phrase) means ‘that is’/’in other words’
ICAR	**:**	Indian Council of Agricultural Research
Inch	**:**	inches

ABBREVIATIONS & SYMBOLS USED	:	FULL FORMS
kg/ha	:	Kilogram per hectare
km	:	kilometer
km/ hour	:	Kilometer per hour
km2	:	kilometer square
LANDSAT	:	Land Satellite stands for Low Altitude Satellite
LULC	:	Land use and land cover
m	:	Meter
Mar	:	March
Max.	:	Maximum
mbgl	:	Meter Below Ground Level
Min.	:	Minimum
mm	:	Millimeter
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
N	:	North
NH	:	National Highways
No.(s)	:	Number(s)
RI value	:	River Index value
S	:	South
SEIAA	:	State Environment Impact Assessment Authority
Sept	:	September
sp.	:	species
sq.km	:	Square kilometer
Temp	:	Temperature
viz.,	:	Latin phrase *'videre licet'*, and is used as a synonym for "namely",
W	:	West

CHAPTER 1: PREFACE

The need for District Survey Report (DSR) has been necessitated by MoEF & CC vide their Notification No. 125 (Extraordinary, Part II Section 3, and Sub-section ii), S.O. 141 (E), dated 15th January 2016. The notification was made to bring certain amendments with respect to the EIA notification 2006 and in order to have better control over the legislation, district level committees for introduction into the system. Preparation of District Survey Reports has been introduced as a part of the above notification. Subsequently, MOEF & CC has published Notification No. 3611 (E), dt. 25th July 2018 regarding the inclusion of the "Minerals Other than Sand" and specified the format of the DSR. Monitoring Guidelines for Sand Mining (EMGSM) January 2020, issued by the Ministry of Environment, Forest and Climate Change is prepared in consideration of various orders/directions issued by Hon'ble NGT in matters pertaining to illegal sand mining and based on the reports submitted by expert committees and investigation teams. This DSR has been prepared in conformity with the S O 141 (E), S O 3611 (E), and other sand mining guidelines published by MOEF & CC from time to time as well as the requirement specified in Assam Minor Mineral Concession rule 2013, (AMMCR), 2013.

The purpose of the District Survey Report (DSR) is to identify the areas of deposition where mining can be permitted and also, to identify the areas where mining will not be permitted due to proximity to infrastructural structures and installations and areas of erosion. The DSR would also help to calculate the total amount of replenishment.

Preparation of this DSR required both primary and secondary data generation. The primary data generation involved the site inspection, survey, ground truthing etc. while secondary data has been acquired through various authenticated sources and satellite imagery studies. The secondary data related to district profile, local geology, mineralization and other activities are available in rather a piecemeal fashion. The district survey report of Tinsukia district also describes the general geographical profile of the district, distribution of natural resources, livelihood, climatic condition, inventory of minor minerals and revenue generation.

The state of Assam itself is very rich in mineral resources. Here "liquid gold" (fuel oil) and other natural resources are found. During the last 70 years, the mineral sector has grown considerably in Assam. In spite of this, the economic growth of this state has been slow. In order to expedite the development process, exploitation of available mineral resources by developing mines & establishment of mineral-based value- added industries has an imperative upshot. Developments achieved in the mining & mineral industries so far, availability of resources & existing trend would offer a glimpse of the future of the mineral sector in the state.

Minor minerals include building stones, gravel, ordinary clay, ordinary sand, limestone used for lime burning, boulders, kankar, morrum, brick earth, bentonite, road metals, slate marble, and stones used for making household utensils. But sand is used for stowing purposes. Coal is considered a major mineral. In the case of Assam, exploitation of minor minerals comes under Rule, 2013 52 (1) of the Assam Minor Minerals Concession Rule. Therefore, this District Survey Report (DSR) will give authentic field data sets and relevant information about the presence of riverbed sand deposits, ordinary earth & brick earth along with river bed boulder and/or fossilized channel deposits which in turn will bestow excellent guidance for systematic and scientific utilization of mineral resources, so that present and future generation may be benefitted at large.

It is also mentioned here that the procedure of preparation of this District Survey Report is as per notification guidelines issued by the Ministry of Environment, Forests and Climate Change (MoEFCC), SO No. 141(E), Dated 15.01.2016, and the format given by SO No. 3611(E), New Delhi, dated 25 July 2018 regarding the preparation of District survey report of mining and other minor minerals as specified in appendix 10 of the notification. The district Tinsukia has an extremely remarkable value from the geological aspect. In mining, this district has been made to cover minor mineral mining locations, areas, and an overview of mining activity in the district with all its relevant features pertaining to geology & mineral wealth. From this point of view, minor minerals are slightly different from other districts of Assam. Far-reaching geological fieldwork and thorough study of different minerals along with inselbergs and geostatistical studies of different mineralogical attributes of different minerals, the mines, and their proprietors have been undertaken to find out the plausible causes for proper documentation of the geological history of the total Tinsukia district. Some precious minerals that are found in Assam is Platinum (Pt), Gold (Au), etc. this report also contains details of the forest, drainage, land use & land cover, etc.

CHAPTER 2: INTRODUCTION

The District Survey Report of Tinsukia District has been prepared as per the guide line of Ministry of Environment, Forests and Climate Change (MoEF& CC), Government of India vide Notification S.O.-1533(E) dated 14th Sept, 2006 and subsequent MoEF& CC Notification S.O. 141(E) dated 15th Jan, 2016. This report shall guide systematic and scientific utilization of natural resources, so that present and future generation may be benefitted at large. Further, MoEF& CC published a notification S.O. 3611(E) Dated 25th July, 2018 and recommended the format for District Survey Report.

The main objective of DSR is identification of areas of aggradations or deposition where mining can be allowed; and identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area. The DSR would also help to calculate the annual rate of replenishment wherever applicable and allow time for replenishment. Besides sand mining, the DSR also include the potential development scope of in-situ minor minerals.

The objectives of the District Survey Report are as follows:

1. To identify and quantify minor mineral resources for its optimal utilization.
2. To regulate sand and gravel mining, identification of site-specific end-use consumers and reduction in demand and supply gaps.
3. To facilitate use information technology (IT) for surveillance of the sand mining at each step.
4. To enable environmental clearance for cluster of sand and gravel mines.
5. To restrict illegal mining.
6. To reduce occurrences of flood in the area.
7. To maintain the aquatic habitats.
8. To protect ground water in the area by limiting extraction of material in riverbeds to an elevation above the base flow.
9. To maintain data records viz. details of mineral resource, potential area, lease, approved mining plan, co-ordinates of lease hold areas, and revenue generation.
10. To design a scientific mining plan and estimate ultimate pit limit.
11. To frame a comprehensive guideline for mining of sand and other minor minerals.

The District Survey Report (DSR) comprises secondary data on geology, mineral resources, climate, topography, land form, forest, rivers, soil, agriculture, road, transportation, and irrigation etc. of the district collected from various published and un-published literatures and reports as well as various websites. Data on lease and mining activities in the district, revenue etc. have been collected from the DL&LRO office of the district and from Government of Assam Mines & Minerals Directorate of Geology & Mining.

2.1 Statutory Framework:

Ministry of Environment, Forest, and Climate Change (MoEF& CC) has published several notifications time to time to formulate and implement the District Survey Report (DSR) for every district. Statutory Framework and its legal aspect with respect to DSR is tabulated in Table 01.

Table 01: Statutory Framework and guidelines on DSR with time scale

Year	Particulars
1957	Mines and Minerals (Development and Regulation) act, 1957 Act is the principal Act for regulation of mines and development of minerals.
1986	The environment (Protection) act, 1986 was enacted in 1986 by the Ministry of Environment and Forests with the objective of providing for the protection and improvement of the environment
1994	The Ministry of Environment, Forest & Climate Change (MoEF&CC) published Environmental Impact Assessment Notification 1994 which is only applicable for the Major Minerals more than 5 ha.
2006	In order to cover the minor minerals also into the purview of EIA, the MoEF & CC has issued EIA Notification SO 1533 (E), dated 14th September 2006, made mandatory to obtain environmental clearance for both Major & Minor Mineral more than 5 Ha.
2012	Further, Hon’ble Supreme Court wide order dated the 27th February, 2012 in I.A. No.12- 13 of 2011 in Special Leave Petition (C) No.19628-19629 of 2009, in the matter of Deepak Kumar etc. Vs. State of Haryana and Others etc., ordered that “leases of minor minerals including their renewal for an area of less than five hectares be granted by the States/Union Territories only after getting environmental clearance from MoEF”; and Hon’ble National Green Tribunal, order dated the 13th January, 2015 in the matter regarding sand mining has directed for making a policy on environmental clearance for mining leases in cluster for minor Minerals.
2013	Assam Minor Mineral Concession rule 2013 recommended rules for regulating the grant of various forms of mineral concessions to prevent illegal mining in the district, The Rules detail restrictions on mining operations near villages, highways, and other structures, and the process for granting mining leases and contracts through competitive bidding or auctions and payments. It also covers General conditions to grant any mineral concession, regulation and control of mining operations, Restoration and Rehabilitation fund, illegal or un-authorised Mining and its consequences. It highlights the significance of scientific mining, detailed reporting, and adherence to environmental and safety regulations. Overall, the Rules aim to ensure responsible mineral extraction, prevent unauthorized activities, and promote sustainable mining practices in Assam, while providing a structured framework for granting and managing mineral concessions in the region.

March 2015	The Mines and Minerals (Development and Regulation) Amendment Act,2015 is an act to amend the Mines and Minerals (Development and Regulation) Act, 1957 which enacted on March 26, 2015,and become effective from January 12, 2015,it introduced several key amendments, including the establishment of Special Courts for mining-related offenses, the requirement for prior approval from the Central Government for certain mining permits, and the extension of mining leases for captive purposes until March 31, 2030. It also revised provisions regarding the auctioning of expired leases and introduced new clauses related to the District Mineral Foundation payments. Additionally, the Act amended definitions and parameters related to mineral content and the powers of the Central Government in regulating mining activity
September 2015	Ministry of Mines notification on 17th September,2015 focuses on exercise of the powers conferred by sub-sections (5) and (6) of Section 9B of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the notification focused on specific rules made by Central Government specifying the amount to be paid by holder of a mining lease or a prospecting license-cum-mining lease, in addition to the royalty, to the District Mineral foundation of the district established by the concerned State Government through notification.
2016	The MoEF&CC in compliance of above Hon'ble Supreme Court's and NGT'S order has prepared "Sustainable Sand Mining Guidelines (SSMG), 2016" in consultation with State governments, detailing the provisions on environmental clearance (EC) for cluster, creation of District Environment Impact Assessment Authority, preparation of District survey report and proper monitoring of minor mineral. There by issued Notification dated 15.01.2016 for making certain amendments in the EIA Notification, 2006, and made mandatory to obtain EC for all minor minerals. Provisions have been made for the preparation of District survey report (DSR) for River bed mining and other minor minerals.
2018	MoEF& CC published a notification S.O. 3611(E) Dated 25th July, 2018 and recommended the format for District Survey Report. The notification stated about the objective of DSR i.e. "Identification of areas of aggradations or deposition where mining can be allowed; and identification of areas of erosion and proximity to infrastructural structures and installations where mining should be prohibited and calculation of annual rate of replenishment and allowing time for replenishment after mining in that area."
2020	Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) 2020 has been published modifying Sustainable sand Mining Guidelines, 2016 by MoEF& CC for effective enforcement of regulatory provisions and their monitoring. The EMGSM 2020 directed the states to carry out river audits, put detailed survey reports of all mining areas online and in the public domain, conduct replenishment studies of river beds, constantly monitor mining with drones, aerial surveys, ground surveys and set up dedicated task forces at district levels. The guidelines also push for online sales and purchase of sand and other riverbed materials to make the process transparent. They propose night surveillance of mining activity through night-vision drones.
October 2020	(In IA No 40/2020 41/2020, 46/2020, 47/2020) and vide order dated 14th October 2020 NGT also mandates that DSR/Replenishment Study should be

	prepared by a consultant having accreditation from NABET which further should be appraised by SEAC and approved by SEIAA. The consultant must follow procedure laid down under SSMMG-2016 and EMGSM-2020 during preparation of DSR.
February 2021	Government of Assam through Assam Minerals regulation and dealers' rule 2020 proposed rules to regulate the possession, storage, trading and transport of minerals and mineral products to check evasion of royalty or seigniorage fee, to stop illegal mining and transportation in the state of Assam. The rule is applicable to all Minerals Dealers and all industries/ factories connected with the sale, purchase, transportation, processing and consumption of minerals for commercial purpose in the state of assam.
October 2021	Assam Minor Mineral Concession (Amendment) Rules, 2021 notified on October 7th, 2021, it focuses to reorganize the royalty payment process for minor minerals utilized by government departments and agencies. It establishes specific rates of royalties based on the project cost, excluding taxes, and mandates that these royalties be deducted at the time of payment to contractors or suppliers. Additionally, the rules introduce a structured collection process for urban local bodies, requiring royalties to be collected in installments throughout the construction phase, thereby ensuring compliance and proper financial management in the use of minor minerals.

Important statutory provisions of Assam Minor Mineral Concession rule:

Mining operation under mining a mineral concession.

- No person shall undertake any prospecting or mining operation activity in respect of any minerals in any part of the State, except under and in accordance with the terms and conditions of a permit or a prospecting licence or a mining lease or a mining contract or a permit, or a concession in any other form, as the case may be, granted:

- Provided that nothing in this sub-rule shall apply to any prospecting operation undertaken by the Geological Survey of India, the Indian Bureau of Mines, and the Atomic Minerals Directorate for Exploration and Research of the Central Government, the Directorate of Geology & Mining, Assam or the Mineral Exploration Corporation Limited.

Restriction on grant of mining lease/contract/ permit.

I. No mining lease/contract /permit shall be granted in respect of any land within a distance of: -

(i) Fifty metres from the outer periphery of the defined limits of any village habitation, National Highway, State Highway and other roads where such excavation does not required use of explosives.

(ii) Two hundred fifty metres for the outer periphery of the defined limits of any village habitation, National Highway, State Highway and other roads where use of explosives if required.

(iii)Five hundred metres from major structures like R.C.C. Bridge, Guide bund etc.

Provided that the Government may relax the above distance parameters, wherever required in the interest of working, mineral conservation or for any unforeseen reasons subject to such condition as may be imposed under the said relaxation.

(2) No mining lease/contract/permit or any other mineral concession shall be granted in respect of any such minor mineral or in respect of any specific or general area which the Government may notify.

Condition on which the Permit for mining/quarrying shall be granted

I. Any mining operation in the case of mining of brick earth or ordinary clay or alluvial deposit below a depth of 1.5 metre shall necessarily require formation of benches for safe mining. The benches would be formed in a manner that the width of the bench is not lesser than the height of the bench.

II. Any quarrying permit granted under these rules shall contain information with regard to the following:

a) Manner, mode and place of payment of rent, royalties, permit money, Rehabilitation and Restoration Fund amount and interest on delayed payments or any other dues as admissible under these rules.

b) Particulars of the receipt heads of the Government to which the payments are to be credited.

c) Grant, compensation of damage to the land owner for the land covered by the permit.

d) Felling the trees, pumping of ground water.

e) Restriction of surface operations in any area provided by any authority.

f) Entering and working in any forest area.

g) Reporting all accidents, use of explosives.

h) Indemnity to the Government against claim of third parties.

i) Mineral to be stacked, measured and dispatched.

j) Applicability of the provisions of all other statutes/rules framed by the Central and State Government.

k) Reclamation or restoration of the mining areas and security thereof.

l) Development and conservation of minerals and environment and ecology of the area.

m) Extent of the area or land from where the minor mineral shall be extracted.

n) Period within which the minor mineral shall be extracted and removed and delivery of possession of land on the expiry of such period or on removal of the quantity of the minor mineral for which the permit is valid/granted.

o) Release of security by the authority issuing permit after having satisfied that the permit holder has fulfilled all the conditions of the permit satisfactorily.

p) Any other condition, as may be found expedient by the competent authority to grant the permit, may be imposed in the interest of scientific mining, mineral conservation and mineral development.

III. In case of the permit holder is not able to remove the whole or any part of the mineral for which he obtained the permit within the permissible time for any reason, whatsoever, he shall not be entitled to claim the refund of permit amount/ royalty or any part thereof.

IV. The permit holders for the brick kilns shall furnish a solvent surety within fifteen days of the issue of the permit by submitting an undertaking of such surety that he would be responsible for deposit of all dues in case the permit holder fails to deposit the same.

Special conditions for river-bed

Following condition shall be application for excavation of minor mineral (s) from river beds in other to ensure safety of river-beds, structures and the adjoining areas:

- No mining would be permissible in a river-bed up to a distance of five times of the span of the bridge on up-stream side and ten times the span of such bridge on down-stream side, subject to minimum of 250 meters on the up-stream side and 500 meters on the down-stream side.
- There shall be maintained an un-mined block of 50 meters width after every block of 1000 meters over which mining is undertaking or at such distance as may be directed by the competent authority.
- The maximum depth of mining in the river-bed shall not exceed three meters measured from the un-mined bed level at any point of time with proper bench formation.
- Mining shall be restricted within the central 3/4th width of the river/ rivulet.
- No mining shall be permissible in an area up to a width specified by the competent authority from the action edges of embankments.
- Any others condition as may be required by the competent authority in public interest.

- **Sustainable Sand Mining Management Guidelines (SSMMG), 2016by MoEF& CC.**

The sustainable sand Mining Management Guidelines 2016 has been prepared after extensive consultation with the States and Stakeholders over a period of one year. The main objective of the Guideline is to ensure sustainable sand mining and environment friendly management practices in order to restore and maintain the ecology of river and other sand sources.

1. Parts of the river reach that experience deposition or aggradation shall be identified first. The Lease holder/ Environmental Clearance holder may be allowed to extract the sand and gravel deposit in these locations to manage aggradation problem.
2. The distance between sites for sand and gravel mining shall depend on the replenishment rate of the river. Sediment rating curve for the potential sites shall be developed and checked against the extracted volumes of sand and gravel.

3. Sand and gravel may be extracted across the entire active channel during the dry season.

4. Abandoned stream channels on terrace and inactive flood plains be preferred rather than active channels and their deltas and flood plains. Stream should not be diverted to form inactive channel.

5. Layers of sand and gravel which could be removed from the river bed shall depend on the width of the river and replenishment rate of the river.

6. Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.

7. Segments of braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.

8. Sand and gravel shall not be extracted within 200 to 500 meters from any crucial hydraulic structure such as pumping station, water intakes, and bridges. The exact distance should be ascertained by the local authorities based on local situation. The cross-section survey should cover a minimum distance of 1.0 km upstream and 1.0 km downstream of the potential reach for extraction. The sediment sampling should include the bed material and bed material load before, during and after extraction period. Develop a sediment rating curve at the upstream end of the potential reach using the surveyed cross- section. Using the historical or gauged flow rating curve, determine the suitable period of high flow that can replenish the extracted volume. Calculate the extraction volume based on the sediment rating curve and high flow period after determining the allowable mining depth.

9. Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.

10. Flood discharge capacity of the river could be maintained in areas where there are significant flood hazard to existing structures or infrastructure. Sand and gravel mining may be allowed to maintain the natural flow capacity based on surveyed cross- section history.

11. Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.

12. The Piedmont Zone (Bhabhar area) particularly in the Himalayan foothills, where riverbed material is mined, and this sandy-gravelly track constitutes excellent conduits and holds the greater potential for ground water recharge. Mining in such areas should be preferred in locations selected away from the channel bank stretches.

13. Mining depth should be restricted to 3 meter and distance from the bank should be 3 meters or 10 percent of the river width whichever less.

14. The borrow area should preferably be located on the river side of the proposed embankment, because they get silted up in course of time. For low embankment less than 6 m in height, borrow area should not be selected within 25 m from the toe/heel of the embankment. In case of higher embankment, the distance should not be less than 50 m. In

order to obviate development of flow parallel to embankment, cross bars of width eight times the depth of borrow pits spaced 50 to 60 meters centre-to-centre should be left in the borrow pits.

15. Demarcation of mining area with pillars and geo-referencing should be done prior to start of mining.

- **Enforcement & Monitoring Guidelines for sand Mining, 2020 (MoEF& CC)**

Ministry of Environment Forest & Climate Change formulated the Sustainable Sand Management Guidelines 2016 which focuses on the Management of Sand Mining in the Country. But in the recent past, it has been observed that apart from management and systematic mining practices there is an urgent need to have a guideline for effective enforcement of regulatory provision and their monitoring. Section 23 C of MMDR, Act 1957 empowered the State Government to make rules for preventing illegal mining, transportation and storage of minerals. But in the recent past, it has been observed that there was large number of illegal mining cases in the Country and in some cases, many of the officers lost their lives while executing their duties for curbing illegal mining incidence. The illegal and uncontrolled illegal mining leads to loss of revenue to the State and degradation of the environment.

1. Parts of the river reach that experience deposition or aggradation shall be identified. The Leaseholder/ Environmental Clearance holder may be allowed to extract the sand and gravel deposit in these locations to manage aggradation problem.

2. The distance between sites for sand and gravel mining shall depend on the replenishment rate of the river. Sediment rating curve for the potential sites shall be developed and checked against the extracted volumes of sand and gravel.

3. Sand and gravel may be extracted across the entire active channel during the dry season.

4. Abandoned stream channels on the terrace and inactive floodplains be preferred rather than active channels and their deltas and flood plains. The stream should not be diverted to form the inactive channel.

5. Layers of sand and gravel which could be removed from the river bed shall depend on the width of the river and replenishment rate of the river.

6. Sand and gravel shall not be allowed to be extracted where erosion may occur, such as at the concave bank.

7. Segments of the braided river system should be used preferably falling within the lateral migration area of the river regime that enhances the feasibility of sediment replenishment.

8. Sand and gravel shall not be extracted up to a distance of 1kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side.

9. The sediment sampling should include the bed material and bed material load before, during and after the extraction period. Develop a sediment rating curve at the upstream

end of the potential reach using the surveyed cross-section. Using the historical or gauged flow rating curve, determine the suitable period of high flow that can replenish the extracted volume.

10. Calculate the extraction volume based on the sediment rating curve and high flow period after determining the allowable mining depth.

11. Sand and gravel could be extracted from the downstream of the sand bar at river bends. Retaining the upstream one to two-thirds of the bar and riparian vegetation is accepted as a method to promote channel stability.

12. The flood discharge capacity of the river could be maintained in areas where there is a significant flood hazard to existing structures or infrastructure. Sand and gravel mining may be allowed to maintain the natural flow capacity based on surveyed cross-section history. Alternatively, off-channel or floodplain extraction is recommended to allow rivers to replenish the quantity taken out during mining.

13. The Piedmont Zone (Bhabhar area) particularly in the Himalayan foothills, where riverbed material is mined, and this sandy-gravelly track constitutes excellent conduits and holds the greater potential for groundwater recharge. Mining in such areas should be preferred in locations selected away from the channel bank stretches.

14. Mining depth should be restricted to 3 meters and distance from the bank should be ¼th or river width and should not be less than 7.5 meters.

15. The borrow area should preferably be located on the riverside of the proposed embankment because they get silted in the course of time. For low embankment, less than 6 m in height, borrow area should not be selected within 25 m from the toe/heel of the embankment. In the case of the higher embankment, the distance should not be less than 50 m. In order to obviate the development of flow parallels to the embankment, crossbars of width eight times the depth of borrow pits spaced 50-to-60-meter centre-to-centre should be left in the borrow pits.

16. Demarcation of mining area with pillars and geo-referencing should be done prior to the start of mining.

17. A buffer distance /un-mined block of 50 meters after every block of 1000 meter over which mining is undertaken or at such distance as may be the directed/prescribed by the regulatory authority shall be maintained.

18. A buffer distance /unmined block of 50 meters after every block of 1000 meters over which mining is undertaken or at such distance as may be the directed/prescribed by the regulatory authority shall be maintained.

19. River bed sand mining shall be restricted within the central 3/4th width of the river/rivulet or 7.5 meters (inward) from river banks but up to 10% of the width of the river, as the case may be and decided by regulatory authority while granting environmental clearance in consultation with irrigation department. Regulating authority while regulating the zone of river bed mining shall ensure that th objective to minimize the effects of riverbank erosion and consequential channel migration are achieved to the extent possible. In general, the area for removal of minerals shall not exceed 60% of the

mine lease area, and any deviation or relaxation in this regard shall be adequately supported by the scientific report.

20. Mining Plan for the mining leases (non-government) on agricultural fields/Patta land shall only be approved if there is a possibility of replenishment of the mineral or when there is no riverbed mining possibility within 5 KM of the Patta land/Khatedari land. For government projects mining could be allowed on Patta land/Khatedari land but the mining should only be done by the Government agency and material should not be used for sale in the open market.

The minerals reserve for riverbed area is calculated on the basis of maximum depth of 3 meters and margins, width and other dimensions as mentioned in para (s) above. The area multiplied by dept gives the volume and volume multiplied with bulk density gives the quantity in Metric Ton. In case of riverbed, mineable material per hectare area available for actual mining shall not exceed the maximum quantity of 60,000 MT per annum.

- **Demand and Utilisation of Sand**

Sand is a multi-purpose topographical material. It is known as one of the three fundamental ingredients in concrete. The composition of sand is diverse. Mostly sand is made of silica which is a common element. It can also come from another source of minerals like quartz, limestone, or gypsum.

From beds to flood plains to coastlines- we can find the sand at almost everywhere. The robustness of sand has played a significant role in everyday life. We use sand practically every other day.

Sand extraction from river beds and brick earth mining for making raw bricks are the main mining activities in the district. With a spurt in construction of real estate sectors and various govt. sponsored projects, the demand for both sand and bricks has increased manifold. The extraction of sand is carried out either manually or through semi- mechanized system. The depth of mining for both river bed sand and brick earth is restricted due to statutory provision in the regulations pertaining to conservation and development of minor minerals.

River sand mining is a common practice as habitation concentrates along the rivers and the mining locations are preferred near the markets or along the transportation route, for reducing the transportation cost.

In the real world, there are a lot of situations where we can find uses of sand. Followings are the common sand uses.

1. While bunging metal, we can mix sand with clay binder for frameworks used in the foundries.

2. Sand can be used for cleaning up oil leak or any spill by dredging sand on that spill. The material will form clumps by soaking up, and we can quickly clean the mess.

3. Sand can be used as a road base which is a protective layer underneath all roads

4. Industrial sand is used to make glass, as foundry sand and as abrasive sand.

5. One creative usage of sand is serving as a candle holder. We can try putting some sand before pouring tea light or any candle in a glass. It holds the candle still and refrain the candle from rolling by giving it an excellent decoration.

6. Adds texture and aesthetic appeal to space.

7. Sand is mostly pure to handle, promptly available and economically wise.

8. We use sand in aquariums, fabricating artificial fringing reefs, and in human-made beaches

9. Sandy soils are ideal for growing crops, fruits and vegetables like watermelon, peaches, peanuts, etc.

10. Sand can light a path by filling mason jars with sand and tea light which is another inexpensive way to make a walkway glow.

11. Sand helps to improve resistance (and thus traffic safety) in icy or snowy conditions.

12. We need sand in the beaches where tides, storms or any form of preconceived changes to the shoreline crumble the first sand.

13. Sand containing silica is used for making glass in the automobile and food industry-even household products for the kitchen.

14. Sand is a strong strand which is used for plaster, mortar, concrete, and asphalt.

15. The usual bricks formulated of clay only are way weaker and lesser in weight than blocks made of clay mixed with sand.

2.2 Methodology of DSR Preparation

The steps followed during the preparation of District Survey Report are given in Figure 2.1. The individual steps are discussed in following paragraphs.

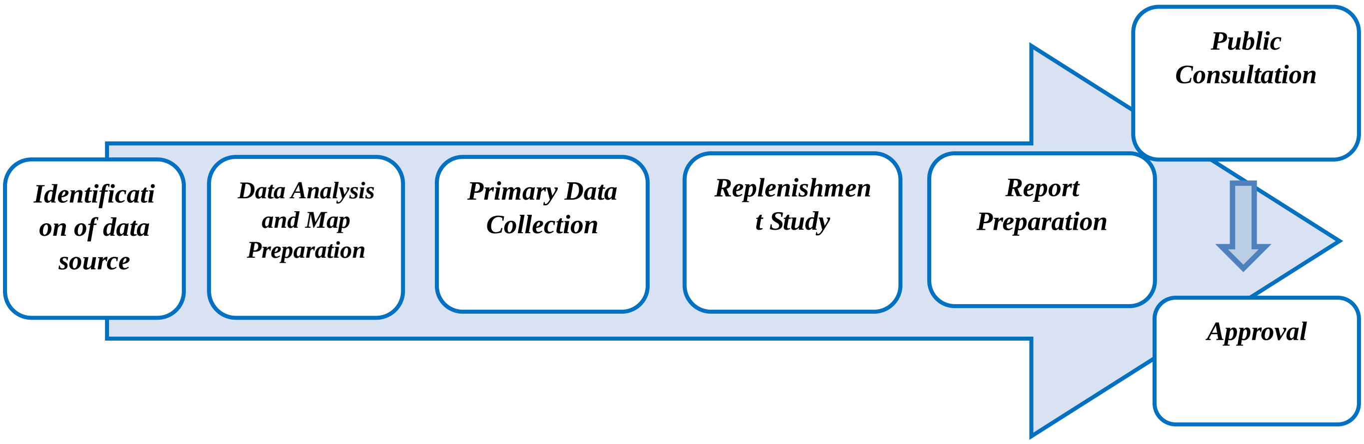
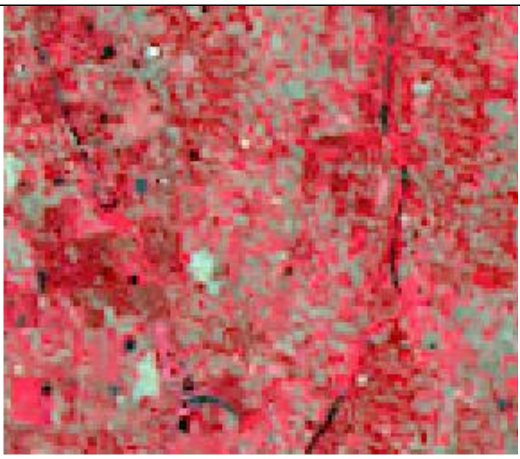


Figure 01: Steps followed in preparation of DSR

Data source Identification: District Survey Report has been prepared based on the primary data base and secondary data base collected and collated from different sources. It is very critical to identify authentic data sources before compiling the data set. The secondary data sources which are used in this DSR are mostly taken from public domain or from the published report in reputed journals. Information related to district profile has been taken from District Census Report, 2011 and District Statistical Handbook published by the Govt. of Assam. Potential mineral resources of the district have been described based on the published report of Geological Survey of India (GSI) or any other govt. agencies like MECL etc. List of mining lease, name of lease holder, lease/block area, resource in already allotted mining lease, revenue from minor mineral sector etc. have been collected from the concern DL & LRO offices of the district. Satellite images have been used for map preparation related to physiography and land use/land cover of the district.

Data Analysis and Map Preparation: To prepare the Maps of the district, we have collected the data set which are captured during the report preparation. They have gone through detail analysis work. District Survey Report involves the analytical implication of captured dataset to prepare relevant maps. Methodology adopted for preparation of relevant maps is explained below:

Land Use and Land Cover Map: Land Use and Land Cover classification is a complex process and requires consideration of many factors. The major steps of image classification include determination of a suitable classification system via Visual Image Interpretation, selection of training samples, Satellite image (FCC-False Color Composite) pre-processing, selection of suitable classification approaches, post classification processing, and accuracy assessment. Here LISS-III satellite imagery has been taken for supervised classification as supervised classification can be much more accurate than unsupervised classification, but depends heavily on the training sites, the skill of the individual processing the image, and the spectral distinctness of the classes in broader scale. According to the Visual Image Interpretation (Tone, Pattern, Texture, Shape, Color etc.) training set of the pixel has been taken. Pictorial descriptions of Land Use classification are explained in Figure 01.

	
Agricultural Land - Based on their Geometrical shape, Red and Pink color tone, Agricultural Land has been identified.	Vegetation Covered Area - Area with continuous Red color tone, Vegetation Covered Area has been classified.

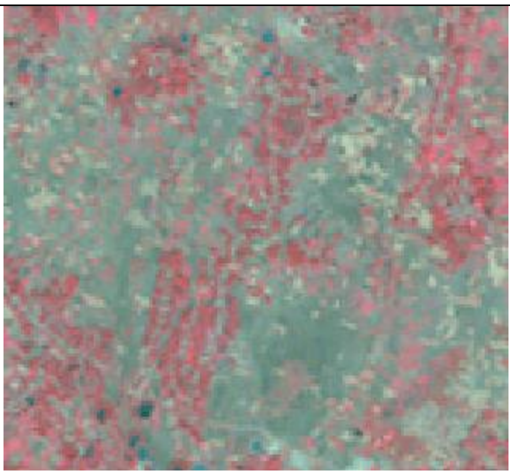
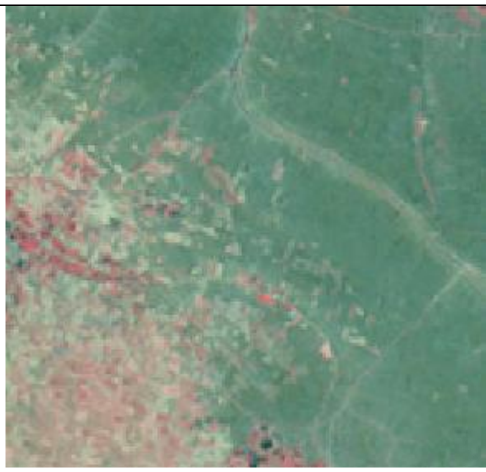
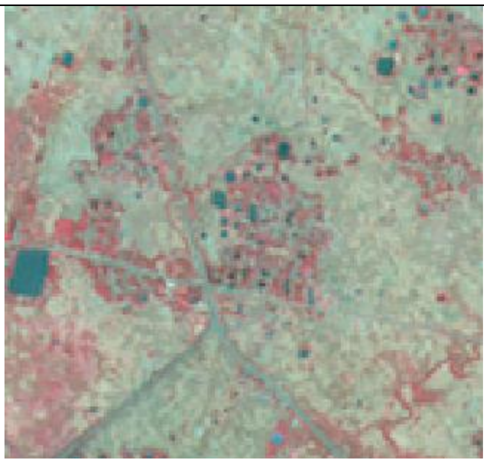
	
Agricultural Fallow Land - Based on their Geometrical shape, Yellowish green color tone, Agricultural Fallow Land has been identified.	Badland Topography- Area with Non geometrical shape and Yellowish green color tone has been identified as Bad Land Topography.
	
Settlement – Area with some geometrical shape in a Linear Pattern including Light Cyan Color has been recognized as Settlement Area.	Water Bodies – Area with Blue color has been classified as Water Bodies.

Figure 02: Pictorial description of Land Use Classification methods

<u>Geomorphological Map:</u> The major step of preparing Geomorphological Map is identifying features like – Alluvial Fan, Alluvial Plain, Hilly Region etc. from Satellite Imagery (FCC- False Colour Composite) via Visual Image Interpretation and then digitisation has been taken into the consideration to prepare map including all the Geomorphological features according to their location. Pictorial descriptions of Geomorphological unit's classification are explained in Figure 03.

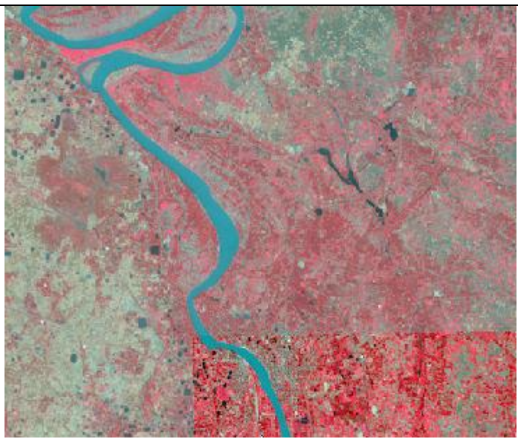
	
Flood plain-Flood plain is a generally flat area of land next to a river or stream. It stretches from the banks of the river to the outer edges of the valley.	OX-BOW Lake- An ox-bow lake starts out as a curve, or meander, in a river. This "U" shaped body of water identified as Ox- Box Lake from Satellite Imagery.

Figure 03: Pictorial description of Geomorphological Units Classification methods

Physiographical Map: The major step of preparing Physiographical Map is generating contour at a specific interval to show the elevation of the area using Cartosat DEM.

Block Map/Transportation Map/Drainage Map:

- Raw Data collected from National Informatics Centre (NIC Website) during May 2024.
- Data has been geo-referenced using GIS software.
- Digitization of block boundary, district boundary, state boundary, international boundary, and district headquarter, sub–district headquarter, places, road, railway, river, nala etc.
- Road name, River name, Railway name has been filled in attribute table of the Layers
- Final layout has been prepared by giving scale, legend, north arrow, etc.

Earthquake Map:

- Raw data collected from Ministry of Earth Science.
- Data has been geo-referenced using GIS software.
- Digitization of Earthquake zone and superimposed it over Block Boundary.
- Zone name has been filled in attribute table of the Layers
- Final layout has been prepared by giving scale, legend, north arrow, etc.

Soil Map:

- Raw data collected from National Bureau of Soil Survey and Land Use Planning during May 2024.
- Data has been geo-referenced using GIS software.
- Digitization of Soil classification zone and superimposed it over District Boundary.
- Soil classification has been filled in attribute table of the Layers.
- Final layout has been prepared by giving scale, legend, north arrow, etc.

Wildlife Sanctuary and National Park location Map:

- Raw data obtained from ENVIS Centre on Wildlife & Protected Areas during August 2020.
- Data has been geo-referenced using GIS software.
- Digitization of Wildlife Sanctuary and National Park and superimposed it over Block Boundary.
- Wildlife Sanctuary & National Park name has been filled in attribute table of the Layers Final layout has been prepared by giving scale, legend, north arrow, etc.

Primary Data Collection: To prepare DSR, primary data has been collected and field work has also been carried out for the district. Field study involves assessment of the mineral resources of the district by means of pitting / trenching in specific interval. This provides clear picture of mineral matters characterization and their distribution over the area.

Replenishment study: One of the principal causes of environmental impacts of river bed mining is the removal of more sediment than the system can replenish. Therefore, there is a need for replenishment study for riverbed sand in order to nullify the adverse impacts arising due to excess sand extraction. We have conducted Physical survey by the help of DGPS to define the topography, contours and offsets of the riverbed. The surveys clearly depict the important attributes of the stretch of the river and its nearby important civil and other feature of importance. This information will provide the eligible spatial area for mining. The annual rate of replenishment carried out on every river of the district to have proper assessment of the sand reserve for mining purposes. The surveys clearly depict the important attributes of the stretch of the river and its nearby important civil and other feature of importance. This information will provide the eligible spatial area for mining.

Report Preparation: The district survey report portrays general profile, geomorphology, land use pattern and geology of the district. The report then describes the availability and distribution of riverbed sands and other minor minerals in the district. Apart from delineation the potential mining blocks, the report also includes Inventorisation of the minerals, recent trends of production of minor minerals and revenue generation there from. Annual replenishment of the riverbed sand has been estimated using field observation, satellite imagery and empirical formula. The road network connecting arterial road to potential mining blocks has been identified. Potential environmental impacts of mining of these minerals, their mitigation measures along with risk assessment and disaster management plan have also been discussed. Finally, the reclamation strategy for already mined out areas is also chalked out.

Public Consultation & Approval: In accordance with the Enforcement and Monitoring Guidelines for Sand Mining, the UT Government would look for public feedback on the list of mining zones that will be placed up for auction. The DSR, which includes the list of zones will be advertised in local and national newspapers as well as in district administration website. The public will have twenty one days to provide their input or any comment which will then be considered by the district committee. Sand mining zones, including clusters and contiguous clusters, will be defined in the final DSR. The final list of sand mining areas, including riverbed, Patta land, Khatedari, desiltation locations and M-sand Plants will be defined in the final DSR, following the public hearing as per Annexure-V. Details regarding clusters and contiguous clusters will be provided in Annexure-VI and Annexure-VII. The process flow diagram is as follows:

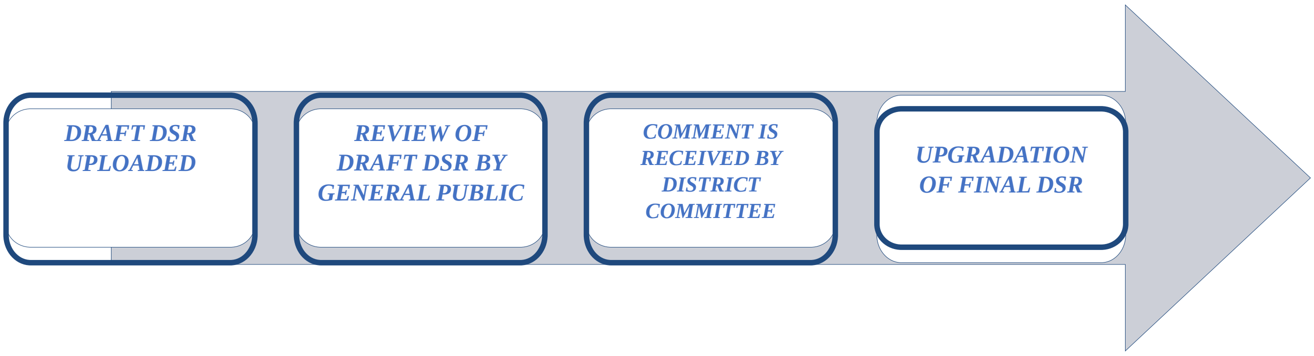


Figure 04: Schematic Representation of Public Consultation

CHAPTER 3: GENERAL PROFILE OF THE DISTRICT

a) General information:

Tinsukia is last district of upper Assam. The district occupies an area of 3790 sq.km. It is situated 480 kilometres (298 mi) north east of Guwahati and 84 kilometres (52 mi) kilometres away from the border with Arunachal Pradesh. It is the administrative headquarters of Tinsukia District of Assam, India.

Some information about Tinsukia district have been discussed in the following:

- Location: Tinsukia is in the far northeast corner of Assam and shares borders with Arunachal Pradesh's Changlang, Namsai, and Lower Dibang Valley districts.
- History: The district's ancient name was Bangmara, which was originally known as Changmai Pathar. It was the capital of the Muttack Kingdom in the late 18th and early 19th centuries.
- Demographics: The district's population is made up of many communities, including Moran, Matak, Adivasi, Tai Ahom, Sonowal Kachari, Nepali, Singpho, Bengali, Marwari, and Bihari.
- Literacy: The district's literacy rate is 70.92%.
- Economy: The district's economy is largely supported by its prominent industries.
- Judicial system: The district's judicial system was established in 1975 with the establishment of the court of Munsiff No. 1 in Tinsukia.
- Administratively, the district consists of six Legislative Assembly Constituencies, six Sub Divisions/Sub Districts that is Sadiya, Doomdooma, Margherita, Digboi, Makum, Tinsukia and four revenue circles they are Tinsukia (Sadar), Doomdooma, Margherita and Sadiya Each revenue circle consists of number of revenue villages. The total number of revenue villages in the district are 253. This district has seven Development Blocks which are Kakopather, Guijan, Hapjan, Itakhuli, Saikhowa, Margherita and Sadiya. Total panchayat of the district is 86.

Figure 05: Location Map of Tinsukia District

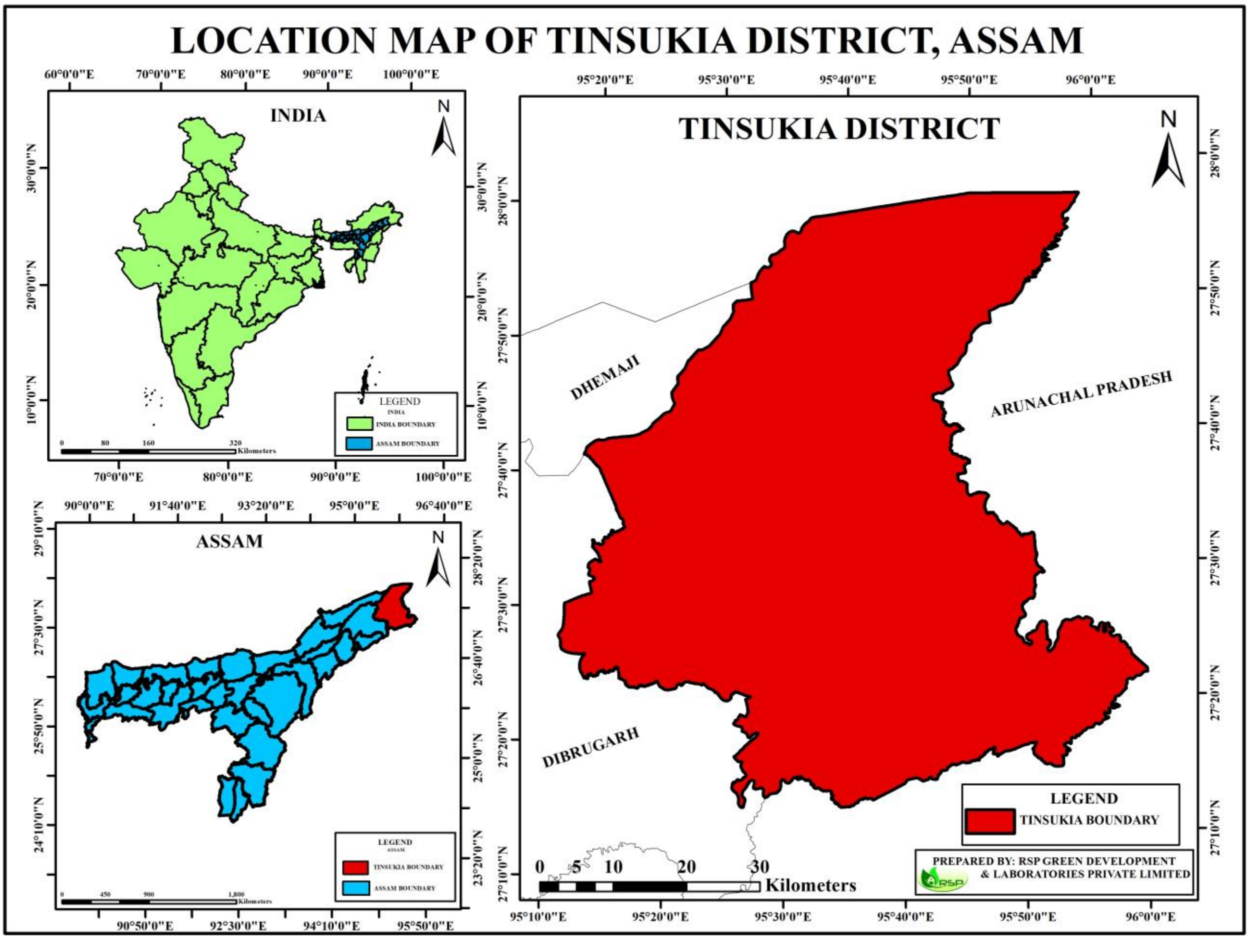


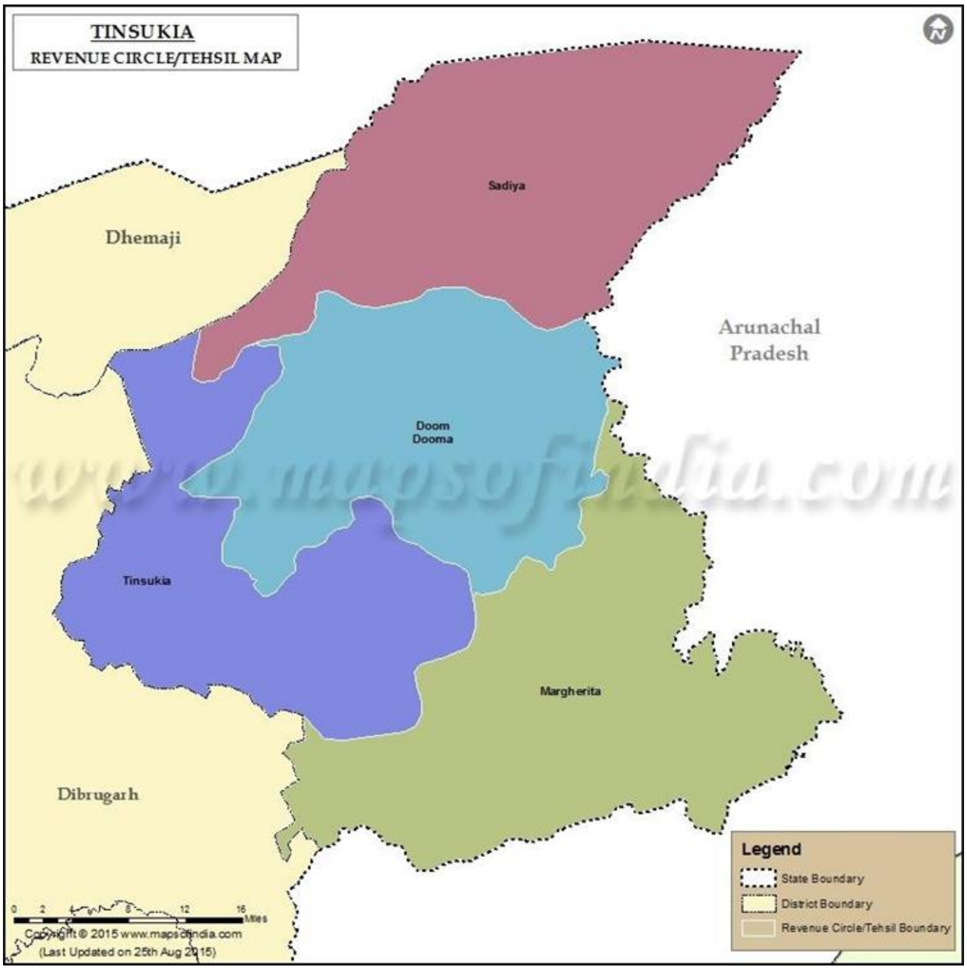
Table No 02: Administrative units of the Tinsukia District

Sl. No.	ADMINISTRATIVE UNITS	STATISTICS
1.	Headquarter	Tinsukia
2.	Sub-Districts	6
3.	Revenue Circles	4
4.	Development Blocks	7
5.	Geographical Area	3790 sq. km
6.	Population	13.3 Lakhs
7.	Literacy	70.9%
8.	Revenue Villages	253
9.	Panchayats	86
Source: *https://en.wikipedia.org › wiki › East Kamrup-metro Brief Industrial Profile of District,*		

Table No. 03: Sub-Division-Wise Development Block and its headquarters of Tinsukia

NAME OF SUB-DIVISION	NAME OF BLOCKS	HEADQUARTERS
Tinsukia	1.Guijan Development Block	Tinsukia City
Margherita	2.Hapjan Development Block	
Sadiya	3.Itakhuli Development Block	
	4.Kakopathar Development Block	
	5.Margherita Development Block	
	6.Chaikhowa Development Block	
	7.Chapakhowa (Sadiya) Development Block	

Figure 06: Administrative Map of Tinsukia District



b) Climatic Condition

Mother Nature is undeniably very benevolent to this district with diversified climate due to different types of topography. The area experiences sub-tropical humid climate where winter temperature goes up to 37o C. Humidity is also more than 90 percent during rainy season. In Tinsukia, the wet season is hot, oppressive, and mostly cloudy and the dry season is warm and mostly clear. Over the course of the year, the temperature typically varies from 49°F to 89°F and is rarely below 45°F or above 95°F.

Winter

The average daily maximum temperature is about 25°C and the minimum is 11°C, with temperatures ranging from 10.6°C to 23.6°C.

Summer

The average daily maximum temperature is 34°C and the minimum is 24°C, with temperatures ranging from 24.5°C to 35.4°C in August, the hottest month of the year.

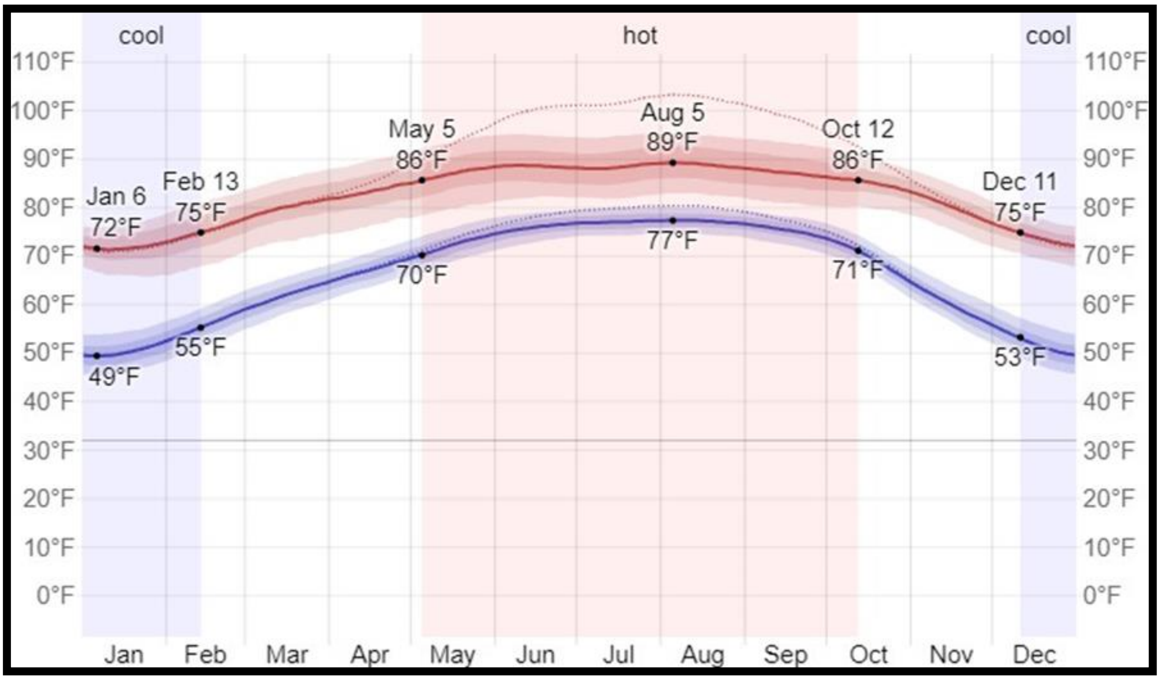
Monsoon

Relative humidity increases from 76% to 84% during the southwest monsoon season, and rainfall is mainly confined to this time.

Table No. 04: The minimum, maximum and average °C Temperature over the year in Tinsukia.

Month	Temperature		
	Minimum	**Maximum**	**Average**
January	10.6	23.6	16.5
February	13.4	26.0	18.8
March	16.2	28.7	21.8
April	18.7	31.5	24.0
May	19.7	32.6	25.2
June	23.6	35.3	27.7
July	24.4	35.6	28.0
August	24.5	35.4	28.3
September	24.4	34.1	27.6
October	19.4	31.4	24.2
November	15.3	29.5	20.6
December	11.1	25.0	17.3

Figure 07: Tinsukia Average Temperature

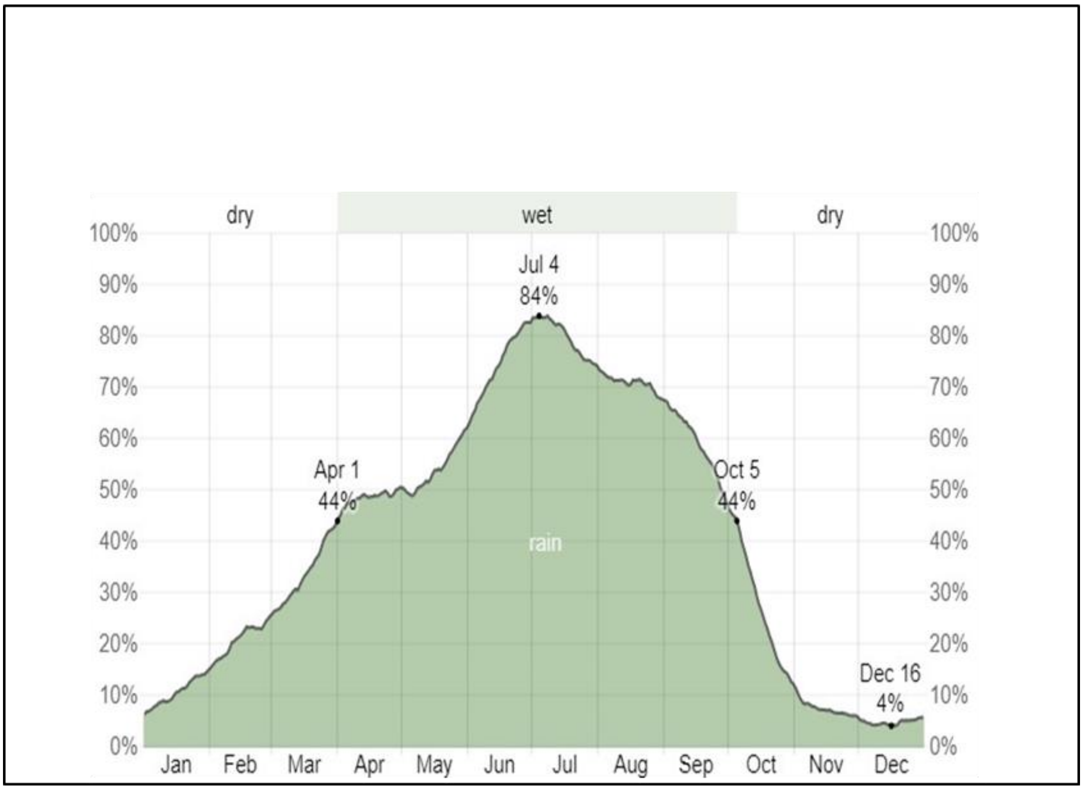


(https://en.climate-data.org/)

c) Rainfall: Monthwise

The area enjoys a sub-tropical climate with abundance of monsoonal rain. The rainfall is not uniform throughout the district. The average rainfall is about 2416 mm (http://karbianglong.gov.in/). Datta & Bose (2020) also showed that, human-genic changes in land use and land cover lead to an increase in extreme precipitation events with high intensity in all parts of the district. Almost 60% of precipitation is received during July to September (http://cgwb.gov.in/). Humidity is high during summer and lower humidity is recorded in winter with pleasurable conditions. The area is endowed with high rainfall during all the months in a year. The South West monsoon sets in the month of June and lasts up to September. Out of 2323 mm normal annual rainfall, about 65 percent rain is received from monsoon

Figure 08: Tinsukia Average Rainfall Month wise



(https://en.climate-data.org/)

d) Topography & Terrain:

The topography of Tinsukia district in Assam, India is characterized by Brahmaputra plains and hills in the south, with a gentle slope towards the northwest:

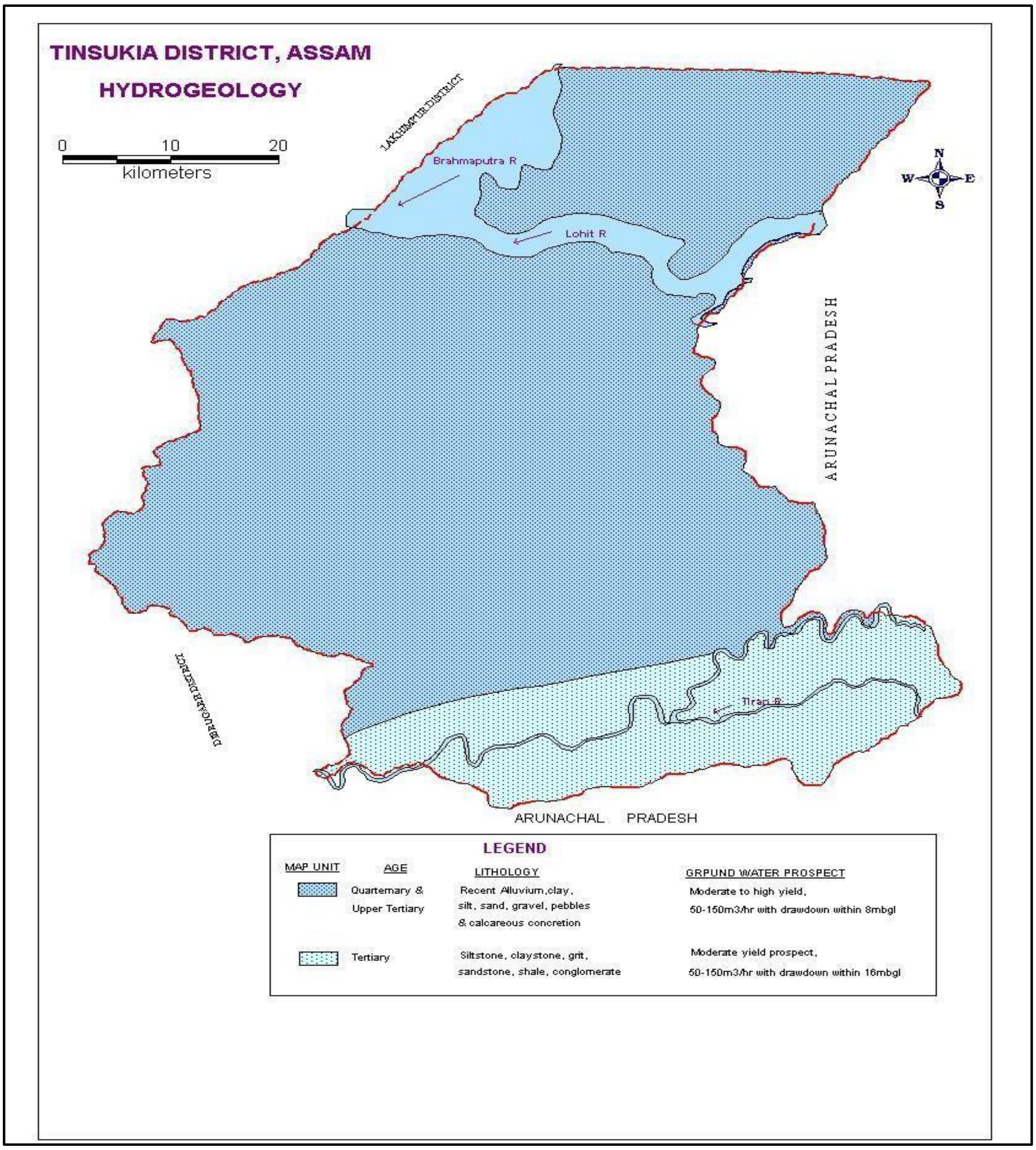
- Location: Tinsukia is located in the far northeast corner of Assam, at 27.5°N 95.37°E.
- Elevation: The average elevation of Tinsukia is 116 meters (380 feet).
- Hydrogeology: The district can be divided into two hydrogeological units: Tertiary Group of Semi-consolidated rocks and Quaternary alluvium of unconsolidated sediments.
- Major water bearing formation: Alluvium.
- Transmissivity: 760 – 19,582 m2/day.

Tinsukia is an industrial district that produces tea, oranges, ginger, other citrus fruits, and paddy (rice). It also has a cosmetic plant of Hindustan Unilever (HUL). Tinsukia district in Assam, India has a variety of terrain, including wetlands, forests, and a Himalayan foothills area

e) Water Course & Hydrology:

The district can be sub-divided into two broad hydrogeological Units (1) Tertiary Group of Semi- consolidated rocks (2) Quaternary alluvium of unconsolidated sediments. Tertiary group of sedimentary rocks are confined to the southernmost part of the area where ground water occurs in the shallow weathered zone and this may be developed through large diameter open wells. Ground water occurs in deeper aquifer consisting of Tipam sandstone and in boulders and gravel beds of Dihing group which are suitable for development through deep tube wells. Alluvial plain covers major part of the district. Ground water occurs in regionally extensive aquifers down to explored depth of 250 m with a very good yield prospect. The aquifers are consisting of sands of various grades and are suitable for both shallow and deep tube wells. Ground water rests at shallow depth and in major part of the district, depth to water level varies from 2 to 5 m bgl during pre-monsoon period and from 1.68 to 4.5 m bgl during post monsoon period. The long tern water level trend study shows no significant change of water level in the last 10 years. The shallow tube wells tapping aquifers within 50 m depth are capable of yielding 20 – 50 m3 /hr at drawdown of less than 3 m. Medium to heavy duty tube wells constructed down to 100 – 150 m depth tapping 25 – 30 m of granular zones are yielding 50 – 100 m3 /hr.

Figure 09: Hydrogeology Map of Tinsukia district

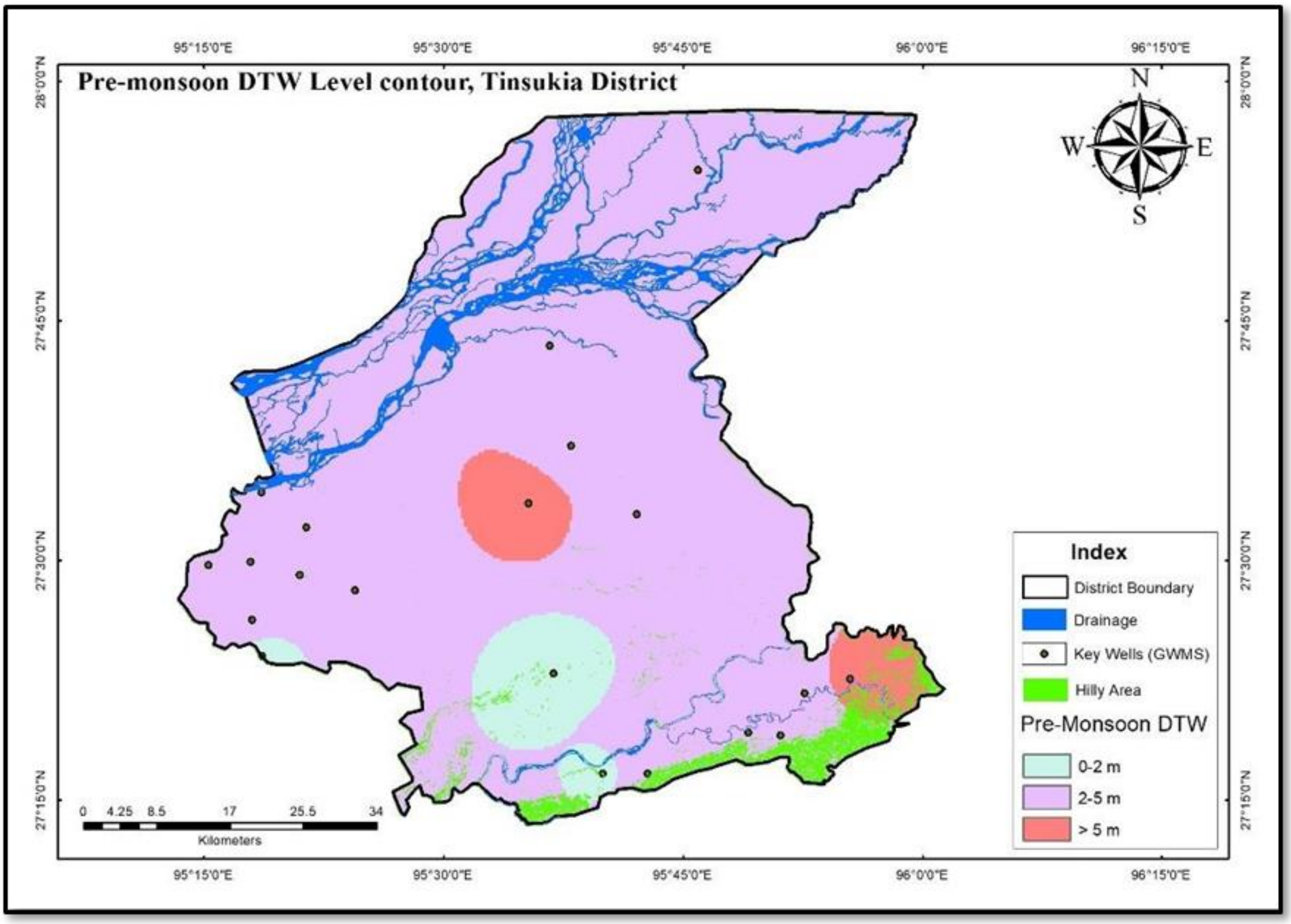


(***Source***: Central Ground Water Board)

f) Ground Water Development:

Ground Water development is at low key at Present. Ground water draft for irrigation purpose is 26 MCM against the vast annual dynamic resources of 1107 MCM. The net annual dynamic resources for future irrigation development are estimated to be 940 MCM.

Figure 10: Depth of Water Level Map (Pre-monsoon)



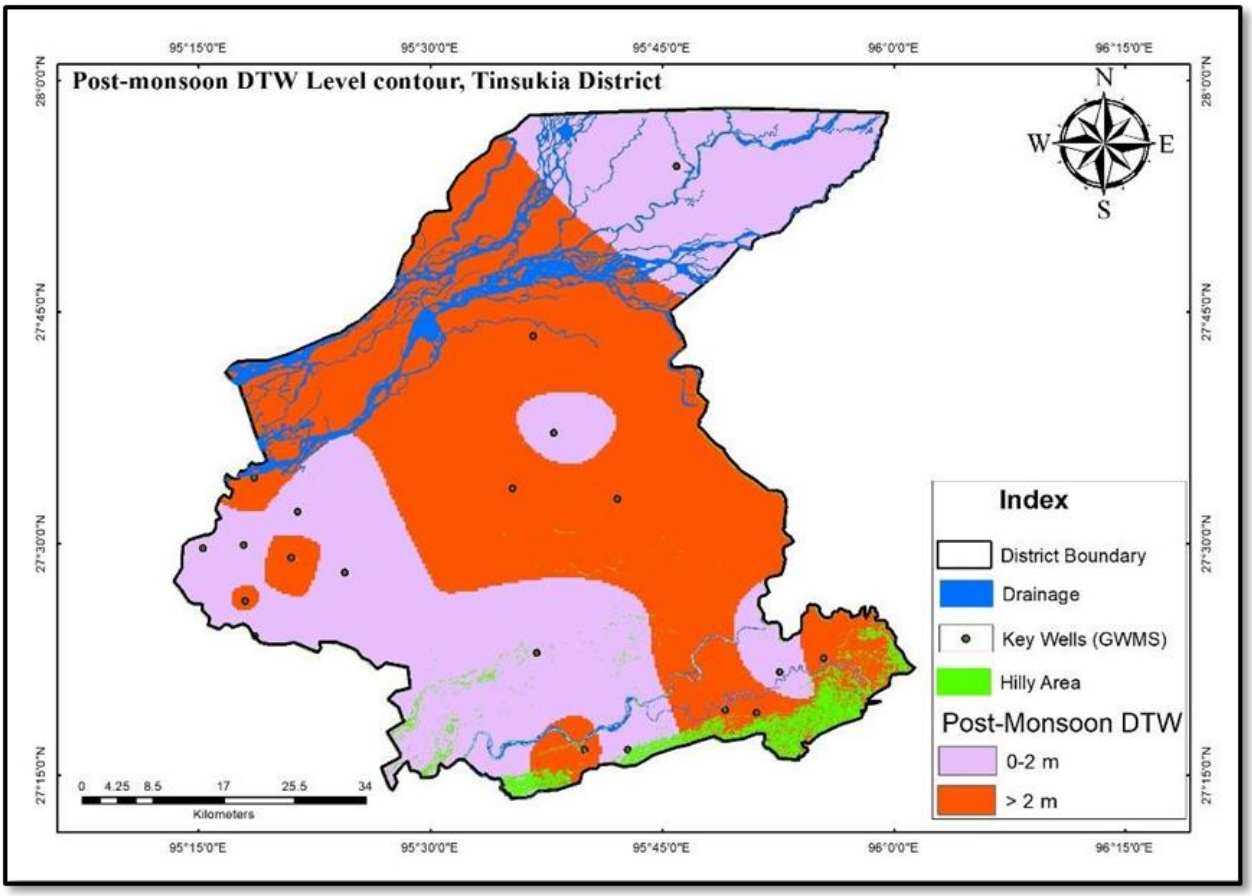


Figure 11: Depth of Water Level Map, (Post- monsoon)

g) Drainage System (general):

The district is drained by mighty River Brahmaputra flowing NE-SW direction and its tributaries. Dibru and Burhi-Dihing flowing from Naga-Patkai hill range in the south. All the rivers are ephemeral in nature and carry huge quantities of water and sediment during rainy season and cause submergence of low-lying areas. The Burhi Dehing River passes through a sub-division of Tinsukia, and although the area is not prone to floods, it has a history of flash floods. The town of Margherita is more prone to erosion than floods. The drainage master plan for Tinsukia, Assam includes:

❖ **Storm water drainage**

Developing a financially viable storm water drainage system that is environmentally and socially responsible

❖ **Water bodies**

Protecting and restoring important water bodies that play a role in the drainage system

❖ **Technology**

Using international technological vision that is customized to the local environment and conditions

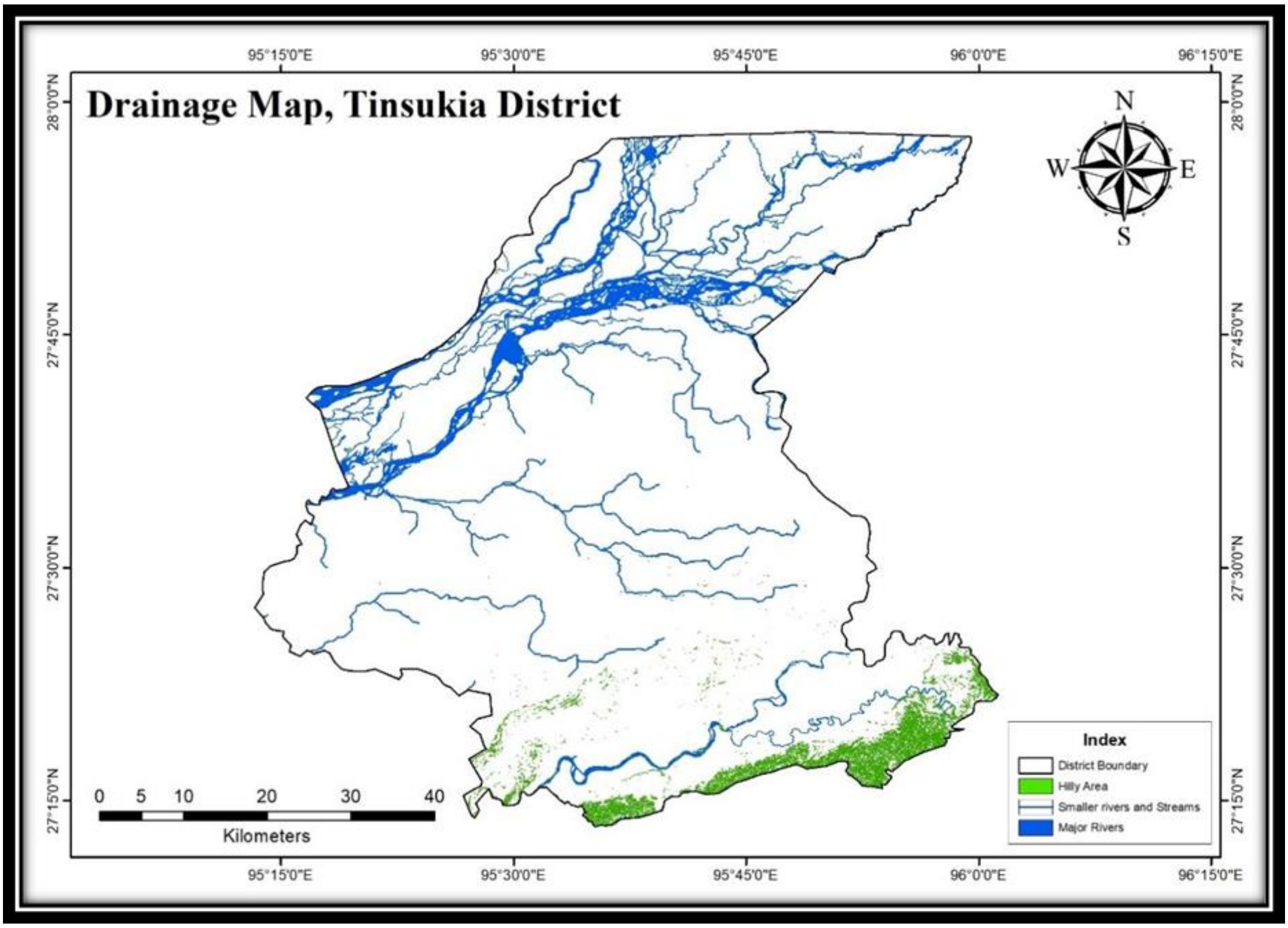


Figure 12: Drainage Network Map of the Tinsukia district

h) Demography:

As per 2011 census, the population of the district is 13,27,929 which is 4.25% of the state's population. With a population density of 350 person per square kilometer, Tinsukia is relatively less dense compared to the population density of the state (398 person per square kilometer).

Table 05: Demographic data table

Considerations	**Statistical Data**
Area of Tinsukia	3,790 sq.km
Total No. of villages	1,180
Total Population	13.3 Lakhs

Male	6.8 lakhs
Female	6.48 lakhs
Density of Population	347/sq.km
Sex Ratio (Adult)	964 females per 1000 males
Sex Ratio (Child)	967 girls per 1000 boys.
Population growth rate (%)	14.51

*(**Source**: www.census2011.co.in)*

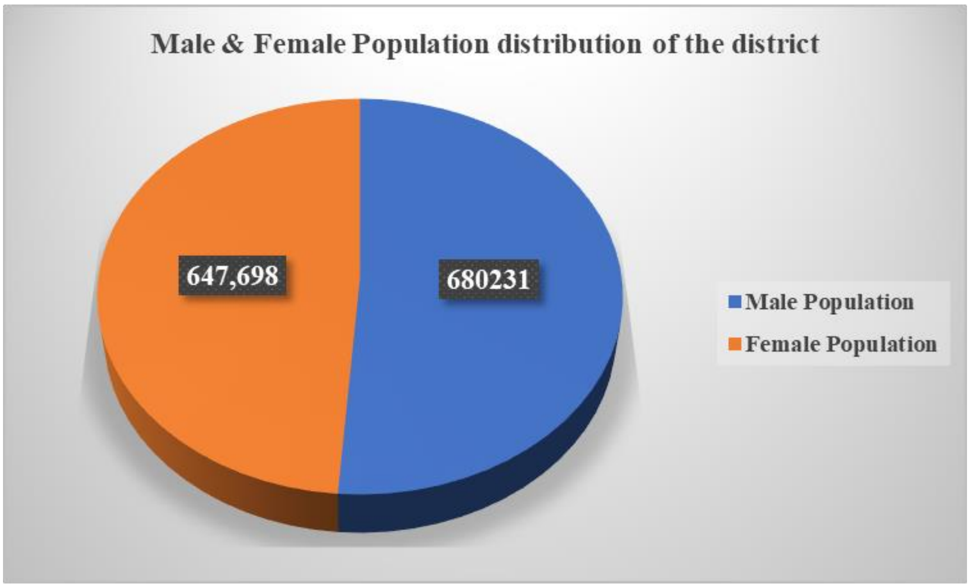
Table No 06: Urban and rural demographic data table of the district

Description	Rural	Urban
Population (%)	80.06%	19.94%
Total Population	1,063,186	264,743
Male Population	541,395	138,836
Female Population	521,791	125,907
Sex Ration	964	907
Child Sex Ration (0-6)	967	917
Child Population (0-6)	155,228	26,598
Male Child (0-6)	78,904	13,873
Female Child (0-6)	76,324	12,725
Child Percentage (0-6)	14.60 %	10.05 %
Male Child Percentage	14.57 %	9.99 %
Female Child Percentage	14.63 %	10.11 %
Literates	590,609	207,713
Male Literates	339,871	113,578
Female Literates	250,738	94,135
Average Literacy	65.05 %	87.22 %
Male Literacy	73.49 %	90.89 %

Female Literacy	56.29 %	83.17 %

(Source: www.census2011.co.in)

Figure 13: Male & Female Population distribution of the district



i) Cropping Pattern:

Agriculture is the main occupation in the rural areas of the district. In Assam, Farmers normally cultivate crops in the kharif and rabi seasons. More or less 80% of the population directly or indirectly are engaged in Agriculture. The district is characterized by mono-cropping pattern. Main food crop of the district is paddy. Important vegetable crops grown in the district includes cabbage, cauliflower, potato, peas etc. Important plantation crops include tea, orange, pineapple, banana etc. Fisheries and animal husbandry are also being taken up on a large scale in the district. The cropping intensity of the district is about 111%. Winter Paddy is the major crop grown in the district. Mustard and Autumn paddy are the other major crops of the district. Agricultural Department is implementing various centre and state government schemes in the district to promote a diversified cropping pattern.

Table No. 07: The cultivated area of major crops over past five years (Area in hecter)

Sr. No.	Crop	2017-18	2018-19	2019-20	2020-21	2021-22 (PE)
1	Winter Paddy	60141	56843	56207	56862	59638
2	Mustard	7743	6148	6730	6458	6024
3	Autumn Paddy	3486	4678	4515	4237	4746
4	Pulses	191	4498	4620	4590	4536

5	Vegetables	3557	4309	5318	5876	4516
6	Potato	2810	3088	4624	4883	3211
	Total	**77928**	**79564**	**82014**	**82906**	**82671**

Source: *District Agriculture Office, Tinsukia*

j) Land Form and Seismicity:

Bureau of Indian Standards, based on the past seismic history, grouped the country into four seismic zones, viz. Zone - II, Zone -III, Zone - IV and Zone - V. Of these, Zone V is the most seismically active region, while zone II is the least. The Modified Mercalli (MM) intensity, which measures the impact of the earthquakes on the surface of the earth, broadly associated with various zones.

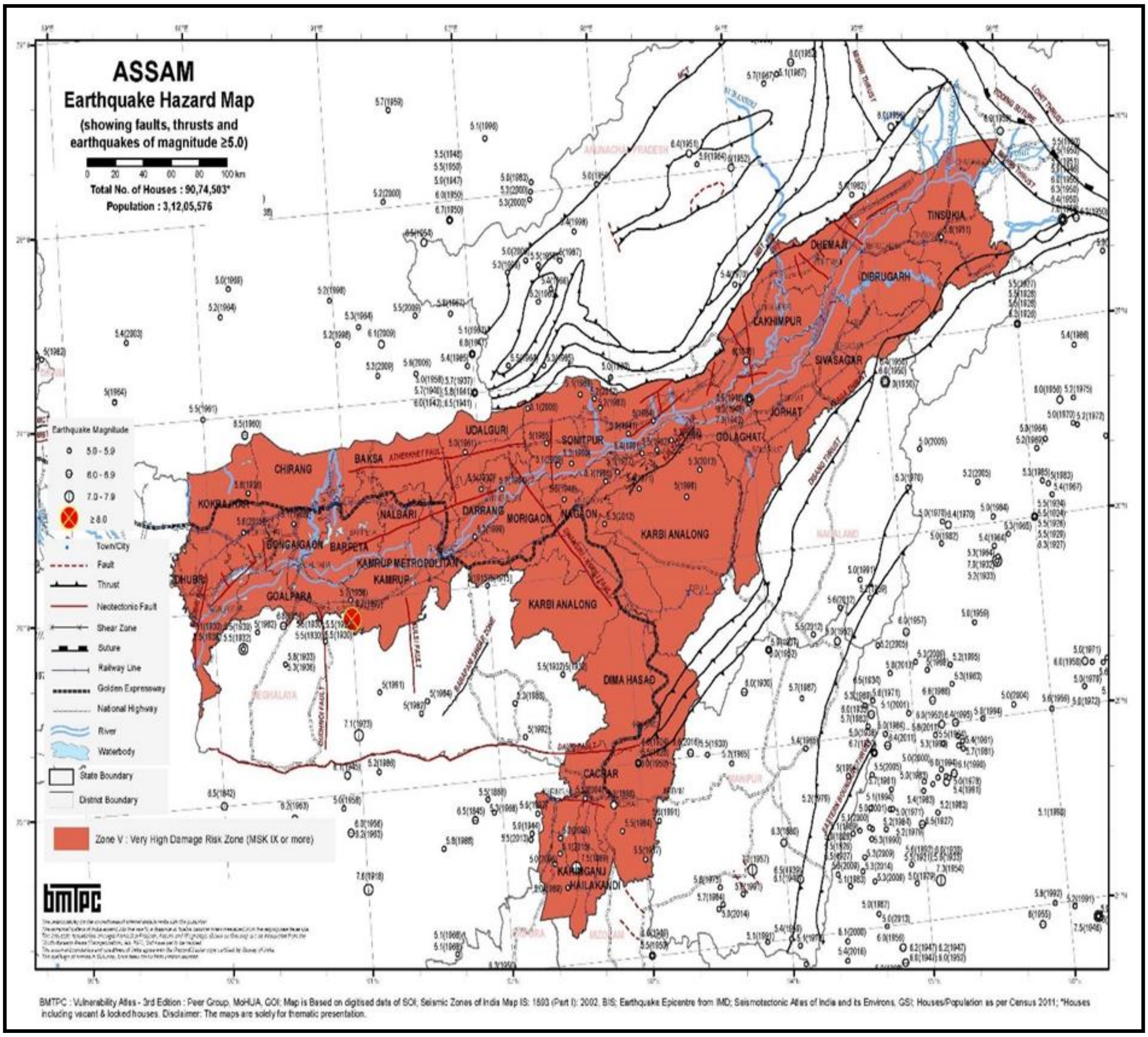
The entire North-East region is in the seismic zone V, i.e more than 8 magnitudes in Richter scale. Tinsukia district falls under seismic zone V.

Table No. 08: Seismic Zone Intensity on MM scale

SEISMIC ZONE	INTENSITY ON MM SCALE
II	Low intensity zone
III	Moderate intensity zone
IV	Severe intensity zone
V	Very severe intensity zone

Source: *Ministry of Earth Science, Seismic Mapping Posted On: 30 JUL 2021 2:27PM by PIB Delhi*

Figure 14: Assam Earthquake Hazard Map



k) Flora:

Doomdooma forest Division falls in Tinsukia district which is situated in a riverine region, with proximity to Dihing-Patkai Range The forest division consists of diversified floral and faunal diversity.

Table No. 09: List of diverse flora in Tinsukia District

Sl. No	*Vernacular Name*	*Botanical Name*	*Status*
Trees			
1.	*Ajhar*	*Lagerstroemiaspeciose*	*Abundant*
2.	*Am*	*Mangifera indica*	*Abundant*
3.	*Amari*	*Aglaia hiernii*	*Abundant*
4.	*Amol*	*Myristica kingie*	*Endangered*
5.	*Amora*	*Spomdius pimmata*	*Endangered*
6.	*Amsia*	*Drimycarpus racemosus*	*Endangered*
7.	*Badam*	*Mansonia dipikae*	*Endangered*
8.	*Bagiou*	*Billemia scabrella*	*Endangered*
9.	*Bandordima*	*Dysoxylum binectariferum*	*Endangered*
10.	*Barhamthuri*	*Talauma hodghonii*	*Endangered*
11.	*Barun*	*Craeteva nurvala*	*Endangered*
12.	*Bhatghila*	*Oroxylum Indicum*	*RET*
13.	*Bher*	*Salix tetrasperma*	*Threatened*
14.	*Bhelkor*	*Trewia nudiflora*	*Endangered*
15.	*Bhelu*	*Tetrameles mudiflora*	*Endangered*
16.	*Bhumloti*	*Symplocos spicata*	*Rare*
17.	*Bhomora, Bohera*	*Terminalia belerica*	*Abundant*
18.	*Bogijam*	*Eugenia jambos*	*Endangered*
19.	*Bogipoma*	*Chikrassia tabularis*	*Abundant*
20.	*Brajanali*	*Zanthoxylum ractsa*	*Abundant*
21.	*Bola*	*Morus laevigata*	*Abundant*
22.	*Bon-am*	*Mangiftra sylvatica*	*Abundant*
23.	*Bon Bagari*	*Zizyphus rugosas*	*Abundant*
24.	*Bon-hualo*	*Cryetocarya anbersonii*	*Abundant*
25.	*Bon-jolokia*	*Cryptocarya amygdalina*	*Abundant*
26.	*Bon-pitha*	*Denella roxburghii*	*Abundant*
27.	*Borpat*	*Ailanthus grandis*	*Abundant*
28.	*Borthekera*	*Garcinia pedunculata*	*Endangered*

29.	Bual	Cordia dichotoma	Abundant
30.	Chalmugra	Hudnocarpus kurzii	Abundant
31.	Dalchini	Cinnamomum zeylanicum	Abundant
32.	Dewa-cham	Artocarpus lakoocha	Abundant
33.	Dhuna	Canarium bengalensis	Endangered
34.	Dimaru	Ficus hispida	Abundant
35.	Galranga	Elaeocarus rugosus	Endangered
36.	Gendhelipoma	Dysoxylum hamiltonii	Endangered
37.	Gohora	Premna dengalensis	Endangered
38.	Gaharisopa	Magnolia griffithii	Endangered
39.	Gomari	Gmelima arborea	Abundant
40.	Gonsoroi	Cinnamomum cecicodaphne	Abundant
41.	Gorumora	Crypteronia paniculata	Endangered
42.	Ghogra, Makarisal, Naga-bhe	Schima wallichii	Endangered
43.	Haludsopa	Adina oliocephala	Endangered
44.	Haludsaki	Endosperum chinensis	Endangered
45.	Hatipolia	Pterospermum acerifolium	Endangered
46.	Hengunia	Meliosma pimmata	Endangered
47.	Hingori	Castanopsis indica	Abundant
48.	Hilikha	Termimalia chebula	Abundant
49.	Holock	Termimalia myriocarpa	Abundant
50.	Hollong	Dipterocarpus macrocarpus	Endangered
51.	Jalpai	Elaeocarpus floribundus	Abundant
52.	Jamak	Syzygium cumini	Abundant
53.	Jawa	Holigama longifolia	Abundant
54.	Morolia	Macranga denticulate	Abundant
55.	Jia	Lannea grandis	Abundant
56.	Jinari	Podocarpus nerifolia	RET
57.	Joba-hingori	Stoanea assamica	Abundant
58.	Jutuli	Altingla excalsa	Abundant
59.	Kadam, Raghu	Anthocephalus indicas	Abundant
60.	Kharipati-dimoru	Ficus nervosa	Abundant
61.	Kathal	Artocarpus integrifolius	Abundant
62.	Kathal-sopa	Michelia manii	Abundant

63.	*Khakan*	*Duabanga grandiflora*	*Abundant*	
64.	*Khorikedwa*	*Artocarpus gomezianus*	*Abundant*	
65.	*Khorikasopa*	*Talauma phellocarpa*	*Abundant*	
66.	*Koliori*	*Mitrephora tomentosa*	*Abundant*	
67.	*Bor-Koliori*	*Polyathia simiarum*	*Abundant*	
68.	*Koroi*	*Albizzia procera*	*Abundant*	
69.	*Kuhir*	*Bridelia retusa*	*Abundant*	
70.	*Kurial, Kanchan*	*Bauhinia purpurea*	*Abundant*	
71.	*Leluk*	*Beilschmiedia bramdisii*	*Endangered*	
72.	*Lamtem*	*Gynocardia odorata*	*Endangered*	
73.	*Leteku*	*Baccaurea sapida*	*Endangered*	
74.	*Lewa*	*Engelhardtia spicata*	*Endangered*	
75.	*Maskoita*	*Callicarpa arborea*	*Endangered*	
76.	*Madar*	*Erythrina stricia*	*Abundant*	
77.	*Maiphak*	*Evodia meliaefolia*	*Endangered*	
78.	*Mekai*	*Shorea assamica*	*Abundant*	
79.	*Medelua*	*Dalbergia assamica*	*Abundant*	
80.	*Mekahi*	*Phoebe cooperiana*	*Abundant*	
81.	*Moj*	*Albizzia lucida*	*Abundant*	
82.	*Morhal*	*Vatica lanceaefolia*	*Endangered*	
83.	*Morolia*	*Massous albus*	*Abundant*	
84.	*Motanahor*	*Pterospermum lanceaefolium*	*Endangered*	
85.	*Patihunda*	*Cinnamomum obtusifolium*	*Abundant*	
86.	*Nagaudal, Hirikh*		*Sterculia guttata*	*Ab*
87.	*Nahor*	*Mesua ferrea*	*Abundant*	
88.	*Odal*	*Sterculia villosa*	*Endangered*	
89.	*Outenga*	*Dillenia indica*	*Abundant*	
90.	*Oxi*	*Dillenia pentagyna*	*Abundant*	
91.	*Pahari*	*Sterculia alata*	*Abundant*	
92.	*Panikadam*	*Hymenodictyon excelsum*	*Endangered*	
93.	*Pan-sopa*	*Michelia montana*	*Abundant*	
94.	*Paroli*	*Stereospermum chelonoides*	*Abundant*	
95.	*Phakdima, Phulgamari*	*Trema orientalis*	*Abundant*	
96.	*Phulkata*	*Styrax serrulatum*	*Endangered*	

97.	*Phulsopa*	*Manglietia insignis*	*Abundant*
98.	*Pichola*	*Kydia calycina*	*Abundant*
99.	*Poma*	*Toona ciliate*	*Abundant*
100.	*Ramanbih*	*Aesculas punduana*	*Abundant*
101.	*Rudraksha*	*Elaeocarpus genitrus*	*Abundant*
102.	*Sam*	*Artocarpus chaplasa*	*Abundant*
103.	*Satiana*	*Alstonia scholaris*	*Abundant*
104.	*Celeng*	*Sepium baccatum*	*Abundant*
105.	*Simol*	*Salmalia malabarica*	*Abundant*
106.	*Sirish*	*Alibizia lebbek*	*Abundant*
107.	*Sissoo*	*Dalbergia sissoo*	*Abundant*
108.	*Sopa*	*Michelia manipurensis*	*Abundant*
109.	*Tepor*	*Garcinia xanphochymus*	*Endangered*
110.	*Thekera*	*Garcinia Sp*	*Endangered*
111.	*Tezpat*	*Cinnamomum tamala*	*Abundant*
112.	*Thutmala*	*Garuga pinnata*	*Abundant*
113.	*Titasopa*	*Michelia champaca*	*Abundant*
114.	*Urium*	*Bischofia favanica*	*Abundant*
Bamboo			
1	*Bhaluka*	*Bambusa balcooa*	*Abundant*
2	*Kotoha,Kotabanh*	*Bambusa bambos*	*Abundant*
3	*Beti banh*	*Bambusa mastersii.*	*Abundant*
4	*Deobanh,Jotia,*	*Bambusa nutans*	*Abundant*
5	*Bijuli,Jowa,Makal.*	*Bambusa pallida*	*Abundant*
6	*Bhaluki, paura*	*Bambusa teres*	*Abundant*
7	*Jati, Nal banh.*	*Bambusa tulda*	*Abundant*
8	*Karail, Jati*	*Dendrocalamus strictus*	*Abundant*
9	*Worra*	*Dendrocalamus giganteus.*	*Abundant*
10	*Kakoa,Kakeo banh*	*Dendrocalamus hamiltonii.*	*Abundant*
11	*Madang*	*Schizostachyum pergracile*	*Abundant*
12	*Behti banh*	*Schizostachyum griffithii*	*Abundant*
13	*Dalu banh*	*Schizostachyum dullooa*	*Abundant*
14	*Bajal banh, bajah banh.*	*Schizostachyum polymorphum*	*Abundant*
15	*Tarai banh, Nah banh, Muli banh.*	*Melocanna baccifera=M.bambusoides*	*Abundant*

Shrubs			
1.	*Bahaka*	*Adhatoda vasica*	*Abundant*
2.	*Betibah*	*Bambusa mastprsii*	*Abundant*
3.	*Bhang*	*Cannabis sativa*	*Abundant*
4.	*Bhekuri*	*Solamum indicum*	*Abundant*
5.	*Bogitora*	*Alpinia allughas*	*Abundant*
6.	*Bajalbah*	*Pseudospachyum polymorphum*	*Endangered*
7.	*Bon-madhuriam*	*Pyrenaria barringtomiaefolia*	*Abundant*
8.	*Bon-pasala*	*Sarauja roxburghil*	*Abundant*
9.	*Bon-manmani*	*Centella asiatica*	*Abundant*
10.	*Bon-medula*	*Cassia tora*	*Abundant*
11.	*Dhopat-tita*	*Clerodendron infortunatum*	*Abundant*
12.	*Dighloti*	*Litsaea salicifolia*	*Abundant*
13.	*Ekra*	*Sclerosiachya fusca*	*Abundant*
14.	*Eragocs*	*Ricinus communis*	*Abundant*
15.	*Ramtamul*	*Pinanga gracilus*	*Endangered*
16.	*Harumanimuni*	*Hydrocotyle rotundifolia*	*Abundant*
17.	*Haukabat*	*Zalacca seceunda*	*Abundant*
18.	*Heloch*	*Antidesma ghaesembilia*	*Abundant*
19.	*Jarmonibon*	*Eupatorium odoratum*	*Abundant*
20.	*Jatibah*	*Bambusa tulda*	*Abundant*
21.	*Jatibet*	*Calamus tenuis*	*Endangered*
22.	*Jengu*	*Licuala peltata*	*Abundant*
23.	*Lejaibet*	*Calamus floribundus*	*Endangered*
24.	*Kakobah*	*Dendrocalamus hamiltonii*	*Abundant*
25.	*Kasidoria*	*Myrsine capipellata*	*Abundant*
26.	*Kathandaphul*	*Coffea bengalensis*	*Abundant*
27.	*Kwpat*	*Phrynium parviflorum*	*Abundant*
28.	*Kush*	*Saccharum sponpancum*	*Abundant*
29.	*Makhioti*	*Moghania strobilifera*	*Abundant*
30.	*Meghela*	*Narenga porphyrocoma*	*Abundant*
31.	*Nol*	*Phragmites karka*	*Abundant*
32.	*Patidoi*	*Schumannianthus dichotomus*	*Abundant*
33.	*Phutkula*	*Melastoma melabathrcium*	*Abundant*

34.	Sorat	Laoportia cremulata	Abundant
35.	Titaphul	Phlogacanthus thyrsiflorius	Abundant
36.	Tokopat	Livistonia jenkinsiana	Endangered
37.	Makalbah	Bambusa pallida	Abundant
38.	Kukurathengia	Leea sambucina	Abundant

Climbers and woody climbers

Sl No.	Scientific Name	Family	Status
1	Ampelopsis nerrifolia	D.Don.Vitaceae	Abundant
2	Ampelopsis rubifolia	Planch. Vitaceae	Abundant
3	Cissampelos Pereira	Lin. Manispermaceae	Abundant
4	Cyclea bicristata (Griff).	Menispermaceae	Endangered
5	Dalbergia pinnata (Lour)	Papilionaceae Prain.	Abundant
6	Derris ferruginea	Benth. Papilionaceae	Endangered
7	Dioscorea bulbifera	L Dioscoreaceae	Abundant
8	D.glabra Roxb.	Dioscoreaceae	Abundant
9	Enanthemum album	.Nees. Acanthaceae	Abundant
10	Erythropalum scandens	Bl. Olacaceae	Abundant
11	Ficus villosa	Bl. Moraceae	Abundant
12	Fissistigma wallichii (Hkf)	Annonaceae Thm.	Abundant
13	Gnetum scandens	Roxb. Gnetaceae	Abundant
14	Hoya longifolia	Wall.ex Wight. Asclepidiaceae	Abundant
15	H. parasitica	Wall. Asclepidiaceae	Abundant
16	H. vaccinioides	Hook.f. Asclepidiaceae	Abundant
17	Jesminum anastomosans	Wall Oleaceae	Abundant
18	J. attenuatum	Roxb Oleaceae	Abundant
19	J. dispermum	Wall Oleaceae	Endangered
20	J. lanceolaria	Roxb Oleaceae	Abundant
21	J.laurifolium	Roxb Oleaceae	Abundant
22	Marsdenia tinctoria	Br Asclepiadaceae	Abundant
23	Mikania micrantha	H.B&K Asteraceae	Endangered
24	Mimosa himalayana	Gamble Mimosaceae	Abundant
25	Modecca trilobata Roxb	Passifloraceae Endangered	

26	*Myrioneuron smilacifolia Wall.*	*Oleaceae Abundant*
27	*Myxopyrum smilacifolium.Bl*	*Oleaceae Abundant*
28	*Oxymitra fornicata (Roxb.)*	*Hook. f. &AnnonaceaeAbundant*
29	*Pericampylus glaucus (Colebr) Miers*	*Menispermaceae Abundant*
30	*Piper attenuatum Ham.*	*Piperaceae Abundant*
31	*P. griffithii C.DC.*	*Piperaceae Abundant*
32	*P. hymanophyllum Miq.*	*Piperaceae Abundant*
33	*P. syvaticum Roxb.*	*Piperaceae Abundant*
34	*Polygonum chinense. Linn.*	*Polygonaceae Abundant*
35	*Pothos cathcartii Schott.*	*Araceae Abundant*
36	*Rapidophora hookari (Scott).*	*Araceae Abundant*
37	*Rourea caudata*	*Planch.Connaraceae Abundant*
38	*Rubus hamiltoni Hk.*	*f .Rosaceae Endangered*
39	*Sabia limoniaceae Wall.*	*Sabiaceae Abundant*
40	*Smilex lancaefolia Roxb.*	*Liliaceae Abundant*
41	*Stemona tuberosa Lour.*	*Stemonaceae Abundant*
42	*Stephania glandulifera Nees.*	*Menispermaceae Endangered*
43	*S.hernandifolia (Wall) Walp.*	*Manispermaceae Abundant*
44	*Tetracera sarmentosa L.*	*Deliniaceae Endangered*
45	*Tetrastigma planicaulata Hk.f.*	*Vitaceae Abundant*
46	*Thunbergia coccnea Wall.*	*Acanthaceae Abundant*
47	*T. grandiflora Roxb.*	*Acanthaceae Abundant*
48	*Vitis capriolata.D.Don.*	*Vitaceae Abundant*
49	*V. elongata Wall.*	*Vitaceae Abundant*
50	*V.lanceolaria Roxb.*	*Vitaceae Abundant*
51	*V. trifolia Linn*	*Vitaceae Abundant*
Orchids		
Sl. no	***Species***	***Flowering Habitat***
Acampe		
1	*Acampe praemorsa (roxburgh)*	*Nov – Dec Epiphyte on tree trunk*
2	*Epidendrum praemorsum*	*Nov – Dec Epiphyte on tree trunks or large branches.*
3	*Acampe rigida*	*June – July Epiphyte on tree trunks or large branches.*

Acanthephippium			
4	*Acanthephippium striatum*	*June – July*	*Grow in shaded and humid places in dense forests, banks of streams*
Aerides			
5	*Aerides multiflora*	*May – July*	*Shaded and humid places in dense forests, banks of streams*
6	*Aerides odorata*	*May – June*	*Epiphyte in lowland forest*
Agrostophyllum			
7	*Agrostophyllum planicaule*	*Aug – Oct*	*Epiphyte deciduous and humid forest*
8	*Agrostophyllum khasianum*	*Aug – Octr*	*Epiphyte deciduous and humid forest*
Bryobium			
9	*Bryobium pudicum*	*April – Aug*	*Epiphyte, deciduous and evergreen forest*
Bulbophyllum			
10	*Bulbophyllum affine*	*June – Aug*	*Epiphyte, humid forest*
11	*Bulbophyllum andersonii*	*October*	*Epiphyte, humid forest*
12	*Bulbophyllum careyanum*	*October – December*	*Epiphyte on tree trunks in humid forest*
13	*Bulbophyllum delitescens*	*June – July*	*Epiphyte in humid evergreen near a waterfall*
14	*Bulbophyllum odoratissimum*	*May – Sept*	*Epiphyte in humid evergreen near a waterfall*
15	*Bulbophyllum roxburghii*	*April – July*	*Epiphytic in evergreen forest*
16	*Bulbophyllum spathulatum*	*April*	*Epiphytic in evergreen forest*
Calanthe			
17	*Calanthe sylvatica*	*Aug – Sept*	*Terrestrial in damp places*
Callostylis			
18	*Callostylis rigida*	*Jan – March.*	*Epiphytic on trees in mixed forests*
	Ceratostylis		
19	*Ceratostylis subulata*	*May – Aug*	*Epiphyte in dense humid forest*
	Cleisocentron		

20	*Cleisocentron pallens*	*June – July*	*Epi. on tree trunks humid forests*
21	*Cleisocentron trichromum*	*Jan – March*	*Epiphytic on trees in mixed forests*
	Cleisostoma		
22	*Cleisostoma appendiculatum*	*Aug– Oct*	*Epiphytic, tree trunks in evergreen forests*
23	*Cleisostoma filiforme*	*April – June*	*Epiphytic, tree trunks in evergreen forests*
24	*Cleisostoma paniculatum*	*Sept – Feb*	*Epiphytic, tree trunks in evergreen forests*
25	*Cleisostoma simondii*	*Aug– Oct*	*Epiphyte, thick-barked tree trunks in humid forest*
26	*Cleisostoma subulatum*	*May – June*	*Epiphyte, tree trunk in dense humid forest*
	Coelogyne		
27	*Coelogyne fimbriata*	*Oct– Dec*	*Epiphyte, on tree trunk in humid forest*
28	*Coelogyne ovalis*	*Aug– Dec*	*Epiphyte on tree trunk in humid forest*
29	*Collabium chinense*	*June – July*	*Shaded and humid places in dense forests*
	Crepidium		
30	*Crepidium acuminatum*	*June – July*	*Terrestrial in dense evergreen forest on rocky terrain, also in the lowlands*
	Cymbidium		
31	*Cymbidium aloifolium*	*April – May*	*Epiphyte on tree trunk in humid forest*
32	*Cymbidium bicolor*	*May – June*	*Epiphyte on tree trunk in humid forest*
33	*Cymbidium dayanum*	*June – July*	*Epiphyte on tree trunk in humid forest*
	Dendrobium		
34	*Dendrobium acinaciforme*	*June – Aug*	*Epiphyte on tree trunk in humid forest*
35	*Dendrobium aduncum*	*May*	*Epiphyte on a small tree evergreen forest*
36	*Dendrobium aphyllum*	*April – May*	*Epiphyte in mixed deciduous forest*

37	*Dendrobium densiflorum*	*April – July*	*Epiphyte tree trunk in evergreen*
Callostylis			
18	*Callostylis rigida*	*Jan – March.*	*Epiphytic on trees in mixed forests*
	Ceratostylis		
19	*Ceratostylis subulata*	*May – Aug*	*Epiphyte in dense humid forest*
	Cleisocentron		
20	*Cleisocentron pallens*	*June – July*	*Epi. on tree trunks humid forests*
21	*Cleisocentron trichromum*	*Jan – March*	*Epiphytic on trees in mixed forests*
	Cleisostoma		
22	*Cleisostoma appendiculatum*	*Aug– Oct*	*Epiphytic, tree trunks in evergreen forests*
23	*Cleisostoma filiforme*	*April – June*	*Epiphytic, tree trunks in evergreen forests*
24	*Cleisostoma paniculatum*	*Sept – Feb*	*Epiphytic, tree trunks in evergreen forests*
25	*Cleisostoma simondii*	*Aug– Oct*	*Epiphyte, thick-barked tree trunks in humid forest*
26	*Cleisostoma subulatum*	*May – June*	*Epiphyte, tree trunk in dense humid forest*
	Coelogyne		
27	*Coelogyne fimbriata*	*Oct– Dec*	*Epiphyte, on tree trunk in humid forest*
28	*Coelogyne ovalis*	*Aug– Dec*	*Epiphyte on tree trunk in humid forest*
29	*Collabium chinense*	*June – July*	*Shaded and humid places in dense forests*
	Crepidium		
30	*Crepidium acuminatum*	*June – July*	*Terrestrial in dense evergreen forest on rocky terrain, also in the lowlands*
	Cymbidium		
31	*Cymbidium aloifolium*	*April – May*	*Epiphyte on tree trunk in humid forest*
32	*Cymbidium bicolor*	*May – June*	*Epiphyte on tree trunk in humid forest*

33	*Cymbidium dayanum*	*June – July*	*Epiphyte on tree trunk in humid forest*
	Dendrobium		
34	*Dendrobium acinaciforme*	*June – Aug*	*Epiphyte on tree trunk in humid forest*
35	*Dendrobium aduncum*	*May*	*Epiphyte on a small tree evergreen forest*
36	*Dendrobium aphyllum*	*April – May*	*Epiphyte in mixed deciduous forest*
37	*Dendrobium densiflorum*	*April – July*	*Epiphyte tree trunk in evergreen*

Source*: A checklist of orchids in Tinsukia District by Khyanjeet Gogoi, Daisa Bordoloi Nagar, Talap, Tinsukia in East Himalayan Society for Spermatophyte Taxonomy ISSN: 0973-9467*

l) Fauna

Table No. 10: List of diverse fauna found in Tinsukia District, Assam

Mammals			
Sl. No.	**Vernacular Name**	**Scientific Name**	**Status**
1	Chinese Pangolin	*Manis pentadactyla*	Rare
2	Flying fox	*Pteropus giganteus*	Rare
3	Slow Loris	*Nycticebus bengalensis*	Threatened
4	Stump-tailed Macaque	*Macaca arctoides*	Rare
5	Assamese Macaque	*Macaca assamensis*	Common
6	Northern Pig-tailed Macaque	*Macaca leonina*	Rare
7	Pig tailed macaque	*M. nemestrina*	Rare
8	Rhesus Macaque	*Macaca mulata*	Threatened
9	Capped Langur	*Trachypithecus pileatus*	Common
10	Western Hoolock Gibbon	*Hoolock hoolock*	Threatened
11	Asiatic black bear	*Ursus thibetanous*(Schedule-1)	Few
12	Malayan Sunbear Sloth Bear	*Melursus ursinus*	Rare

13	Indian Wild Dog (Dhole)	*Cuon alpinus*	Rare
14	Yellow throated marten	*Martes flavigula*	Threatened
15	Hog Bagder	*Arctonyx collaris*	Threatened
16	Binturong	*Arctictis binturong*	Threatened
17	Jackal	*Canis aureus*	Threatened
18	Jungle Cat	*Felis chaus*	Common
19	Fishing Cat	*Prionailurus viverrinus*	Rare
20	Golden Cat	*Catopuma temminckii*	Rare
21	Leopard Cat	*Prionailurus bengalensis*	Enadangered
22	Marble Cat	*Pardofelis marmorata*	Enadangered
23	Clouded Leopard	*Neofelis nebulosa*	Enadangered
24	Common Leopard	*Panthera pardus*	Few
25	Royal Bengal Tiger	*Panthera tigris*	Enadangered
26	Asian Elephant	*Elephus maximus*	Enadangered
27	Wild Pig	*Sus scrofa*	Common
28	Sambar	*Cervus unicolor*	Rare
29	Indian Muntjac	*Muntiacus muntjak*	Threatened
30	Small Indian Civet	*Viverricula indica*	common
31	Large Indain Civet	*Viverra zibetha*	Common
32	Common Palm Civet	*Paradoxurus jerdoni*	Rare
33	Masked Palm Civet	*Paguma larvata*	Rare
34	Crab Eating Mangoose	*Herpestes urva*	Common
35	Grey Mongooses	*Herpestes edwardsii*	Common
36	Small Asian Mongoose	*Herpestes javanicus*	Common
37	Small Asian Clawed Otter	*Amblonyx cinereus*	Rare
38	Gaur (dung and tracks).	*Bos gaurus*	Threatened

39	Serow	*Capricornis Sumatraenis*	Rare
40	Malayan Giant Squirrel	*Ratufa bicolor*	Rare
41	Hoary-bellied Himalayan Squirrel	*Callosciurus pygerythrus*	Threatened
42	Pallas' red-bellied squirrel	*Callosciurus erythraeus*	Common
43	Himalayan Stripped Bellied Squirrel	*Tamiops mcclellandii*	Common
44	Northern Red Giant Flying Squirrel	*Petaurista petaurista candidula*	Common
45	Asian Red-cheeked squirrel	*Dremomys rufigenis*	Common
46	Parti-coloured flying squirrel	*Hylopetes alboniger*	Common
47	Hoary bamboo rat	*Rhizomys pruinosus*	Common
48	Chinese or crestless Himalayan porcupine	*Hystrix brachyura*	Rare
49	Brushtailed Porcupine	*Atherurus macrourus*	Rare
50	Rhfous tailed hare	*Lepus nigricollis* *Syn.ruficaudatus*	Threatened
51	Chinese Pangolin	*Manis pentadactyla*	Threatened
52	White-tailed Mole	*Parascaptorsp.*	Rare
53	House Rat	*Rattus rattus*	Common
54	Himalayan Rat	*Rattus nitidus*	Common
55	House mouse	*Mus musculus*	Common
56	Northern tree shrew	*Tupaia belangeri*	Common
57	Indian Flying Fox	*Pteropus giganteus*	Treatened
58	Dobson's Horshoe Bat	*Rhinolophus yunanensis*	Common
59	Greater False Vampire Bat	*Megaderma lyra*	Common

Table No. 11: List of avifauna in Doomdooma Division

Avifauna (Birds)			
Sl. No.	**Vernacular Name**	**Scientific Name**	**Status**
1	Red Jungle Fowl	*Gallus gallus*	R, C
2	White-cheeked Partridge	*Arborophila atrogularis*	R, r (NT)
3	Rufous-throated Partridge	*Arborophila rufogularis*	R, r
4	Kaleej Pheasant	*Lophura leucomelanos*	R, r
5	Grey Peacock Pheasant	*Polyplectron bicalcaratum*	R, r
6	Barred Buttonquail	*Turnix suscitator*	R, C
7	Small Buttonquail	*Turnix sylvatica*	R, C
8	Blue-breasted Quail	*Coturnix chinensis*	R, r
9	Black Francolin	*Francolinus francolinus*	R, C
10	Swamp Francolin	*Francolinus gularis*	R, r, VU
	Anatidae		
11	Ruddy Shellduck	*Tadorna ferruginea*	WM, C
12	White-wing Wood Duck	*Cairina scutulata*	R, r (EN)
13	Lesser Whistling Teal	*Dendrocygna javanica*	R, C
14	Openbill stork	*Anastomus oscitans*	R, C
15	Lesser Adjutant Stork	*Leptoptilos javanicus*	R, C (VU)
	Ardeidae		
16	Cattle Egret	*Bulbulcus ibis*	R, C
17	Little Egret	*Egretta garzetta*	R, C
18	Large Egret	*Casmerodius albus*	R, C
19	Little Heron	*Butorides striatus*	R, C
20	Indian Pond Heron	*Ardeola grayii*	R, C
21	Cinnamon Bittern	*Ixobrychus cinnamomeus*	R, r
22	Yellow Bittern	*Ixobrychus sinensis*	R, r
	Phalacrocoracidae		
23	Indian Cormorant	*Phalacrocorax fuscicollis*	R, r
24	Great Cormorant	*Phalacrocorax carbo*	WM, C
25	Little Cormorant	*Microcarbo niger*	R, C
	Anhingidae		
26	Oriental Darter	*Anhinga melanogaster*	NT, R, r
	Accipitridae		
27	Crested Serpent Eagle	*Spilornis cheela*	R, C

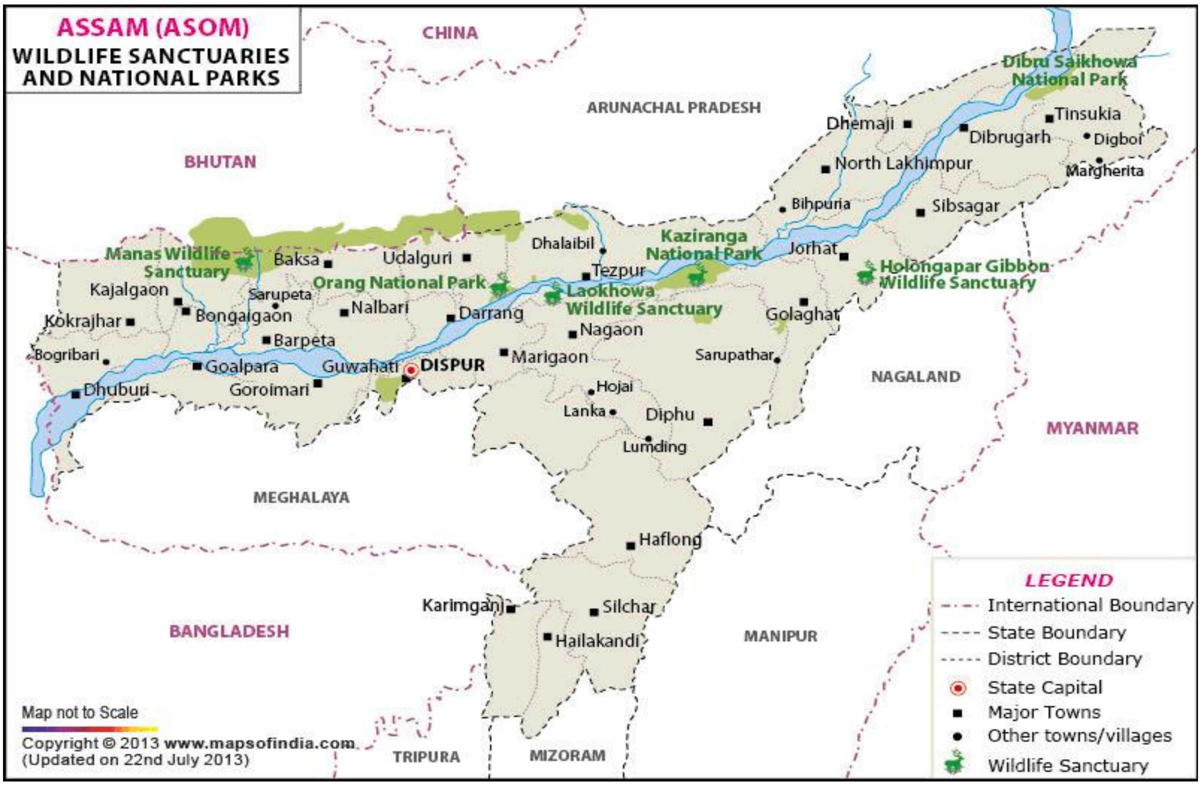
28	Eurasian Sparrowhawk	*Accipiter nisus*	R, C
29	Crested Goshawk	*Accipiter trivirgatus*	R, r
30	Pied Harrier	*Circus melanoleucos*	WM, r
31	Black Kite	*Milvus migrans*	R, r
32	Shikra	*Accipiter badius*	R, C
33	Long-billed Vulture	*Gyps indicus*	R, r (CR)
34	Indian White-backed Vulture	*Gyps bengalensis*	CR, R, r
35	Greater Grey-headed Fish-Eagle	*Ichthyophaga ichthyaetus*	NT, R, r
	Falconidae		
36	Common Kestrel	*Falco tinnunculus*	WM, C
	Rallidae		
37	White-breasted Waterhen	*Amaurornis phoenicurus*	R, C
38	Water Cock	*Gallicrex cinerea*	R, r
39	Purple Moorhen	*Porphyrio porphyrio*	WM, C
40	Common Moorhen	*Gallinula chloropus*	WM, C
	Charadridae		
41	Little-ring Plover	*Charadrius dubius*	R, C
42	Lesser Sand Plover	*Charadrius mongolus*	WM, C
43	Little Stint	*Calidris minuta*	WM, C
44	Red-wattled Lapwing	*Vanellus indicus*	R, C
45	River Lapwing	*Vanellus duvaucelii*	R, C
	Scolopacidae		
46	Common Snipe	*Gallinago gallinago*	WM, r
47	Pintail Snipe	*Gallinago stenura*	WM, C
48	Common Greenshank	*Tringa nebularia*	
49	Common Sandpiper	*Actitis hypoleucos*	WM, C
	Laridae		
50	River Tern	*Sterna aurantia*	WM, C
	Columbidae		
51	Pompadour Green Pigeon	*Treron pompadoura*	R, C
52	Yellow-footed Green Pigeon	*Treron phoenicoptera*	R, C
53	Thick-billed Green Pigeon	*Treron curvirostra*	R, C
54	Pin-tailed Green Pigeon	*Treron apicauda*	R, C
55	Wedge-tailed Green Pigeon	*Treron sphenura*	R, C

56	Green Imperial Pigeon	*Ducula aenea*	R, C
57	Mountain Imperial Pigeon	*Ducula badia*	R, C, VU
58	Purple Wood Pigeon	*Columba pulchricollis*	R, C
59	Ashy Wood Pigeon	Columba pulchricollis	
60	Spotted Dove	Streptopelia chinensis	R,C
61	Oriental Turtle Dove	Streptopelia orientalis	R, r
62	Red Collared Dove	*Streptopelia tranquebarica*	R, r
63	Emerald Dove	*Chalcophaps indica*	R, r
64	Eurasian Collard Dove	*Streptopelia decaocto*	R, r
65	Barred Cuckoo Dove	*Macropygia unchall*	R, r
	Psittacidae		
66	Rose-ringed Parakeet	*Psittacula krameri*	R, C
67	Alexandrine Parakeet	*Psittacula eupatria*	R, C
68	Red-breasted Parakeet		R, C
69	Blossom-headed Parakeet		R, r
	Cuculidae		
70	Drongo Cuckoo	*Surniculus lugubris*	SM, r
71	Large Hawk Cuckoo	Heirococcyx sparverioides	
72	Common Hawk Cuckoo	Heirococcyx varius	R, r
73	Indian Cuckoo	*Cuculus micropterus*	R, C
74	Rufous-bellied Plaintive Cuckoo	*Cacomantis merulinus*	R, r
75	Pied Crested Cuckoo	*Clamator jacobinus*	SM, r
76	Red-winged Crested Cuckoo	*Clamator coromandus*	R, r
77	Asian Koel	*Eudynamys scolopacea*	R, C
78	Green-billed Malkoha	*Phaenicophaeus tristis*	R, C
79	Lesser Coucal	*Centropus bengalesis*	R, C

❖ **Wildlife Sanctuary: Dehing Patkai in Tinsukia District**

Dehing Patkai National Park is located in the Dibrugarh and Tinsukia districts of Assam and covers an area of 231.65 km^2 (89.44 sq mi) rainforest. It was declared a wildlife sanctuary on 13 June 2004. On 13 December 2020 Government of Assam upgraded it into a national park. On 9 June 2021 Forest Department of Assam officially notified it as a national park. It is located in the Dehing Patkai Landscape which is a dipterocarp-dominated lowland rainforest. The rainforest stretches for more than 575 km^2 (222 sq mi) in the districts of Dibrugarh, Tinsukia and Charaideo. The forest further spreads over in the Tirap and Changlang districts of Arunachal Pradesh. Dehing Patkai National Park harbours the largest stretch of lowland rainforests in India. Dehing Patkai Wildlife Sanctuary was declared as Dehing Patkai Elephant Reserve under Project Elephant. Dehing-Patkai as a potential wildlife sanctuary was identified in late 1980s during a primate survey as "Upper Dehing Wildlife Sanctuary". Subsequently during a study on white-winged wood duck in early 1990s, it was discovered as a globally important site for this duck and recommended to be upgraded to "Upper Dehing National Park".The distance from Tinsukia to Dehing Patkai National Park via NH315 is 59.6 Km (Approx).

Figure 15: Wildlife Sanctuaries and National Parks of Assam



*(**Source:** https://www.mapsofindia.com/maps/wildlife/wildlife-assam.htm)*

CHAPTER 4: PHYSIOGRAPHY OF THE DISTRICT

4.1 General Land form:

Tinsukia district in Assam, India has many landforms, including ponds, national parks, and a bridge:

- **Na-Pukhuri**

A cluster of nine ponds in the southeastern corner of Tinsukia Town, built during the reign of the last Muttock King, Sarbananda Singha. The central pond is the main attraction.

- **Dehing Patkai National Park**

Home to India's largest lowland rainforest, this park was once known as the Upper Dehing Wildlife Sanctuary.

- **Dhola-Sadiya Bridge**

Named after Assam artist and filmmaker Bhupen Hazarika, this bridge is the longest in India.

- **Ancient roads**

The Matak territory had many ancient roads, including Godha-Borbaruah road, Rangagarah road, Rajgor road, and Hatiali road.

4.2 Soil & Rock pattern

Physiographically the area is characterised by Brahmaputra plains and hills in the southern part, with gentle slope towards north-west. The distinguishable geomorphic units are as follows.

a) Flood plain

b) Younger and older alluvium plain

c) Structural hill

The soil in the area may be grouped into three broad categories depending upon the origin and occurrence. These are given below.

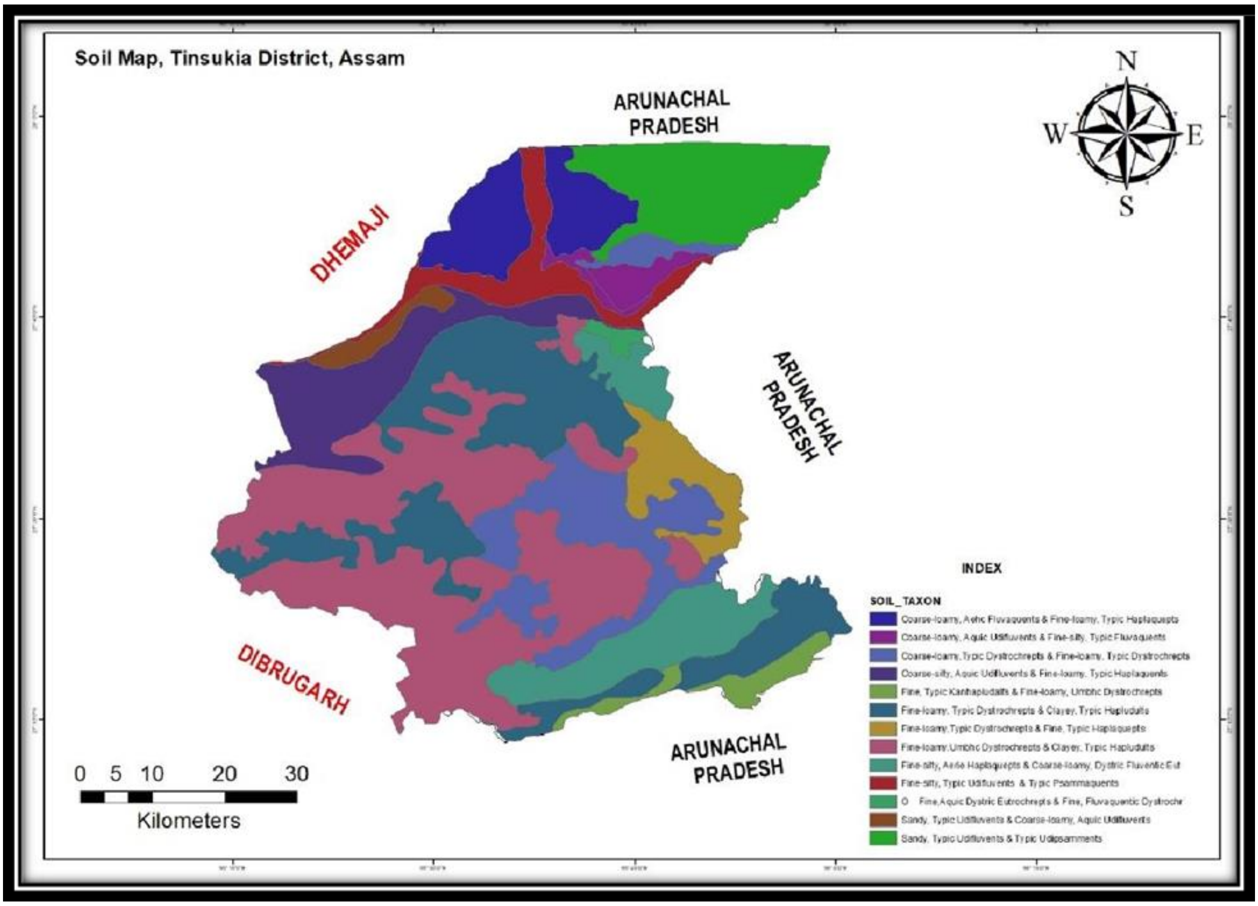
a) Newer alluvial Soil: Flood plain areas of River Brahmaputra and the tributaries in the northern part are characterized by light grey clay with sand and silt.

b) Older alluvial Soil: It occurs mainly in the central part with limonite yellow to reddish yellow clay.

c) Soil cover in forest and hilly areas: It is deep reddish in colour and occurs over the older geological formation in the southernmost part of the district.

The climate, vegetation and parent rock types, topography, occurrence of flood and other biotic factors have considerably influenced the genesis of soil and consequently great variation in soiltypes have been observed in different parts of the district. Based on the soil test results, it has been found that the soil of Tinsukia district is mainly acidic. Micronutrients, especially Zn, Bo,Mo and Cu etc. were found in almost all parts of the district.

Figure 16: Soil Map of the Tinsukia district



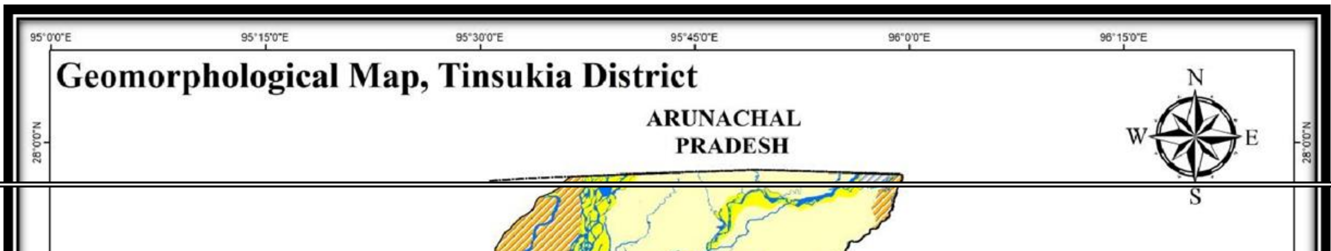
4.3 Different geomorphological units:

In general, geomorphology of a particular region includes physiographic features and drainage basins.

Physiographic Features

Physiographically the area is characterised by Brahmaputra plains and hills in the southern part, with gentle slope towards north-west. The distinguishable geomorphic units are as follows: (a) Flood plain (b) Younger and older alluvium plain (c) Structural hill the soil in the area may be grouped into three broad categories depending upon the origin and occurrence. These are given below: (a) Newer alluvial Soil: Flood plain areas of River Brahmaputra and the tributaries in the northern part are characterised by light grey clay with sand and silt. (b) Older alluvial Soil: It occurs mainly in the central part with limonite yellow to reddish yellow clay. (c) Soil cover in forest and hilly areas: It is deep reddish in colour and occurs over the older geological formation in the southernmost part of the district.

Figure 17: Geomorphological map of Tinsukia district



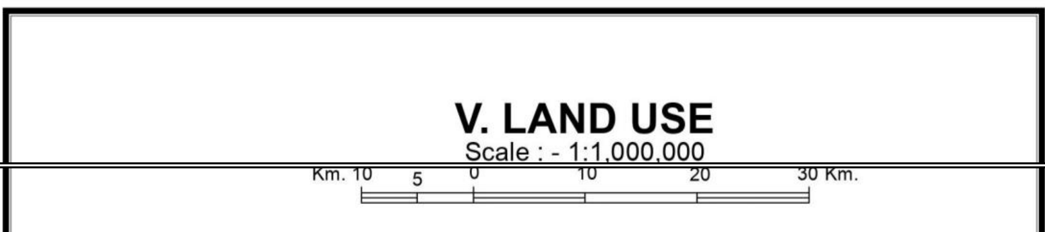
CHAPTER 5: LAND USE PATTERN OF THE DISTRICT

Bruce Jones of U.S. Geological Survey, Reston, Virginia USA, stated in his research report, entitled “Importance of Land Cover and Biophysical Data in Landscape-Based Environmental Assessments” that, biophysical data as land use and land cover play important roles in socioeconomic and environmental assessments relative to a large number of existing issues. Land is a dynamic perception, which alters over space and time. The study of changing land-use pattern has significant geological aspect. As land use transformation is the consequence of various human induced activities over a particular space in different time periods, thus nature of land use of an area reflects the levels of socio-cultural and economic development of a particular province. Therefore, the term “land-use” may broadly be defined as putting up of a piece of land into productive purpose. Human interventions in particular and natural phenomena in general are considered to be the factors affecting the land use pattern. The LULC data have become especially important locally as well as globally with concern for the issues as worldwide climate change. However, land cover and digital biophysical data by themselves are not sufficient for broad-scale environmental assessments. These data must be combined with insitu data collected from comprehensive research and monitoring programs to derive and interpret broad-scale environmental condition (Bruce Jones). So, systematic and regional analyses of land use pattern bear great significance and the changing nature of land use. Practices help to explain the causes of increasing intensity of resource use and changing relationships of human activities in relation to nature and help in its judicious uses too. Land utilization statistics provide detailed information of the land use pattern of an area, according to the land utilization, the total area divided into various types of landforms such as forest, cultivable land, fallow land, crop area etc., The total geographical area of the district is 4,20,393.4 Ha out of which 40.49% is cultivable, 10.78% is forest, 59.64% is under non-agricultural use and 2.51% is barren/waste land. Area under pasture is very negligible and marginally productive due to prevailing system of open grazing since long without adding any nutrient. This area is required to be given special attention for corrective treatment to enhance the productivity

Table No. 12: Area under LULC of Tinsukia District, 1991-2020

LULC categories	1991		2020		Change 1991 to 2020	
	Area in km^2	%	Area in km^2	%	Area in km^2	%
Dense forest	661.84	17	740.87	20	79.03	3
Degraded vegetation	772.2	20	274.34	7	-497.86	-13
Agriculture	862.44	23	1186.06	31	323.62	8
Barren land	798.81	21	641.04	17	-157.77	-4
Built-up	473.41	13	699.5	18	226.09	5
Water body	81.01	2	146.76	4	65.75	2
Sandbar	150.82	4	111.94	3	-38.88	-1

Figure 18: Land Use and Land Cover Map of the Tinsukia district



5.1) Forest:

As per the Indian State of Forest Report (ISFR) 2011, the Forest and Tree Cover of the country is 23.81% of the geographical area of the country. The forest cover of the country has registered a marginal decline of 0.05% as compared to the previous assessment published in ISFR 2009.

According to ISFR 2019 total forest area of the Tinsukia district is 1,582.57 Sq. Km in which around 410.10 Sq.km area is very dense Forest, 353.92 Sq.km is moderately dense forest and 818.55 Sq. Km is Open Forest. On the other hand, according to ISFR 2021 total forest area of the Tinsukia district was 1583.38 Sq. Km in which around 407.83Sq. Km. area is very dense Forest, 350.49 Sq. Km area is moderately dense forest area and 825.06 Sq. km. area is Open Forest.

Table No. 13: Details of forest area in the district Tinsukia (In Sq. Km)

Area	Year 2019	Year 2021
Very Dense Forest Area	410.10	407.83
Moderately Dense Forest Area	353.92	350.49
Open Forest	818.55	825.06
Total Forest Area	1,582.57	1583.38

The boundaries of the Doomdooma Division were officially established by notification no. FOR.287/66/118 dated April 18, 1974. The division has since undergone further reorganization to enhance its administration and management. The Doomdooma Division consists of 20 Reserve Forests located within the geographical coordinates of North Latitudes 27°20’ to 28°00’ and East Longitudes 95°15' to 96°00’, all within Tinsukia district. This division was established by transferring some Reserve Forests from the Digboi and Doomdooma Divisions. Originally it was part of the Lakhimpur Division, Doomdooma was created due to increased revenue and administrative demands, leading to the gradual formation of separate territorial divisions. The area covered by all the Reserve Forests in Doomdooma is approximately 30,904.35 hectares. Sixteen of these forests are situated south of the Lohit and Brahmaputra rivers. The Sadiya Station (North Block), Kundil Kalia, and Deopani Reserve Forests mark the boundary between Assam and Arunachal Pradesh. The Doomdooma Division is bordered by Arunachal Pradesh to the north and east, Digboi Division to the south, and Lakhimpur and Doomdooma Divisions to the west.

Tinsukia district consists of lot of reserve forests they are: Bhanjan R.F, Bogapani R.F., Burhi Dihing R.F., Dangori R.F., Dibru R.F, Digboi R.F. (West Block) R.F., Dirak R.F, Duarmara R.F, Dumduma R.F, Gelapukhuri R.F, Hahkhati R.F, Hologaon R.F, Jaipur R.F., Kakaojan R.F, Kotha R.F., Kukuramora R.F., Kumsong R.F, Mechaki R.F., Nalni R.F., Namphai R.F., Namphuk R.F., Takauani R.F., Tarani R.F., Tinkopani R.F. Tipang R.F, Tirap R.F, Upper Dihing R.F. (West Block), Upper Dihing R.F.(east block) Both the Upper Dihing Reserved Forests (West Block) and Dirak Reserved Forests fall under Digboi Forest Division in Tinsukia district. the reserve forests of the district consists of wetlands and the whole reserve forest area is rich in floral and faunal diversity.

Table No. 14: Forest area of Doomdooma forest Division:

Sl. No.	Name of the Forest Divisions	Coordinates		Total forest area in Hac.
		Latitude	Longitude	
1	Doomdooma Division	The extent of area lies between		30904.42
		27.5'and27.42'N	94.41'and95.30'E	

Table No. 15: Range-wise distribution of area of Doomdooma Forest Division

SL. No.	Range	Total Area (Ha)
1	Doomdooma	4175.15
2	Saikhuwa	3801.62
3	Sadiya	11498.70
4	Kakopather	3546.17
5	Khatangpani	5237.96

Table No. 16: Range wise distribution of area of Digboi Forest Division

SL NO.	Name of Range	Total Area (In Ha)
1	Jagun Range	10802
2	Lekhapani Range	25199
3	Margherita Range	10843
4	Margherita West Range	16158
5	Digboi Range	21764
6	Lakhipather Range	34791
7	Soraipung Range	15462

The total geographical area of the Doomdooma forest division is 1251 Sq. km, out of which 29% forestarea, 27% is agricultural area, 11% waterbody, 3% waste land and 1% built up area.

Table No. 17: **LAND UTILIZATION PATTERN UNDER DOOMDOOMA FOREST**

DIVISION (in Sq. km)

Sl. No.	Name	Area (in Sq. km)
1	Total Geographical area	1251.00
2	Total Built up Area	12.12
3	Total Agricultural Land	345.06
4	Total Forest Area	362.78
5	Total Wasteland	33.49
6	Total Water body	133.76
7	Others	363.79

Figure 19: Geographical representation of area and percentage cover of Doomdooma forest division in Sq. Km

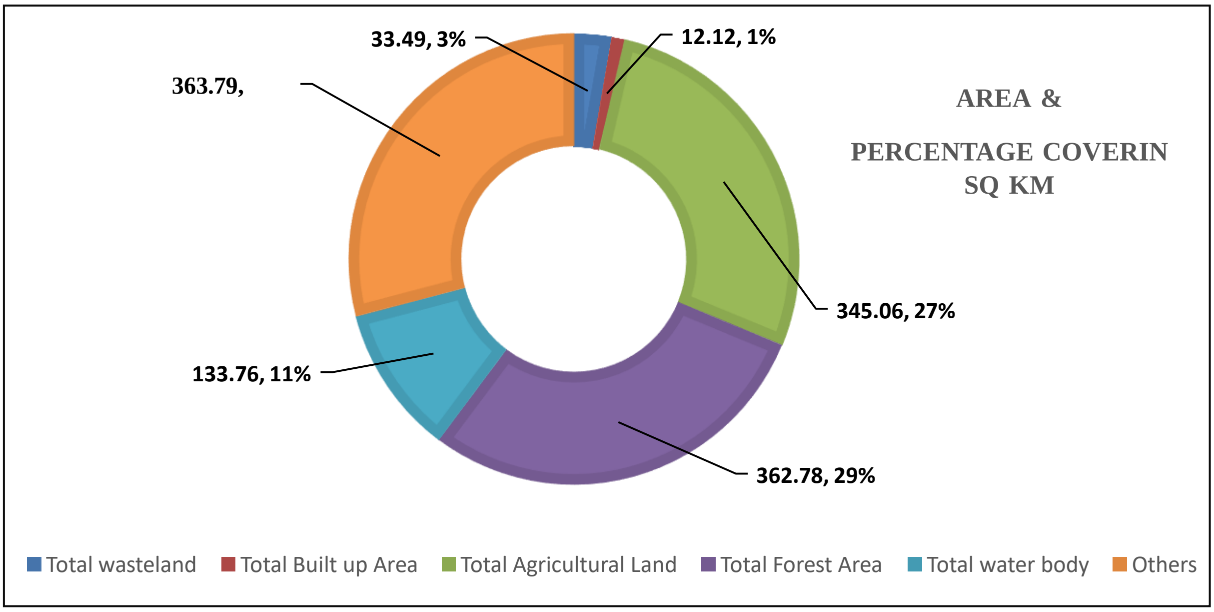
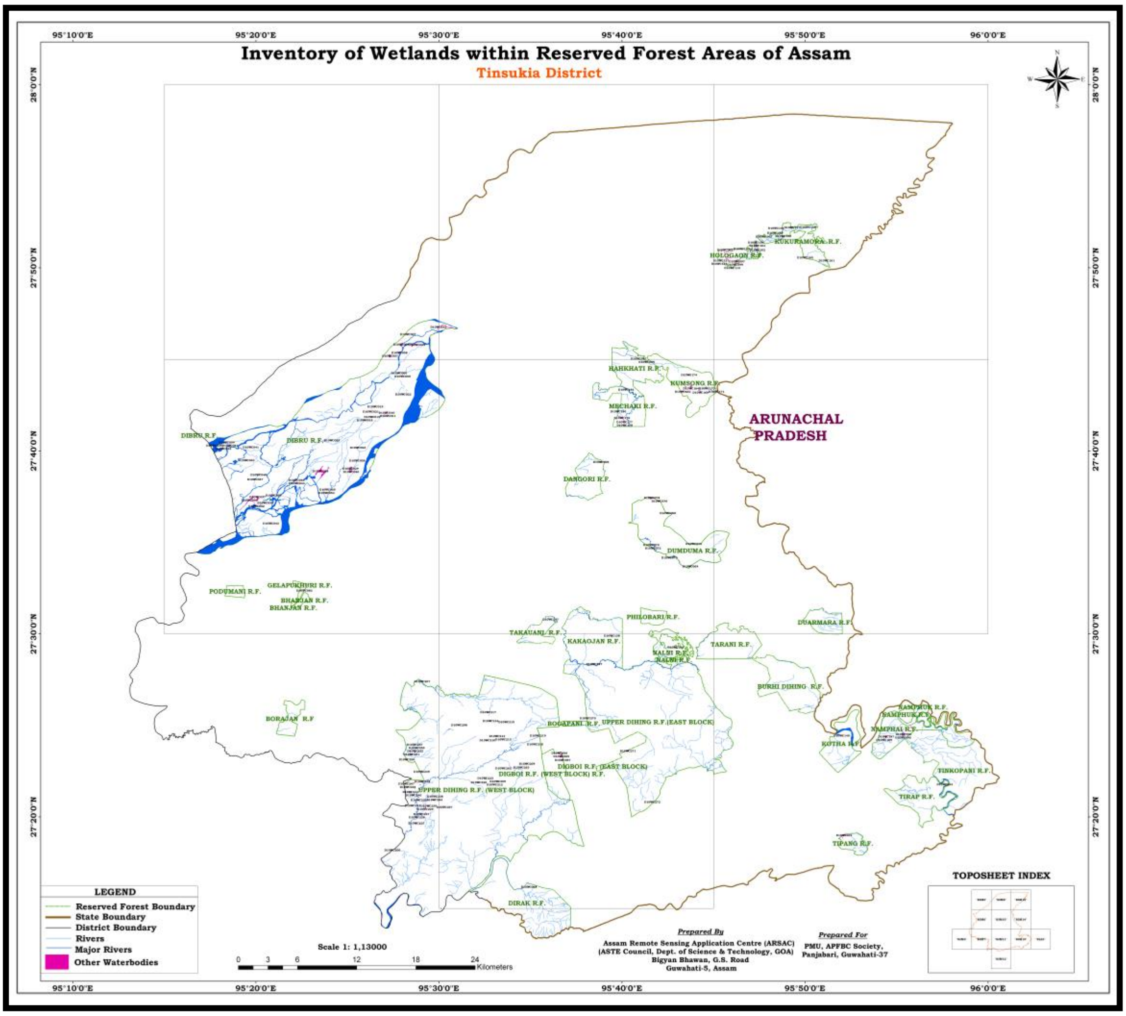


Figure 20: Wetlands within Reserve Forest Area of Assam (Tinsukia district)



5.2 Agriculture and Irrigation

Agriculture is considered as the backbone of the economy of Tinsukia district. Majority of the people in the district depend on agriculture for their livelihood. The major crop of the district is paddy The total geographical area of the district is 350200 ha. Of which, the gross cropped area is 1,98,579 ha and the net sown area is 1,43,321 ha creating a cropping intensity of 139%. About 55,258 ha area under double cropping while the net irrigated area is only 16273 ha. Rice is the staple food of the people. Apart from Rice, wheat, rapeseed, mustard, sugarcane, gram, peas and potatoes are also grown in the district

Table No. 18: Areas under various major crops of Tinsukia district in the year 2020-21

Sr. No.	Crop	Area in Ha.	Production in MT	Production in Kg/Ha.
1	Winter Paddy	56862	177637	3124
2	Autumn Paddy	4237	13253	3128
3	Summer Paddy	220	730	3318
4	Mustard	6458	5334	826
5	Pulses	4590	4016	875
6	Vegetables	5876	66022	11236
7	Potato	4883	36624	7500
8	Maize	1628	4096	2516
9	Black gram	3061	2620	856
10	Turmeric	506	4167	8236
11	Ginger	1645	16865	10252
12	Pea	1422	1271	894

Source: *District Agriculture Office, Tinsukia*

5.3 Plantation & Horticulture:

Horticulture plays a crucial role in commercializing agriculture. As urbanization grows and awareness of the benefits of fruits and vegetables increases, demand rises. The horticulture and plantation sectors now offer profitable opportunities for farmers, entrepreneurs, and companies. These sectors serve as dynamic tools for improving farmers' economic situations, allowing for diversification with high-value crops, increasing land productivity, providing nutritional security, creating jobs, ensuring ecological sustainability, and boosting export earnings. In Tinsukia district as on 31 March 2021, there are 23511 nos. of Small Tea Growers in 21509 ha. As on 30 August 2021, the production of tea is 81.31 M.KG. Under the area of 57008.79 ha. The major plantation and horticultural crops in the district are tea, orange, areca nut and banana.

Table No. 19: Areas under various Horticultural Crops as on 31 March, 2022:

Sl. No.	Crops	Area in Ha
1	Orange	964
2	Pear	82
3	Coconut	96.25
4	Areca nut	2687
5	Banana	354
6	Papaya	251
7	Pineapple	180
8	Assam lemon	646
9	Guava	116
10	Litchi	40
11	jack fruit	88
12	Betel vine	352
13	Black Pepper	277
14	Ginger	1630
15	Turmeric	480

5.4 Mining:

Tinsukia is an industrial district of Assam. The major mineral mined in Tinsukia, Assam, is coal. The North Eastern Coal Fields, a unit of Coal India Limited, has the exclusive rights to mine the coal reserves in Tinsukia. Tinsukia's history of extractive industries also includes oil, timber, and plywood. The Oldest oil refinery in India is situated at Digboi and places like Margherita and Ledo are famous for open cast coal mining. It is one of the most important tea-growing and processing districts in the country. Coal, Petroleum and natural gas occur in the district at Borgolai, Tikak parbat, Tripled & Tipong. Larg e reserves of natural gas are found in association with oil which is also being supplied to the house hold of nearest towns through pipeline. Ground water occurs in regionally extensive aquifers. The aquifers consist of sands of various grade sand are suitable for both shallow& deep tube wells. The unconsolidated alluvial sediments of the district bear accumulative high permeability, low bearing capacity with poor foundation characteristics.

CHAPTER 6: GEOLOGY AND MINERAL WEALTH

6.0 GEOLOGY

Regional Geology:

The overall geological set up of India is divided into three parts i.e., Extra-peninsula, Peninsula and Indo-Gangetic Plain. The Assam state is partially covered by Himalayan Mountain System as the thick sequence of marine rocks followed by freshwater rocks was deposited in Cenozoic times. Another part of this state is partially occupied by Indo-Gangetic plains.

The different types of rock from different ages are found in Assam state belonging to

a) Proterozoic Gneissic Complex;

b) Meso-Palaeo Proterozoic Shillong Group;

c) Neo-Proterozoic Lower Palaeozoic Granite Plutons;

d) Permo-carboniferous Lower Gondwana sedimentary rocks.

e) Alkali Complexes of Samchampi, Borpung and volcanic rocks represented by Sylhet Trap of Cretaceous age,

f) Lower Tertiary (Paleocene-Eocene) shelf sediments of the Jaintia Group extending along the southern and eastern flanks of Mikir Hills and geo-synclinal sediments of the Disang Group in parts of the North Cachar Hills;

g) Upper Tertiary (Oligocene to Pliocene) shelf and volcanic rocks represented by the Cretaceous Sylhet Trap and geo-synclinal sediments covering the southern flanks of Mikir Hills, the North Cachar Hills and the hills of the Cachar district in the Surma valley area exposed in the northern foothills of Naga-Patkai range covering the southern margin of Sibsagar, Jorhat and Dibrugarh districts. The northern part of Assam is comprised with southern foothills of Eastern Himalaya forming a narrow strip.

h) The Quaternary deposits consisting of Older and Newer Alluvium present in flood plains and terraces of the Brahmaputra valley, Surma valley and other river basins of Assam.

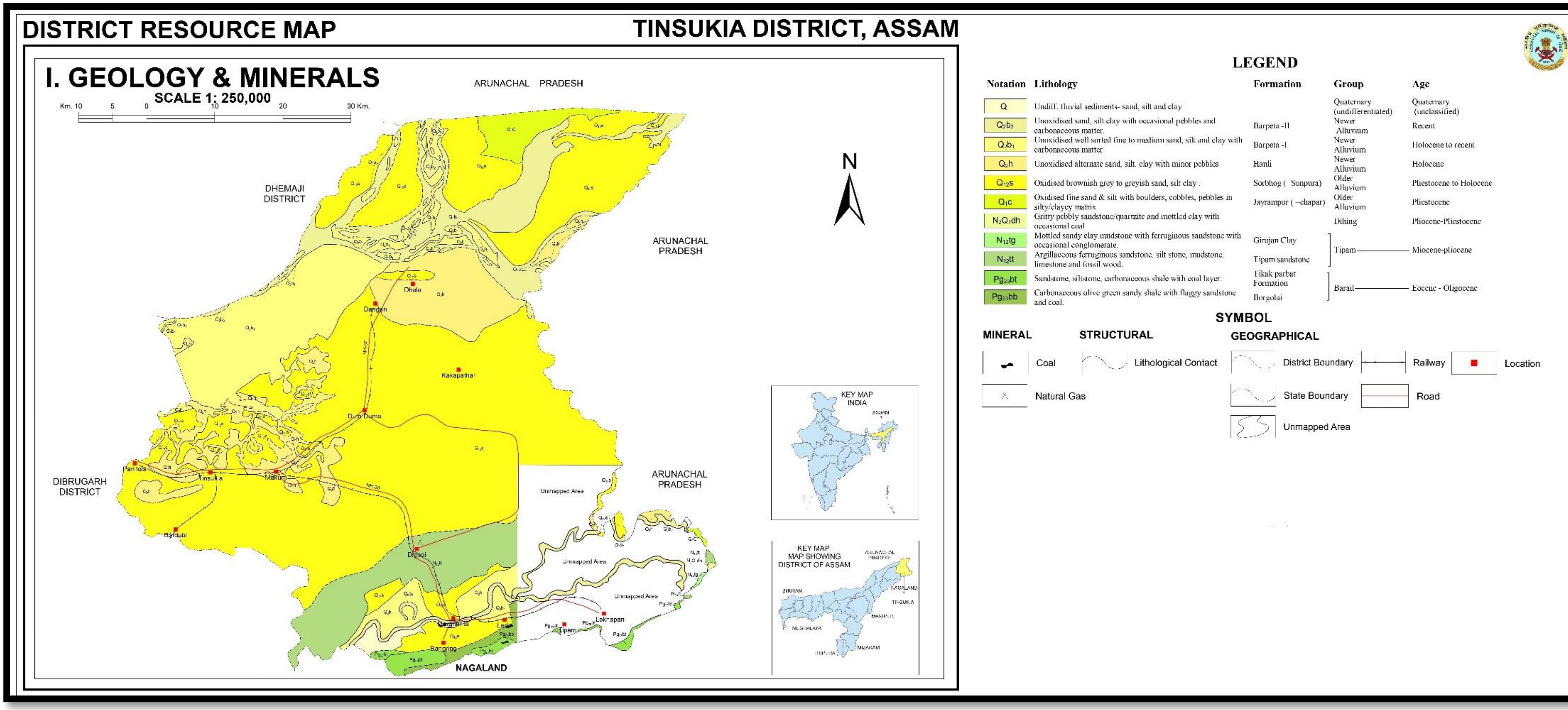
Tinsukia District is forming a part of Assam-Arakan geological domain. The Assam-Arakan basin witnessed two major phases of tectonic development. It developed as a composite shelf-slope-basinal system under a passive margin setup during the period from Early Cretaceous to the close of Oligocene. During the post- Oligocene time, however, different parts of the mega basin witnessed different evolutionary trends, mostly under compressive tectonic forces. In general, the district is covered by vast Quaternary sediments deposited by Brahmaputra River and these sediments overlie Tertiary Group of rocks. Geologically, the district is characterized by Tertiary and Quaternary litho-assemblages ranging from Eocene to Meghalayan age. The oldest litho-unit is Borgolai Formation of Barail Group. This Formation is composed of sandstone, clay, clayey sandstone, carbonaceous shale and coal seams. The lower part of the formation is characterized by hard sandstone, bluish grey micaceous sandstone with alternate bluish clay beds and carbonaceous shales. The upper part of this formation is composed with massive sandstone which overlies by thick alternating assemblage of clay, sandy clay, and clayey sandstone. This formation is conformably overlain by Tikak-Parbat Formation which is also belongs to Barail Group of rocks. Tikak-Parbat formation is consisted of medium to coarse grained, light-coloured quartzose sandstone with intercalation of shale, shandy shale, clays, carbonaceous shale with coal seam in the basal part. There leaf impressions are preserved in carbonaceous shale. It is overlain unconformably by the Tipum Group of rocks. The Tipam Group is made up of the top argillaceous Girujan Clay Formation and the bottom arenaceous Tipam Sandstone Formation. This formation forming the older boundary of the Tipam Group. It is composed of ferruginous sandstone with siltstone and clay of Miocene to Pliocene in age. The upper part of Tipam group is generally filled with Girujan formation. This formation is characterized by mottled clay, mudstone and thin ferruginous sandstone along with occasional conglomerate with oil and gas reserve along some places. This formation occurs as linear patches in the southern part of the district. Tipam Group is unconformably overlain by the rocks of Dihing group. The fluvial Pliocene deposit named Dihing Group, occurring in the southern part of the district. This formation is characterized by denudational hills, slightly undulsting surfaceof alternating beds of gritty, pebbly sandstone, quartzite and mottled clay with occasional clay. The quaternary sediment overlies upon the Tertiary rocks. These quaternary sediments are classified into two groups i.e., Older and Newer Alluvium. These Quaternary sediments are separated from the rest of the Tertiary rocks by an unconformity. Older Alluvium is classified into two morpho-stratigraphic units i.e., Jayrampur and Sorbhog. Jayrampur Formation is composed of oxidized, brownish yellow sand, silty clay with pebbles of weathered gneiss and quartzites. This formation is forming the older boundary of quaternary sediments. Sorbhog Formation is characterized by highly oxidized reddish-brown sand, silty clay with occasional pebbles and cobbles, forming the next older sedimentation of Quaternary sediments. Newer Alluvium Group is classified into e.g., Haul, Barpeta I and Barpeta II. The oldest formation, Hauli which is forming the basement of quaternary sediments of Newer Alluvium. It is characterized by oxidized alternate sand and silt and also clay with carbonized wood and minor pebbles in flood plains. Barpeta-I comprises with white to greyish sand, silt, pebble and clay with carbonaceous matter. Barpeta- II contains with most recent sediments like unoxidized sand, silt, and clay with occasional pebbles along with carbonaceous matters.

Table No. 20: Stratigraphic succession of Tinsukia District

AGE	GROUP	FORMATION	LITHOLOGY
Quaternary (Unclassified)	Quaternary (undifferentiated		Undifferentiated fluial sediments, sand, silt and clay.
Maghalayan	Newer Alluvium	Barpeta II (Sisimukh II)	Unoxidized & unstabilized sand, silt, clay with occasional pebbles
Maghalayan		Barpeta I (Sisimukh I)	White to greyish sand, silt, pebble and clay
Holocene		Hauli	Unoxidized sand silt and clay
Pleistocene-Holocene	Older Alluvium	Sorbhog (Sunpura)	Oxidized brownish grey to greyish sand, silty clay with occasional pebbles and cobbles
		Jayrampur (Chapar)	Oxidised fine sand & silt with boulders, cobbles, pebbles in silty/clayey matrix
------Unconformity------			
Miocene- Pliocene	Tipam Group	Girujan Clay Formation	Mottled clays, sandy shale and subordinate mottled, coarse to gritty sandstone
		Tipam Sandstone Formation	Argillaceous ferruginous sandstone, silt stone, mudstone, limestone and fossil wood
------Unconformity------			
Eocene – Oligocene	Barail Group	Tikak Formation	Sand stone, siltstone, carbonaceous shale with coal layer.
		Borgolai Formation	Carbonaceous olive-green sand y shale with flaggy sand stone and coal.

***(Source:** GSI Miscellaneous Publication No. 30 Part IV Vol 2 (i) Assam. (2009)*

FIGURE 21: GEOLOGY & MINERAL MAP OF THE DISTRICT



*(**Source:**GSI, DRM, NER, 2017)*

Local Geology (Based on Field Investigation):

The geology of Tinsukia District encompasses the history of disposition of different types of litho-units in foreland facies condition of dispositional history. Geologically, the district comprises the Quaternary and Tertiary rocks. The rocks belong to Borgolai Formation of Barail Group are forming the basement of the district. This district is basically, from the point of view of geology, can be divided into three units:

- Dissected hills, medium drainage textured, sub-parallel, synclinal ridges with anticlinal valleys.
- Pediment zones
- Low-lying flats or Present floodplain

Tinsukia District is part of the Assam-Arakan geological domain and is covered by vast Quaternary sediments deposited by the Brahmaputra River. These sediments overlie the Tertiary Group of rocks, which are characterized by litho-assemblages ranging from Eocene to Quaternary age. The oldest litho-unit is the Borgolai Formation of the Barail Group, which is composed of sandstone, clay, clayey sandstone, carbonaceous shale, and coal seams. The lower part of this formation is characterized by hard sandstone, bluish grey micaceous sandstone with alternate bluish clay beds and carbonaceous shales. The upper part is composed of massive sandstone, which overlies by thick alternating assemblages of clay, sandy clay, and clayey sandstone. The thickness of this formation is about900-2500m. The Tikak-Parbat Formation, also belonging to the Barail Group, is overlain by the Tipum Group, which is made up of the top argillaceous Girujan Clay Formation and the bottom arenaceous Tipam Sandstone Formation. The strike of this formationis ENE-WSW with 45^0 southernly dipping near Namdang Colliery and 15^0 nera Tirap colliery. The thickness of Barail Group in southeastern part of Upper Assam Valley decreases in a north-westerly di- rection and this group may pinch out to the north of Brahmaputra – Baruah & Ratnam, C, (1982). The upper part is generally filled with the Girujan Formation, characterized by mottled clay, mudstone, and thin ferruginous sandstone. The thickness of Girujan Clay formation in south-eastern part of Upper Assam Valley is generally decreasing. The Dihing Group, a fluvial Pliocene deposit in the southern part of the district, is unconformably overlain by the rocks of the Dihing group. The quaternary sediment overlies upon the Tertiary rocks and are classified into two groups: Older and Newer Alluvium. Older Alluvium is divided into two morpho-stratigraphic units: Jayrampur and Sorbhog. The Newer Alluvium Group is divided into Haul, Barpeta I, and Barpeta II. Hauli is the oldest formation, forming the basement of quaternary sediments of Newer Alluvium. Barpeta-I comprises white to greyish sand, silt, pebble, and clay with carbonaceous matter, while Barpeta-I contains most recent sediments like unoxidized sand, silt, clay, and occasional pebbles along with carbonaceous matter.

Following litho-units have been encountered from Tinsukia District:

- Silt, Clay, Sand (Bimodal)
- Coarse, gritty, poorly consolidated sandstone with conglomerate
- Mottled clay, sandy shale, coarse to gritty sandstone.
- Argillaceous ferruginous sandstone, silt stone, mudstone, limestone and fossil wood.
- Sand stone, siltstone, carbonaceous shale with coal layer.

CHAPTER 7: MINERAL WEALTH

7.1 Overview of mineral resources:

Assam today is considered as "Mineral Paradise" having commercially exploitable major and minor minerals though there are reports of minerals and metals being used during early historic age, scientific mining and metallurgical industries in Assam started only after independence. During last 70 years, the mineral sector has grown here considerably. Rejecting all sorts of geological congregations and perturbations, it can be said that the economic progress of Assam is manifested in the form of retrogressive progress. In order to accelerate the economic growth exploitation of available mineral resources by developing mines with its full safety and establishment of target oriented and value added industries is an imperative. Development achieved, without jeopardizing the environment, in the mining and mineral beneficiation industries so far, availability of resources and existing trend would offer a glimpse of future, eradicating all types of schism in mineral economy, of mineral sector in the state of Assam.

Systematic investigation especially surface & subsurface mining in all the mineral & ore-bearing promising zones selectively will cater the light and then people will not be able to throw a volley of questions about the mineral wealth of Assam. A strong foundation in case of mining especially in Tinsukia of Assam must give perspective and confidence. It is pertinent to say that the preparation of DSR of Tinsukia is a laudable attempt. So, sustainable management of mineral resources is of immense importance & it is increasing at an exponential rate, therefore, sustainable management of mineral resources requires a long-term perspective so that these all last for the generations to come.

Sand, especially riverbed sand, is naturally occurring granular material composed of finely divided rock and mineral particles ranging between 0.0625 mm to 2 mm in diameter.

Basically, riverbed sands are produced due to weathering of rocks by mechanical forces. By a long-lasting process, the weathered rocks form gravel and further disintegrate to sand. Gravel occurs here as unconsolidated accumulations and consists of particles larger than sand (diameter >2 mm), that is granules, pebbles, cobbles, boulders or any other combinations of these.

7.2 Details of Resources:

MAJOR MINERALS

- **Coal: Makum Coalfield** area in Assam is situated in the eastern Himalayan province, along the western side of Patkai Range in the district of Tinsukia district. This coal seams are belonged to Tikak Parbat Formation and Bargolai Formation of Barail Group. The mine is not only opencast but also underground mines of Tertiary Coal Deposit. These Tertiary strata are folded and distributed into a number of thrust slices. According to Mishra and Ghosh (1996), this belt continues for more than 300km trending ENE-WSW direction. Good quality coal is observed with low ash and moisture content along with high sulphur. Total reserve of these seam is about 316 million tones and proved reserved 305million tones. Four collieries are present in this Coal field such as Namdang Colliery, Borgolai Colliery, Ledo Colliery and Tipong Colliery.

  Saraipung Tarajan Coal Deposits are another coal deposits are situated in Tinsukia District with 0.5million tons of Probale Reserve. The coal is very workable with 6.5% of moisture content, ash content is about 4.7% and fixed carbon content is about 44.8%. It occurs intermittently along the strike length of 7km.

- **Petroleum and Natural Gas: Digboi Oil Field** was one of the largest oil fields in India present in Tinsukia district. It is Asia'a oldest refinery. It was first discovered accidently in 1867 while a railway line was laying in this area. It is 13km long and about nine kilometer long and about one kilometer wide. It lies on tightly folded anticline. The steeper flank of this anticline has been cut by Naga thrust in the North-West direction. The oil bearing formation is Tipam sandstone in Miocene age. Thi refinery was commissioned in 1901, establishing India's first refinery.

  Dirok Gas Field: The Hindustan Oil Exploration Company (HOEC), in collaboration with Oil India Limited (OIL) and Indian Oil Corporation Limited (IOCL), is the operator of this field, which is situated in block AAP-ON-94/1 B in the Tinsukia district. It is estimated that 11.88 million metric barrels of oil equivalent are contained in the field. Phase II development of the field is now underway, involving the construction of a 35-kilometer pipeline to Duliajan and the drilling of three further development wells.

  Dinjan-1 well: This well is situated in the upper Assam basin's Tinsukia petroleum mining license. The well-produced gas at a rate of 115,000 standard cubic meters per day and encountered approximately 10 meters of sands holding hydrocarbons. *(**Source:** GSI, DRM,2024)*

MINOR MINERALS

The world scenario of reserve and production of river bed sand deposits indicate that although India stands among the top, from point of view, reserve, Assam is not also a solitary exception. The Tinsukia district is amongst the last few in sand production. Sand production of Bhaogdoi river, Jhanji river, Charipani river and Brahmaputara river play a vital role.

- Riverbed sand and River bank sand deposits.
- Earth/clay: Generally found in this district.
- Silt: It is also present in huge amount in this district.
- Pebbles, cobbles and Boulder: Generally found in the river channel deposit used for building material purposes and also as road metals by local people.

7.2.1 SAND AND OTHER RIVERBED MINERALS:

I. Drainage System

The drainage pattern of the studied area is the manifestation of the catchment of Doom Dooma River, Deopani River, Dibang River, Dibru River, Moilajan River, Buri Dehing River and Brahmaputra River and its' tributaries. The drainage patterns of these rivers are dendritic to sub-parallel in nature and totally is controlled by several structural features and concealed lithology below the surface.

During the survey of the investigated area of Tinsukia it is noticed that a number of rivers and rivulets together with their streams of different orders drains the district. All the streams, rivulets and river courses vary depending on the topography and physiography of the area. The streams, rivulets and rivers follow the lowest elevation courses for which the drainage courses vary widely in the district. The streams and river courses are in directions northern in case of Dibru River. Brahmaputra River is flowing through the northern side of the district. Buri Dehing River flowing the southern side of the district. The runoff water carries pebbles, cobbles and sand from upstreams and is deposited on river beds depending on the water flow rates. At places their banks are abrupt and broken into deep gullies.

Brahmaputra River

The river rises to a height of 5300 meters in the Himalayan Kailash hills. It passes via Tibet before entering India through Arunachal Pradesh, then on through Assam and Bangladesh until entering the Bay of Bengal. It runs through the southern part of the district. Brahmaputra River forming the southern boundary of the district. The river sand found in the plain/ bed of this river is not suitable for construction purpose. The river gives the local inhabitants essential supplies and facilitates transportation and agriculture. Total length of Brahmaputra in this district is about 25.4 km.

Doom Dooma River

Doom Dooma River is originating foot hills near Bordumsa village of Arunachal Pradesh. It is flowing through the Central part of the district, covering 16.7km in length. The river fell in to Dibru River near Doomdooma town. Total length covers by this river in this district is about 16.7km

Deopani River

River Deo Pani originated from the hills of eastern Arunachal Pradesh and flows south and south-west direction. Collected water from Emeh, Iphi and many more small streams contribute the water flow of Deo Pani flow towards west and releases its water to Dibang River. The river is also known as Ejeh River. Total length covers by this river in this district is about 4km.

Dibang River

The Dibang River is an upstream tributary of the Brahmaputra in the Indian state of Arunachal Pradesh. It is also referred to as Sikang by the Adi and Talo in Idu. It starts in the Upper and Lower Dibang Valley areas and passes via the Mishmi Hills. In the Upper Dibang Valley area of Arunachal Pradesh, close to the Keya pass on the Indo-Chinese border, the Dibang River has its source. The districts of the Upper and Lower Dibang Valleys are included in the river's drainage basin in

Arunachal Pradesh. The Mishmi Hills are located where the Dibang joins the lowlands near Bomjir, Dambuk, and other places. There is a severe river gradient and braided channel morphology with the Dibang between Bomjir (Nizamghat) and Sadiya. The Dibang has a strong river gradient and a braided channel morphology between Bomjir (Nizamghat) and Sadiya. Its width varies from 4 to 9 kilometers (2 to 6 mi). It frequently alters its path, causing flooding and the devastation of forests and arable land near its banks. The 195-kilometer (121-mile) Dibang River reaches the River Lohit north of the Dibru-Sikhowa sanctuary, which is close to the Assamese town of Sadiya. The principal tributaries of the Dibang are the Sisar, Mathun, Tangon, Dri, Ithun, and Emra. Throughout its course, the Dibang is joined by several tributaries, including the Airi, Ilu, Imu, Ahi, Ashu, Epipani, and Eze (Deopani) rivers. In the upper course, the majority of these rivers join it and showing the fan-shaped catchment area. Total length covers by this river is about 20km in Tinsukia district. This river flows in the northern boundary of the district

Dibru River

A tributary of the Brahmaputra River on its left bank is the Dibru River. The basin empties onto the Assamese plain, which is surrounded by the rivers Brahmaputra and Lohit in the north, the Noa Dihing River in the east, and a few tributaries of the Burhi Dihing River in the south and west. The basin drains into this vast sub-Himalayan landscape. Geographically, it spans 27º25´30″ N to 27º46´30″ N and 95º6´0ź E to 95058´30″ E, encompassing approximately 1779 sq km in Tinsukia, Dibugarh, Dhemaji district of Assam, and a portion of Arunachal Pradesh. The region is home to evergreen and semi-deciduous forests, with high humidity and moderate temperatures. The basin's slope ranges from a gently sloping surface to a base level slope (0º-5º). This river runs about 17.5km in the district.

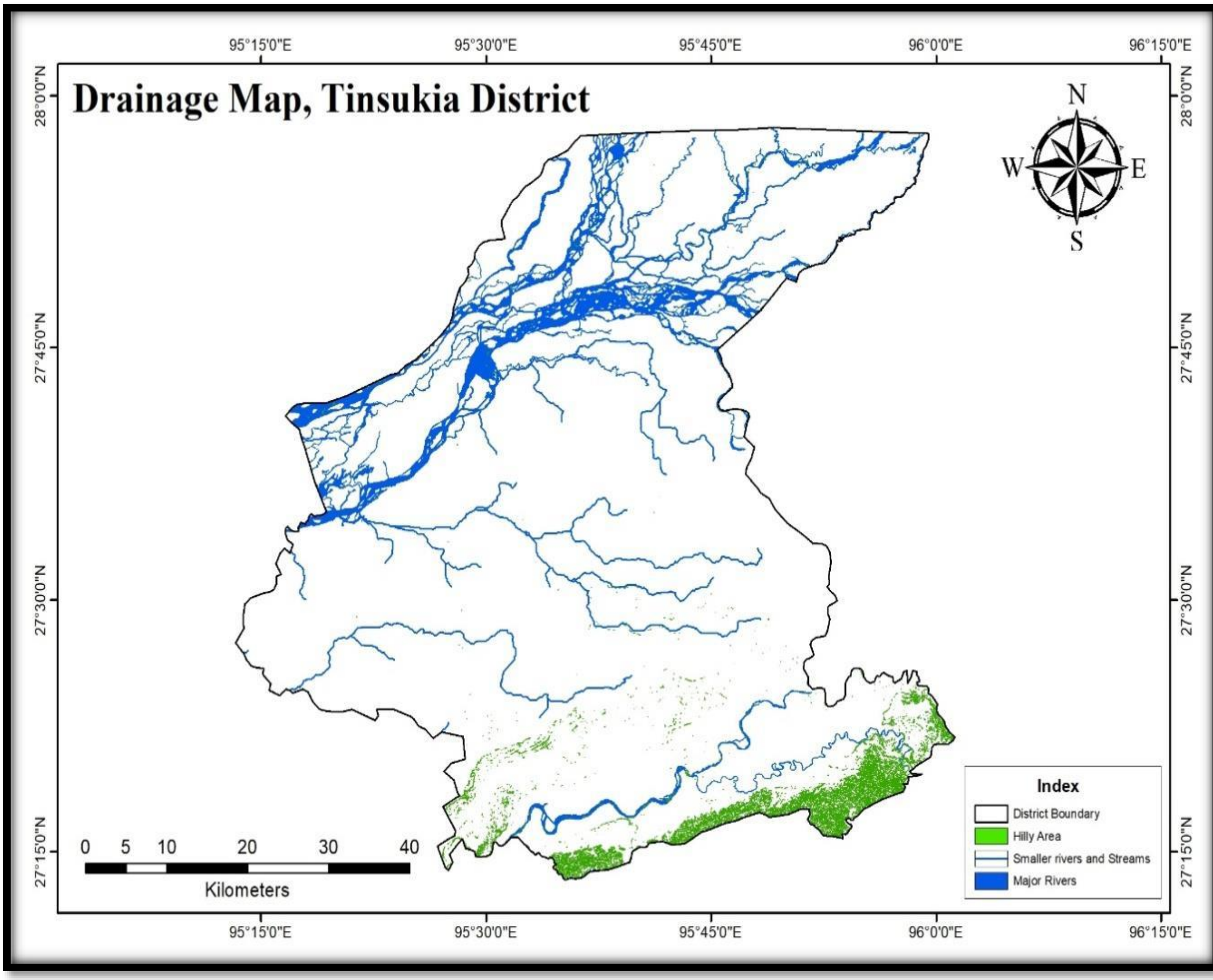
Moilajan River

This is a perennial river flowing in the central part of the district. It is a tributary of Doom Dooma River, flowing about 12.6 km in this district.

Buri Dehing:

Dihing, also known as Buri Dehing (Dihong meaning wide river), is a sizable tributary of the Brahmaputra River in Upper Assam, northeastern India. It is approximately 380 kilometers (240 mi) long. The river rises in the Eastern Himalayas (the Patkai Hills) in Arunachal Pradesh at 2,375 meters (7,792 feet) above sea level. It then runs through the districts of Tinsukia (Tinicukeeya) and Dibrugarh in Assam before joining the Brahmaputra near Dihingmukh. Approximately 6,000 square kilometers (2,300 sq mi) make up its watershed.[2] Numerous oxbow lakes have been formed in the region by the Dihing. On the northern bank of the Dihing, there lies a river called Namdapha. On the southern bank of the Dihing, the Disang River is a tributary. Along its path, the Jeypore-Dihing Rainforest, Namdapha National Park, a number of oil fields, wet rice fields, bamboo orchards, and tea gardens create a distinctive scenery. The small towns in its valley are called Ledo, Margherita, Digboi, Duliajan, and Naharkatia (Nahorkotiya). One of the main sources of water for the Brahmaputra River is dihing. The Dihing Valley plains are home to a wide range of plants and animals. The Dihing Plains are where the majority of betel nut production occurs. Total length covers by this river is about 4.61km in Tinsukia District. *(**Source:** Topography of the Brahmaputra River and its Tributaries by Dr.Gururaj Prabhu K.)*

Figure 22. Drainage Map of Tinsukia District



The common hydrological regime is defined by the tropical monsoon climate with alternating dry and wet seasons. Mid-June to mid-September is the rainy season in which 90 percent of the rainfall occurs. The spatiality of rain is also controlled by the orientation of the axis of monsoon trough. Naturally, the base flow is either little or almost lacking. The annual peak flow occurs during the highest monsoon downpour. So, the flood ability, transportability, competency and erosive power of the streams attain their maxima at that time. The network of channel is growing in a random fashion. All these aspects influence the rate of soil erosion in the district in a great way.

a) Drainage System with description of main rivers

Table No. 21: Drainage system with description of main rivers

Sl. No.	Name of the River	Area drained (sq.km.)	% area drained in the district
1.	Brahmaputra River	118.11	3.12 %
2	Doom Dooma River	0.501	0.013 %
3.	Deopani River	0.16	0.004 %
4.	Dibang River	0.6	0.015 %
5.	Dibru River	0.875	0.023 %
6.	Moilajan	0.63	0.016 %
7.	Buri Dehing River	0.9681	0.025%

b) Salient Features of important rivers and streams

Table No. 22: Salient Features of important rivers and streams

Sl. No.	Name of the River/ Stream	Total length in the district (km)	Place of origin	Altitude at origin (m)
1.	Brahmaputra River	25.4	Kailash ranges of Himalayas	5300
2.	Doom Dooma River	16.7	Bordumsa village of Arunachal Pradesh	180
3.	Deopani River	4	Karbi plateau	133
4.	Dibang River	20	Near the Keya pass in the Dibang Valley district of Arunachal Pradesh	1793
5.	Dibru River	17.5	Natun Maithang bujiliban	155
6.	Moilajan River	12.6	Hollong Pathar	171
7.	Buri Dehing River	4.61	Patkai hills of Arunachal Pradesh	2,375

II. Annual deposition of riverbed minerals

Annual deposition of riverbed minerals is dependent on various factors which are explained below.

A) Geomorphological studies

Geomorphological characteristic of a river is foremost factor for annual deposition of sedimentary load. The study includes following parameter:

i) Place of Origin

Details of origin of rivers of Tinsukia District are furnished in Table.

Table No. 23: Place of Origin of important rivers and streams

Sl. No.	**Name of the River or Stream**	**Place of Origin**
1	Brahmaputra River	Kailash ranges of Himalayas
2	Doom Dooma River	Bordumsa village of Arunachal Pradesh
3	Deopani River	Karbi plateau
4	Dibang River	Near the Keya pass in the Dibang Valley district of Arunachal Pradesh
5	Dibru River	Natun Maithang bujiliban
6	Moilajan River	Hollong Pathar
7	Buri Dehing River	Patkai hills of Arunachal Pradesh

ii) Catchment Area

The Tinsukia district of Assam is mainly drained by Brahmaputra, Doom Dooma River, Deopani, Dibang River, Dibru River, Moilajan River, Buri Dehing River which are forming the main catchment area.

Table No. 24: Catchment areas of main rivers of Tinsukia district, Assam

Sl. No.	Name of the River or Stream	Catchment Area (sq. km.)
1	Brahmaputra River	118.11
2	Doom Dooma River	0.501
3	Deopani River	0.16
4	Dibang River	0.6
5	Dibru River	0.875
6	Moilajan River	0.63
7	Buri Dehing River	0.9681

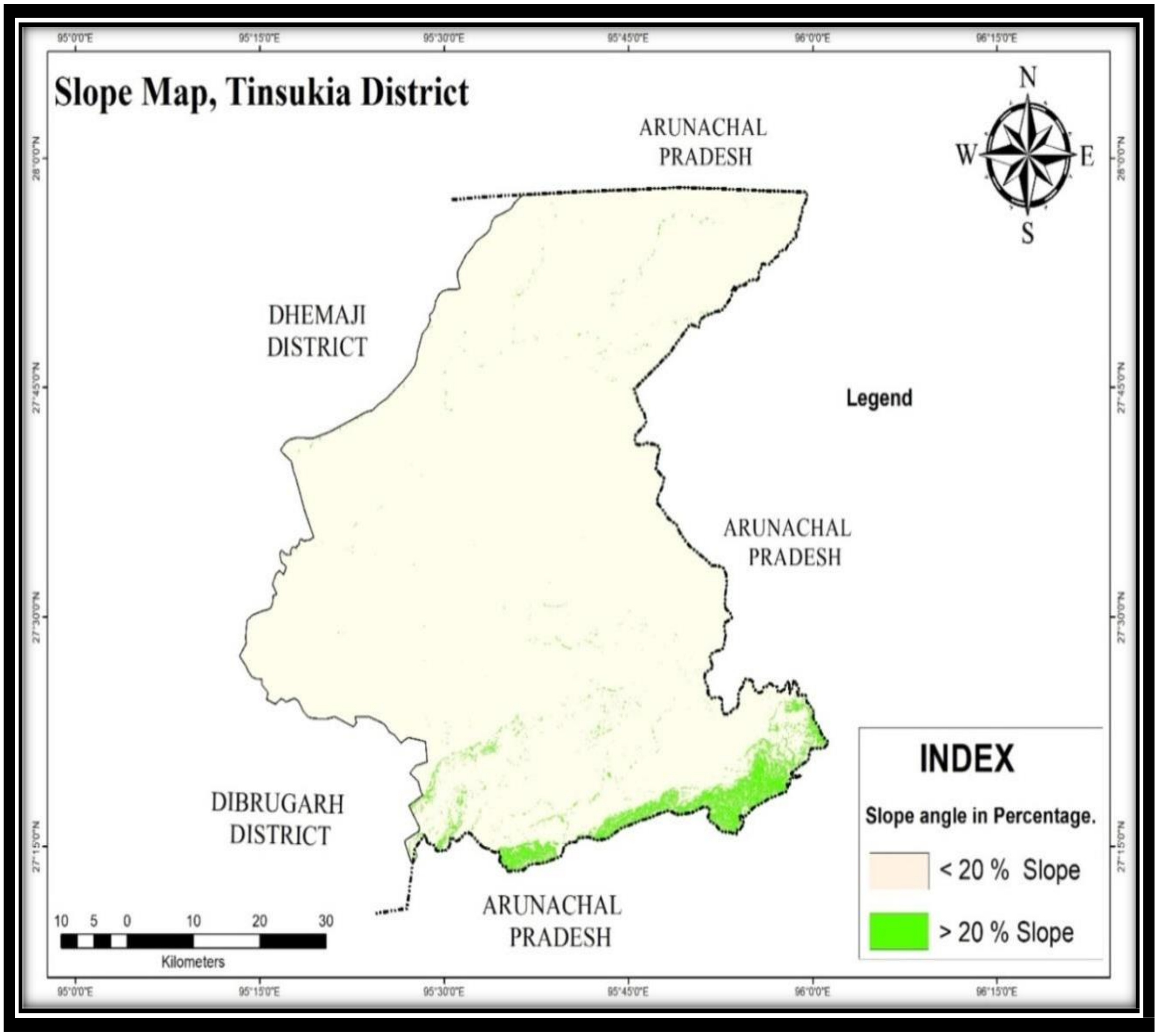
iii) General profile of river stream

If rivers are always straight i.e., if rivers follow straight course the meaning of slope becomes value less, but if the river is curvy and follows a sinusoidal pattern (as is usually the case, at least to some extent), then we have to measure the horizontal distance along the sinuous projection of the course of the river on a horizontal plane. The slope can be measured in feet per mile or some metric units like meters per kilometers. Recalling some trigonometry, we might recognize the tangent of a slope angle although measuring the slope of a river is not an easy matter. The slope of the rivers of the district, in this case, has been measured following the method of Digital Elevation Model (DEM).

To reach the targeted approach, here contour lines are digitized from topographic map using a scale of 1:8000; from this map few contours are also digitized in flat areas. Spot heights are also digitized. From this height data, contour interpolation is completed in ArcGIS approach. This slope map is exported to ERDAS for further processing. The slope map is classified to 0-15 degree or more than 15 degree.

The longitudinal profile and the cross-sectional profile of the streams or rivers is provided in **Annexure IX**.

Figure 23: Slope Map of the Tinsukia district, Assam



*(**Source:** Aquifer Mapping and Management of Ground Water Resources by CGWB)*

iv) Annual deposition Factor

Rivers are important geological agents for erosion, transportation and deposition. Deposition and erosion in river valleys can strongly modulate the downstream delivery of sediment (Fan and Cai, 2005; Malmon et al., 2005). A riverine sediment budget provides an effective conceptual framework within which to quantify sediment mobility, transport, deposition, and storage within a drain-age basin, as well as sediment output from the basin (Walling et al., 2002). It is therefore critical to understand this modulation effect (Walling and Horowitz, 2005). Annual deposition of riverbed materials depends on various factors which are as follows:

Geological erosion and soil erosion are the two basic terms used to describe erosion processes. Geological erosion refers to regular or natural erosion brought on by long-term geological processes that wear down mountains and produce floodplains, coastal plains, and other landforms to develop. Soil erosion happens gradually or at an alarming rate, but it is a continual process. It leads to various negative effects, including ongoing topsoil erosion, ecological harm, soil collapse, and many more.

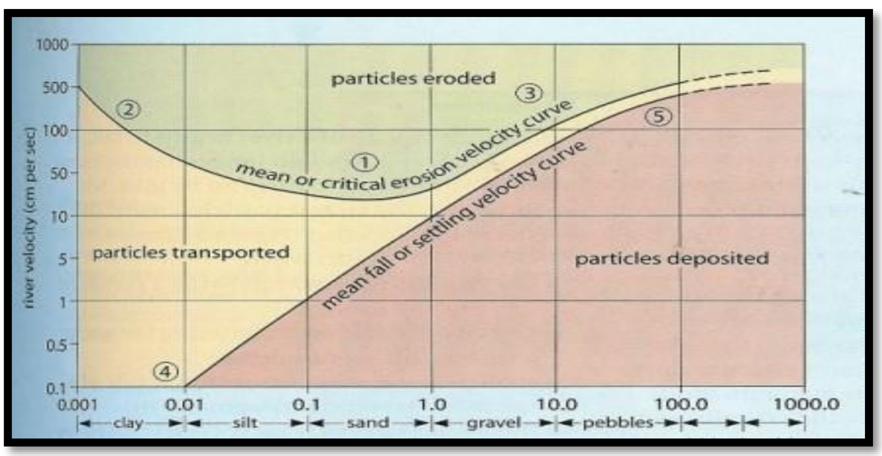
The soil fragments are loosening or being washed away in the valleys, oceans, rivers, streams, or far-off regions throughout this process. Human activities like agriculture and deforestation have contributed to this situation getting worse.

Fluvial erosion is the direct removal of soil particles by moving water. The force of the flowing water and the resistance of the bank material to erosion both affect the pace of fluvial erosion

1. Process of deposition

After erosion, the eroded materials get transported with running water. When the river losses its energy and velocity falls, the eroded material is deposited. A river can lose its energy when rainfall reduces, evaporation increases, friction close to river banks and when enters a shallow area (flood plain) or towards its mouth where it meets another body of water. Hjulström curve showing the relationship between particle size and the tendency to be eroded, transported or deposited at different current velocities.

Figure 24: HJULSTRÖM CURVE



***(Source:** Sediment Petrology, Pettijohn)*

In this diagram, X-axis indicates the grain size in mm and Y-axis indicates the flow velocity of the river in cm. s^{-1}. The lower line of the diagram shows the relationship between flow velocity and particles in motion, with pebbles at 20-30 cm. s^{-1}, medium sand grains at 2-3 cm.s^{-1}, and clay particles at 0 cm s^{-1}. The grain size of particles can indicate the velocity at the time of sediment deposition. The upper line shows the flow velocity required to move a particle from rest, with smaller particles needing higher velocity to move them below coarse silt size due to the properties of clay minerals, which dominate the fine fraction in sediment. Clay minerals are cohesive and stick together, making it difficult to entrain them in a flow. The behavior of fine particles in a flow which has important consequences for deposition in natural depositional environments. Mud can accumulate in any setting where flow stops for long enough for clay particles to be deposited, and resumption of flow does not re-entrain the deposited clay unless the velocity is relatively high. Alterations of mud and sand deposition are seen in intermittent environments, such as tidal settings.

2. Mode of sediment transport in rivers

Sediment transport is the transportation of detrital particles via air, water, ice, or gravity. When transported by air and water (fluid transport), grains (which may be sand particles) travel as a bed load (by rolling, sliding, and saltation) or in suspension when the turbulence keeps the grains moving.

The amount and size of sediment moving through a river channel are determined by three fundamental controls: competence, capacity and sediment supply.

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:

i. Dissolved load

ii. Suspended load

iii. Saltation load

iv. Wash load

v. Bed load

i. **DISSOLVED LOAD:** The amount of sediment carried in solution by a stream's total sediment load, particularly ions from chemical weathering, is known as the dissolved load. Along with suspended load and bed load, it makes up a significant portion of the overall number of debris removed from a river's drainage basin.

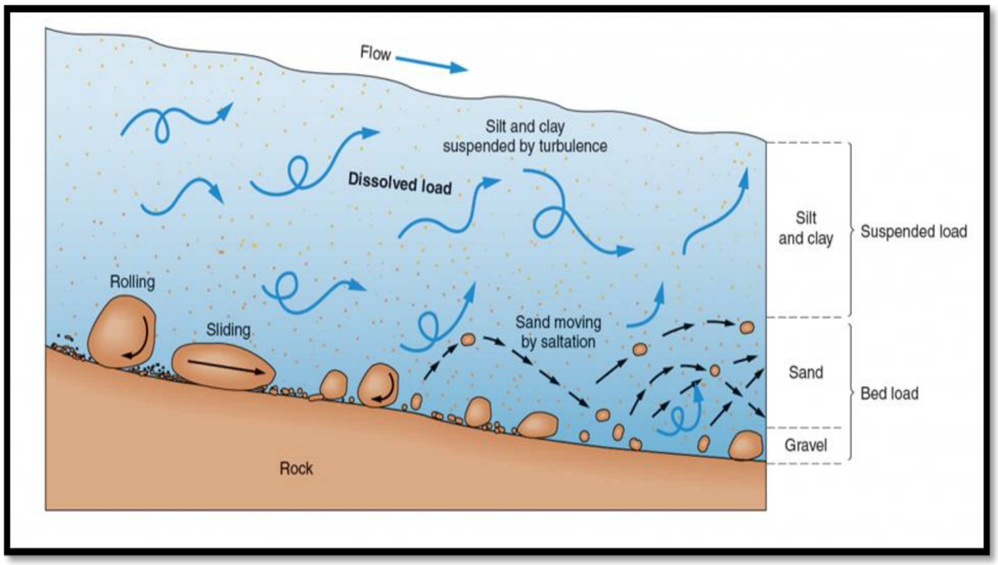
ii. **SUSPENDED LOAD:** The term "suspended load" describes the portion of the total sediment transport that is kept suspended by turbulence in the flowing water for extended periods of time without contact with the stream bottom. Sometimes the particles may float on the surface of the water and thus become the part of the fluid mass. The duration of a particle's suspension is determined by the intensity of turbulence and velocity of the river-flow. It is nearly moving at the same speed as the flowing water.

iii. **SALTATION LOAD:** The portion of the bed load that is moving, either directly or indirectly, as a result of the impact of bouncing, i.e., the intermittent jumping motion of the particles due to presence of eddies, along the stream bed. The smaller particles show higher lift and longer jump.

iv. **WASH LOAD:** Particle sizes smaller than those found in substantial amounts in the bed material make up that portion of the suspended load. It is conveyed through the stream without deposition since it is in almost permanent suspension. The discharge of the wash load through a reach is determined solely by the rate at which these particles become available in the catchment area, not by the flow's transport capacity.

v. **BED LOAD:** Particles that are too large to be carried as suspended load are bumped and pushed along the stream bed as bed load. The larger particles move close to the surface floor by rolling or sliding and occasional low leap. Bed load sediments do not move continuously. Streams with high velocity and steep gradients do a great deal of down cutting into the stream bed, which is primarily accomplished by movement of particles that make up the bed load.

Figure 25: Mode of Sediment Transport in Rivers



***(Source:**https://www.bgs.ac.uk/discovering-geology/geological-processes/deposition/#:~:text=Deposition%20is%20the%20laying%20down, sea%20shells)%20or%20by%20evaporation. (British Geological Survey))*

3. Sediment Transport Rate

The rate at which sediment is moved past a cross section of the flow is called either the sediment transport rate or the sediment discharge. It is related to the sediment load, but it's different, just because different fractions of the sediment load are transported at different rates. It can be measured in mass per unit time, or in weight per unit time, or in volume per unit time. The sediment transport rate is commonly denoted by Qs.

4. Estimation of Sedimentation

There are two approaches to obtaining values describing sediment loads in streams. One is based on direct measurement of the quantities of interest, and the other on relations developed between hydraulic parameters and sediment transport potential.

The total bed material load is equal to the sum of the bedload and the bed material part of the suspended load; in terms of volume transport per unit width, $q_t = q_b + q_s$. Here wash load, i.e. that part of the suspended load that is too fine to be contained in measurable quantities in the river bed, is excluded from q_s.

There are number of equations to compute the total sediment load. Most of these equations have some theoretical and empirical bases.

In 1973, Ackers and White developed a general theory for sediment transport which was calibrated against the flume-transport data then available. Their functions have been widely accepted as one of the best available procedures for estimating the total bed load over the full width of the flow section.

Dendy Bolton formula is often used to calculate the sedimentation yield. But use of these equations to predict sediment yield for a specific location would be unwise because of the wide variability caused by local factors not considered in the equations development. However, they may provide a quick, rough approximation of mean sediment yields on a regional basis. Computed sediment yields normally would be low for highly erosive areas and high for well stabilized drainage basins with high plant density because the equations are derived from average values. The equations express the general relationships between sediment yield, runoff, and drainage area.

5. Sediment Yield

The water that reaches a stream and its tributaries carries sediment eroded from the entire area drained by it. The total amount of erosional debris exported from such a drainage basin is its sediment load or sediment discharge and the sediment yield is the sediment discharge divided by the total drainage area of the river upstream of the cross section at which the sediment discharge is measured or estimated. Sediment yield is generally expressed as a volume or weight per unit area of drainage basin—e.g., as tons per square kilometre. Further, sediment yield is usually measured during a period of years, and the results are thus expressed as an annual average.

v) Replenishment Study (As per EMGSM guidelines, 2020):

Replenishment defines rejuvenation of riverbed sand deposition phenomena. The word replenishment is the fulcrum of riverbed sedimentation under different depositional environmental conditions especially during rainy seasons. The rate of gross or absolute silt production (erosion) in the watershed and the ability of the stream system to transport the eroded material in a river have a direct relation with the quantity of sediment delivered into a river. The rate of gross erosion is dependent upon many physical factors like climatic conditions, nature of soil, and slope of the area, topography and land use. Hydro-physical conditions of the watershed govern the capability of transporting the eroded material. It has been observed that the average rate of sediment production decreases as the size of drainage area increases. And also, larger the watershed, the lesser is the variation between the rates. The larger watershed presents more opportunity for deposition of silt during its traverse from the point of production. The watershed with maximum land use class of forest, generate very low rate of production unless the forests are degraded or open forest. The cultivated watersheds with unscientific farming produce very high rate of silt production. The total amount of eroded material, which reaches a particular hydraulic control point, is termed as sediment yield. The rotational mining is being adopted to facilitate the replenishment of the excavated pits during rainy season. Thus, the mineable area is to be divided in two blocks i.e., the upstream block and the downstream block. The mining of these blocks is suggested on rotation basis in such a way that pit of previous year mining will act as depository for the monsoon season. Sand is extracted from the said lot during one year; more than the extracted quantity of the same are automatically replenished by rainfall in the monsoon by the river/nallah itself on account of its flow and velocity.

For sustainability of river sand mining, it is necessary that the mine pits formed as a result of sand excavation are refilled with sand by natural process of replenishment in a reasonable period of time so that the area is again available for mining. The rate of excavation should be decided in accordance with the rate of replenishment which is the rate at which sand/gravel is deposited on the river flood plain by the river during monsoon season. However, determination of site- specific rate of replenishment is quite difficult as it is dependent on several factors such as geology and topography of the catchment area of the river, breadth of the flood plain, rainfall in that particular year (which is quite variable and not very much predictable much in advance) etc. Dandy-Bolton formula is generally used to calculate the sediment yield. But it is to be kept in mind that to prepare the mining plans of the mines, the factor of annual replenishment is to be taken into consideration while calculating the mineral reserves. It has also been observed that during flooding, all the pits replenish with sand. Hence, mined out areas in the pre- monsoon season will be completely replenished with sand during monsoon. Therefore, it has been assumed that the pits will be replenished after each monsoon.

Base Flow is influenced by incoming groundwater to aquifers and is closely related to watershed characteristics. Understanding baseflow characteristics is of great importance to river ecosystems and water management. Baseflow is the portion of stream flow that is delayed subsurface flow and generally maintained by groundwater discharge. Regardless of the specific climatic environment, its main features are tightly related to geological catchment properties. Understanding the baseflow process is important to deal with various water resource issues, such as water resources management strategies, low flow conditions assessment, hydrological modeling calibration, and water quality studies. However, no direct approach exists for continuously measuring the variability of streamflow recession under different conditions and the corresponding baseflow, because the baseflow is usually affected by diverse climatological and geological factors, with considerable variations in spatio-temporal watershed characteristics (e.g., geology, land use, soil type, etc.) and climatic conditions influence baseflow discharge to streams. Addressing such processes requires quantitative estimates of baseflow discharge across a gradient of watershed types. The development of quantitative methods for baseflow estimation is also necessary to understand water budgets (Stewart et al., 2007), estimate groundwater discharge (Arnold and Allen, 1999) and associated effects on stream temperature (Hill et al., 2013), and address questions of the vulnerability and response of the water cycle to natural and human-induced change in environmental conditions, such as stream vulnerability to legacy nutrients (Tesoriero et al., 2013).

Given the importance of baseflow, many methods have been used to quantify the baseflow component of stream discharge beginning with Boussinesq (1877). Approaches for baseflow estimation can be grouped into two general categories: graphical hydrograph separation (GHS) methods, which rely on stream discharge data alone, and tracer mass balance (MB) methods, which rely on chemical constituents in the stream, stream discharge, and the streamflow end-member constituent concentrations (runoff and baseflow). Many different approaches for GHS exist, including recession curve methods and digital filter methods. Recession curve methods are generally considered more objective than digital filter methods because they provide an assumed integrated signal of basin hydrologic and geologic characteristics through identification of a linear recession constant based on the falling limb of the hydrograph (Barnes, 1939; Hall, 1968; Gardner et al., 2010).

However, in context of the rivers of district, the volume (weight) of the precipitated sand has been derived during Pre-monsoon and Post-monsoon period along with the thickness of the sand layers deposited in the respective periods. But, to erect hydrograph model which is essential for estimation of depth of base flow, data on daily discharge of water volume (weight) is required. Hence, it can be proposed that if these data are provided from the concerned authority of the state government (secondary data- already requested for providence), depth of base flow as well as the hydrograph model can be estimated. The quantitative estimation of the depth of base flow cannot be done due to absence of data. But a relative comparison between the mining depth and depth of baseflow has been done on the basis of collected data by making pit on the river bed.

Usually, replenishment or sediment deposition / depletion quantities can be estimated in the following ways:

- Direct measurement of the sand bar upliftment;
- Monitoring of the new sand bars created in the monsoons within the channel;
- Elimination of sand bars during the monsoon etc.

With systematic data acquisition over a period of several years, regression equations can be developed for modeling of the sediment yield and annual replenishment with variable components.

Several theoretical and empirical formulae can be used for the calculation of catchment runoff and sedimentation loads as thumb rules. Sedimentation in riverbeds depends on catchment areas / characteristics, peak flood of the river. Some of the common empirical formulae used for rough estimation of the Catchment runoffs, Peak Discharge, Bed load transportation and sediment yields for replenishment studies are as under:

- **COMMON METHODS FOR REPLENISHMENT:**

- List of instruments: DGPS, GPS and Hammer.
- List of software: ARC GIS, Google Earth, Microsoft and Google Maps.

➢ CATCHMENT YIELD CALCULATION

The total quantity of surface water that can be expected in a given period from a stream at the outlet of its catchment is known as yield of the catchment in that period. The annual yield from a catchment is the end product of various processes such as precipitation, infiltration and evapotranspiration operating on the catchment. Catchment Yield can be estimated using following formula:

Catchment Yield (m3) =Catchment area (m2) * Runoff coefficient (%) *Rainfall (mts/annum)

The runoff generated from a watershed is estimated using Strange’s Tables Method to get obtain approximate yield results. Runoff from a catchment is dependent upon annual rainfall as well as catchment area and characteristics such as soil types and the type of groundcover / land usage. Remote sensing is used for demarcation of catchment boundaries and computation of catchment area relevant to the drainage system. Strange’s table is used to determine the Runoff coefficient of the catchment.

➢ PEAK FLOOD DISCHARGE CALCULATION

The term “peak discharge” stands for the highest concentration of runoff from the basin area. The accurate estimation of flood discharge remains one of the major challenges as it depends upon physical characteristics of the catchment area and the flood intensity, duration and distribution pattern. There have been many different approaches for determining the peak runoff from an area. As a result, many different models (equations) for peak discharge estimation have been developed. Formulae used for Peak Discharge calculation are as below:

i. As per Dicken’s formula, Q = CA3/4

Where: **Q** is Maximum flood discharge (m3/sec); A is Area of catchment in Sq. Km and **C** is Constant whose value varies widely between 2.8 to 5.6 for catchments in plains and 14 to 28 for catchments in hills

ii. As per Jarvis formula, $Q = CA^{1/2}$

Where: **Q** is Maximum flood discharge (m3/sec); A is Area of catchment in Sq. Km and **C** is Constant whose value varies between 1.77 as minimum and 177 as maximum. Limiting or 100 percent chance floods are given by the value of C of 177.

iii. As per Rational formula, Q = CIA

Where: **Q** is Maximum flood discharge (m3/sec); A is Area of catchment in Sq. Km and **C** is the Runoff coefficient (ratio of runoff to total rainfall) which depends on the characteristics of the catchment area.

I is Intensity of rainfall (in m/sec).

➢ BED LOAD TRANSPORT CALCULATION

The most difficult problem in river engineering is to accurately predict bed load transport rates in torrential floods flowing from mountainous streams. Three modes of transport namely; rolling, sliding and saltation may occur simultaneously in bed load transport. The different modes of transportation are closely related, and it is difficult, if not impossible, to separate them completely. There are a number of equations to compute the total sediment load. Most of these equations have some theoretical and empirical bases.

i. Ackers and White Equation:

Ackers and White (1973) used dimensional analysis based on flow power concept and their proposed formula is as follows.

Ct = Cs Gs (d50/h) (V/U*) n ′ [(Fgr/A1) − 1] m

The dimensionless particle dgr is calculated by:

Dgr = d50 (g(Gs-1)/v2)1/3

The particle mobility factor Fgr is calculated by:

Fgr = (U*n ′/(Gs-1) g d50)1/2 * (V/ (5.66log (10h/ d50))1-n'

Where,

$A1$ = Critical particle mobility factor

Cs = Concentration coefficient in the sediment transport function

Ct = Total sediment concentration

$d50$= Median grain size

dgr= Dimensionless particle diameter

Fgr= Particle mobility parameter

g= Acceleration of gravity

Ds, Sg = Specific gravity

h= Water depth

m= Exponent in the sediment transport function

n'= Manning roughness coefficient

U= Shear velocity

V= Mean flow velocity

ν= Kinematic viscosity

ii. Meyer – Peter's equation:

Meyer-Peter's equation is based on experimental work carried out at Federal Institute of Technology, Zurich. Mayer-Peter gave a dimensionless equation based, for the first time, on rational laws. Mayer- Peter equations giving an empirical correlation of bed load transport rates in flumes and natural rivers. The simplified Meyer-Peter's equation is given below:

gb = 0.417[τ0 (η'/ η)1.5 - τc]1.5

Where,

gb = Rate of bed load transport (by weight) in N per m width of channel per second. η'= Manning's coefficient pertaining to grain size on an unrippled bed and Strickler formula i.e., η'= (1/24) x d1/6 where d is the median size (d50) of the bed sediment in m.

η = the actual observed value of the rugosity coefficient on rippled channels. Its value is generally taken as 0.020 for discharges of more than 11cumecs, and 0.0225 for lower discharges.

τc = Critical shear stress required to move the grain in N/m2 and given by equation τc = 0.687da, where dais mean or average size of the sediment in mm. This arithmetic average size is usually found to vary between d50 and d60.

τ0= Unit tractive force produced by flowing water i.e., γwRS. Truly speaking, its value should be taken as the unit tractive force produced by the flowing water on bed = 0.97γwRS. R is the hydraulic mean depth of the channel (depth of flow for wider channel) and S is the bed slope.

- **SEDIMENT YEILD ESTIMATION**

Sedimentation occurs as the stream velocity decreases thus reducing its ability to carry sediment. Coarse sediments deposit first, which may then interfere with the channel conveyance and may cause rivers to meander and form distributaries. As the area of the flowing water increases, the depth decreases, the velocity is reduced, and eventually even fine sediments begin to get deposited. As a result, deltas may be formed in the upper portion of reservoirs. The deposited material may later be moved to deeper portions of the reservoir by hydraulic processes within the water body.

There are many sediment transport equations which are suitable for use in the prediction of the rate of replenishment of rivers. Some of the common equations used to estimate sediment yields are:

- Dandy – Bolton Equation
- Modified Universal Soil Loss Equation (MUSLE) developed by Williams and Berndt (1977)

Dandy – Bolton Equation:

The formula uses catchment area and mean annual runoff as the key variables. It does not differentiate between the characteristics of basins and streams.

Dandy and Bolton equation estimates all types of sediment yield *i.e.*, through Sheet and rill Erosion, gully Erosion, Channel Bed and bank erosion and mass movement etc. Dandy- Bolton determined the combined influence of runoff and drainage area to compute the sediment yield. They developed two equations *i.e.*, for run off less than 2 inches and for run off more than 2 inches, which are given below:

For run off less than 2 inches:

$(Q<2in)\ S=1289*(Q)\ 0.46*[1.43-0.26\ Log\ (A)]$

For run off more than 2 inches:

$(Q > 2\ in):\ S= 1958*(e\ -0.055*Q)\ *[1.43-0.26\ Log\ (A)]$

Where: S = Sediment yield (tons/sq miles/yr) Q = Mean Annual runoff (inch) A = Net drainage are in sq mile

Modified Universal Soil Loss Equation (MUSLE):

Modified universal soil loss equation (MUSLE) for estimation of sediment yield is also used widely. MUSLE is a modification of the Universal Soil Loss Equation (USLE). USLE is an estimate of sheet and rill soil movement down a uniform slope using rain- fall energy as the erosive force acting on the soil (Wischmeier and Smith 1978). Depending on soil characteristics (texture, structure, organic matter, and permeability), some soils erode easily while others are inherently more resistant to the erosive action of rain- fall.

MUSLE is similar to USLE except for the energy component. USLE depends strictly upon rainfall as the source of erosive energy. MUSLE uses storm-based runoff volumes (weight) and runoff peak flows to simulate erosion and sediment yield (Williams 1995). The use of runoff variables rather than rainfall erosivity as the driving force enables MUSLE to estimate sediment yields for individual storm events. The generalized formula of MUSLE is as below:

$Y=11.8*(Q*qP).56\ *K*Ls*C*P$

Where,

Y = sediment yield of stream (t/yr/km2),

Q = average annual runoff (m3),

K = soil erodibility factor,

qP = Highest discharge recorded (m3/s),

Ls = gradient/slope length,

C = cover management factor,

P = erosion control practice.

A. REPLENISHMENT STUDY BASED ON SATELLITE IMAGERY

To delineate replenishment percentage in the river bed of the district, below mentioned steps have been followed.

- **Satellite imagery studies**

Satellite imagery study involves demarcation of sand/ RBM zones on riverbed of the district. Both pre and post monsoon images need to be analyzed to established potential sand/ RBM zones.

- **Field data collation**

Field data collation was carried out during May- June for all the sand/ RBM zones on continuous basis for pre monsoon period and November – December for all the sand/ RBM zones on continuous basis for post monsoon period. In both the cases, relative elevation levels were captured through GPS/DGPS/ Electronic Total Station. Thickness of the sand/ RBM zones was measured through sectional profiles. The field survey for collect post-monsoon data has been conducted November- December time period in 2023 while preparing the District Survey Report of Tinsukia district.

- **Selection of study profiles**

Study profiles are selected based on the occurrence of the sand / RBM zones in the channel profiles. Aerial extents of each of the profiles are mapped from satellite imageries. Frequency distribution did while selection of the ground truthing of the zones.

- **Data compilation:**

Following data were compiled for generation of this annual replenishment report:

- Elevation levels of the different sand/ RBM zones as measured at site.
- Extents of the sand/ RBM zones are measured from the pre monsoon satellite imageries.
- Sand/ RBM zones production data of the district.

All these data were compiled while estimation of the replenished sand/ RBM zones in the district.

- **Assessment of sediment load in the river:**

Assessment of sediment load in a river is subjective to study of the whole catchment area, weathering index of the various rock types which acts as a source of sediments in the specific river bed, rainfall data over a period not less than 20 years, and finally the detail monitoring of the river bed upliftment with time axis. Again, the sediment load estimation is not a dependent variable of the imaginary district boundary, but it largely depends upon the aerial extents of the catchment areas, which crossed the district and state boundaries.

- **METHODOLOGY FOR CALCULATING THE TOTAL POTENTIAL OF MINOR MINERAL IN THE RIVER BED ANNUAL DEPOSITION**

For estimating the reserve of River Bed Material [Sand/Gravel (Minor Mineral)], the following parameters were considered:

a) The volumes of the reserves are calculated on the basis of the established width, thickness and length of the deposit as per actual field data.

b) The tonnage of the reserve quantity is obtained by multiplying the above volume with the bulk density of mineral to arrive at tonnes per cum (as per lab report).

c) The depth of the reserves has been estimated considering the available deposit thickness and the water level/red line.

The same procedure shall be followed for acquiring post monsoon data, its reserve estimation and then correlating between pre and post monsoon volumes as per table given below:

Table No. 25: Estimation of Sand/ RBM zones Reserves in Pre & Post Monsoon periods in sand/ RBM zones

Estimation of Sand Reserves in Pre & Post Monsoon periods in sand bars										
Sl. NO.	**Deposit zone code**	**Area in Sq. m.**	**Ave. Thickness (m)**	**Quantity (CUM)**	**Sl. NO.**	**Deposit zone code**	**Area in Sq. m.**	**Ave. Thickness (m)**	**Quantity (CUM)**	**Difference (cum) 'YY'**
PRE-MONSOON					**POST-MONSOON**					
1					1					
This table would be added after post-monsoon survey										
Source: *Field Survey and DGPS data*										

Table No. 26: Sediment Load Comparison Pre & Post monsoon period for different rivers of Tinsukia District

River Name	Pre-monsoon No of Ghats	Post-monsoon No of Ghats	Pre-monsoon Sediment Load (CUM)	Post-monsoon Sediment Load (CUM)	Difference (CUM) 'YY'	Percentage Variance (%) (Postmosoon - Premosoon / Postmonsoon *100)
This table would be added after post-monsoon survey						
Source: *Field Survey and DGPS data*						

B. Geological studies

i) Lithology of the catchment area

- **Brahmaputra River:** Unstabilized & unoxidized sand, silt, clay and clay with carbonized wood and minor pebbles.
- **Burhi Dehing River:** Unoxidised alternate sand, silt, clay with minor pebbles.
- **Dibang River River:** Unoxidised sand, silt clay with occasional pebbles and carbonaceous matter.
- **Deopani River:** UN diff. fluvial sediments- sand, silt and clay.
- **Doom Dooma River:** Unoxidised alternate sand, silt, clay with minor pebble. Unoxidized alternate sand, silt, clay with minor pebble, Argillaceous ferruginous sand stone, silt stone, mudstone, lim estone and fossil wood.
- **Dibru River:** UN diff. fluvial sediments- sand, silt and clay.

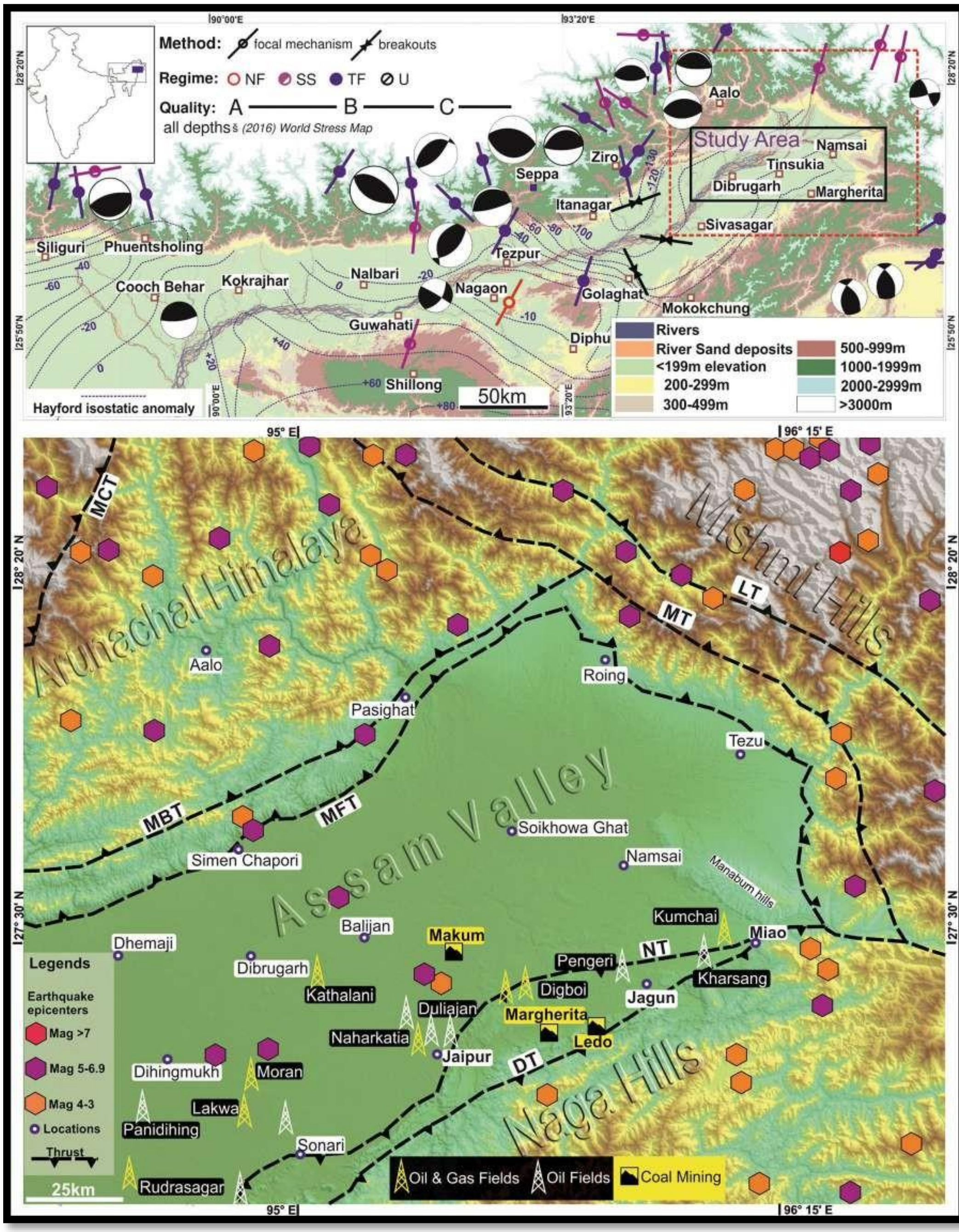
ii) Tectonics and structural behavior of rocks

The Himalayas, which formed from the NER (North-eastern Region) of India to the Hindu Kush area (Afghanistan) in the west, are a result of the contact between the Indian and Eurasian plates, which is why high seismicity prevails in NER (Ghosh et al., 2018). The Himalayan belt is one of the world's most seismically active regions due to the Indian plate's average annual convergence with the Eurasian plate (Catherine, 2004). Because of the tectonic activity underlying it, the active tectonic zone experiences changes that might be slow, quick, or rapid. Folds, fractures, and basin formation are markers of previous tectonic activity-induced deformation (Das et al., 2011). However, the region's sluggish geomorphological changes cannot be seen as modifications in surface deformations or basin drainage patterns and features that are easily seen (Agrawal et al., 2022). The Assam valley, a region characterized by the Himalaya-Tibet and Indo-Burmese collisions, is characterized by the Arunachal Himalaya, Mishmi Hills, and the Assam-Arakan fold-thrust belt. The region has been seismically active, with 167 earthquakes of 2.5 magnitude occurring between December 1908 and November 2020. The maximum compressive stress (SHmax) vectors from the world stress map suggest plate movement in the area, with N-S compression driving the frontal thrust sub-splay systems of the Mishmi and Assam-Arakan fold-thrust belt. The region has experienced several earthquakes between December 1908 and November 2020. There were two significant tectonic development stages in the Assam-Arakan basin. It evolved from an Early Cretaceous to a Late Oligocene composite shelf-slope-basinal system with a passive margin configuration. However, several regions of the mega basin showed distinct evolutionary patterns during the post-Oligocene era, mostly as a result of compressive tectonic pressures.

A brief overview of the Brahmaputra basin's geology can be found in Talukdar et al (2004). This region of the upper Assam valley is crucial for the production of coal and oil. There are numerous coal mines and oil belts (Kent and Dasgupta 2004). The Assam-Arakan fold-thrust belt and the foothill ranges of the Himalayas encircle this area. The Mishmi Thrust (MT) and the Main Frontal Thrust (MFT) delineate the valley's north and northeast boundaries. The northward propagation of NT below the Digboi anticline (Kent et al. 2002), which is the frontal extension of the Naga-Patkai hills range, tectonically delineates the southern portion of the valley. The NT system's hanging wall contains the Digboi oil field (Mathur and Evans 1964). This section of the Brahmaputra valley records Paleogene and Neogene sediments over Precambrian basement rocks, characterized by multiple Oligocene, Miocene, and Pliocene unconformities (Mathur and Evans 1964; Handique et al.1989; Mathur et al. Similar to this, the Schuppen belt has been found to contain Tertiary rocks of comparable age covering Precambrian rocks (Evans 1932; Ranga Rao 1983; Deshpande et al. 1993).

The Digboi doubly plunging anticlinal structure, which emerged from the NT (Kent et al. 2002), is located between Margherita and Jaipur. The river Burhi Dihing flows along the trend of the fore-deep basin formed on the SE back-limb of the structure. In the upper Brahmaputra valley, the drainage networks are largely governed by the tectonic framework. Lahiri and Sinha (2012) reported on seismic survey that the morpho-tectonic evolution of fluvial dynamics is responsible for the formation of basement "highs," channel incorporation to form Majuli River Island, and river Brahmaputra's abandonment. In 2010, Sahoo and Gogoi provided a stratigraphic analysis of the upper Assam basin. By combining surface observations with geophysical data, they were able to determine that, throughout the Eocene, an estuary condition predominated, with typical progradational, aggradational, and transgressive regressive sediment stacking patterns. "...a unique polycyclic basin that involves a shift from Paleocene–Oligocene passive margin setting to Miocene foreland phase followed by an inter-mountain basin," is how Sahoo and Gogoi (2010) summarized the evolution of this basin. Their geophysical investigations revealed the existence of NE and ENE-trending blind normal faults, which were more active in the Oligo-Miocene. Paleogeographic studies conducted by Deb et al. (2012) identified high-probability areas from the upper Assam basin for future exploration in Baghjan (near Doom Dooma, Tinsukia district). Numerous geomorphic anomalies in the Naga piedmont along the NT systems were discovered by Kunte (1988) during his terrain analyses using remote sensing of the Mikir massif and the Naga foothills. These anomalies suggest the possibility of entrapment and hydrocarbon generation. Quantitative models were developed by Singh et al. (2012) to explain how the Schuppen belt affects the petroleum systems in the north Assam shelf in relation to important factors like maturity and petroleum generation in both the shelf and the sub-thrust area.

Figure 26: Tectonics and structural Map of the District



C. Climate Factors

i) Intensity of rainfall

Rainfall and humidity are closely allied in terms of climatology. The district has a climate which is characterised by a highly humid atmosphere, abundant rain and general coolness. Therefore, heavy summer rainfall and high humidity affect the weather of Tinsukia district. The area enjoys a sub-tropical climate with abundance of monsoonal rain. The rainfall is not uniform throughout the district. The average monsoonal rainfall is about 2323 mm. Almost 65 % of precipitation is received during July to September.

ii) Climate zone

The Tinsukia district has sub-tropical tropical/Equatorial climate as Assam lies in the regime of monsoon climate of the sub-tropical belt. So, people of Tinsukia enjoy heavy summer rainfall, abundance of monsoonal rain, experiences winter drought, high humidity and relatively pleasant temperature throughout a year.

iii) Temperature variation

Average temperature of the district is around 36 °C (Max) and minimum of 8 °C. In summer weather becomes hot and humid with temperature range 21°C - 35 °C. The temperature ranges from 17 °C - 21°C degree in winter which begins from October and continues till February. *(**Source:** https://www.tinsukiaonline.in/guide/geography, https://www.indianclimate.com/)*

Annual Deposition:

Annual deposition of riverbed minerals has been calculated on post-monsoon sand volume. The pre-monsoon sand volume of the river is the depleted resources and is replenished by the monsoon rainfall.

- **TOTAL POTENTIAL OF MINOR MINERAL IN THE RIVER BED ANNUAL DEPOSITION**

According to Sustainable Sand Mining Guidelines, 2016 and Enforcement & Monitoring guidelines, for Sand Mining, 2020 mining depth of the mining zones are 1 meter for hilly area.

The annual deposition of riverbed minerals is shown in the Table given below.

Table No. 27: Annual deposition

River Name	**Zone**	**Type of Material**	**Quantity in CUM (as per YY)**	**60% of quantity in CUM**
Brahmaputra River				
Doom Dooma River				
Deopani River				
Dibang River				
Dibru River				
Moilajan River				
Buri Dehing River				
This Table would be added after post-monsoon survey				

1. Riverbed minerals zone area recommended for mineral concession in the above table has been calculated as per the Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) 2020.

2. As per guidelines, mining depth has been restricted to 3 meters depth and distance from the bank is ¼th of river width and not be less than 7.5 meters.

3. Also, mining is prohibited up to a distance of 1 kilometer (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on up-stream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side.

4. Riverbed minerals zone deposits acting as potential sites for sand mining along with other aspects as mentioned above are illustrated in Satellite images in **Annexure VIII.**

III. Riverbed Mineral Potential

Process of disposition etc.:

Sand: Huge quantities of quality sands are found to occur in part of rivers. Smaller patches are also available locally in the other smaller rivers as well.

Table No. 28: Resources of Potential Riverbed Mineral

Boulder (Mcum)	Pebbles/Gravel (Mcum)	Sand/White sand (Mcum)	Total Mineable, Mineral Potential (Mcum)

DETAILS OF POTENTIAL SOURCES / SITES OF RIVER BED MATERIAL

Potential sensitive sites for mining near forests, protected areas, habitation, bridges etc., shall be avoided. For this, a sub-divisional committee may be formed which after the site visit shall decide its suitability for mining. The list of mining leases as per the recommendation of the Committee needs to be defined in the following format given in as **Annexure –V.**

The Sub-Divisional Committee shall make recommendations regarding the suitability of all potential mining sites and also record the reason for approving the specific mining leases on the basis of its field inspections. The details regarding cluster and contiguous cluster formation will be provided as in **Annexure-VI.**

No mining Zone

Mining of river bed materials is prohibited is some places on the river channel due to presence of notable landmarks like, sanctuary or national parks, forests, bridge/public civil structure or highways.

A definition of a protected area was established by IUCN in 1994, which is described as

"*An area of land and /or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.*"

As per the Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) 2020 the restricted zone for mining is a distance from the bank is ¼th of river width and not be less than 7.5 meters. Also, there is a no mining zone up to a distance of 1 kilometre (1 km) from major bridges and highways on both sides, or five times (5x) of the span (x) of a bridge/public civil structure (including water intake points) on upstream side and ten times (10x) the span of such bridge on down-stream side, subjected to a minimum of 250 meters on the upstream side and 500 meters on the downstream side.

No mining zone has been marked for an area up to a width of 100 meters from the active edge of embankments. Also, the concave side of the river is marked as no mining zone, as mining is this area will affect the course of river in future and will erode the river bank.

Mining has a range of environmental consequences for protected areas, whether operations are undertaken within them or nearby. The types of impact may be listed as follows:

- Direct land take and loss of vegetation cover in the mined area and other parts directly affected by associated activities such as deposition of tailings, or consequences such as subsidence;
- Pollution affects, especially on water supplies, aggravated by accidents (e.g., to tailing dams);
- Impacts due to access associated with mining (roads, railways, pipelines, power lines etc.), which permit illegal hunting, habitat fragmentation and alien invasions;
- Secondary effects of human immigration in association with real or perceived livelihood opportunities (e.g., on water supplies, illegal hunting, harvesting of vegetation, alien invasions, illegal land settlements);
- Impacts on other protected area values from noise and visual intrusion, arising from both mining and secondary activities, including transportation.

The 2020 guidelines for sand mining stress on protecting rivers and habitats of species including turtles and calls for such sensitive areas to be declared as no-mining zones. It also called for using the latest technology for surveillance of illegal mining as well as estimating minable reserves.

A United Nations Environment report has said that, led by China and India, the world is mining sand at unsustainable levels exceeding the replenishment rate and that can have far-reaching social and environmental implications. Unsustainable sand mining practices are rampant in India. Despite a set of guidelines in 2016 to curb the practice, illegal and unsustainable sand mining has continued to be common, spurring the Indian government to take another step toward enforcing rules. The environment ministry has now come out with, Enforcement & Monitoring Guidelines for Sand Mining 2020‟ to regulate sand mining and check illegal mining.

This comes four years after the Government's Sustainable Sand Management Guidelines 2016, which was unsuccessful in putting an end to rampant illegal sand mining across the country. The latest guidelines suggest the use of technologies like drones with night vision for surveillance of sand mining sites, steps to identify sources of sand, procedures for replenishment of sand, post environmental clearance monitoring of sand mining sites, a procedure for environmental audit of such areas and steps to control the instances of illegal mining.

Among these, the focus on monitoring of sand mines after environment clearance is considerable given that so far it has been an area where the performance of authorities, central or state, is considered very poor.

The need for the latest version of the guidelines was felt after illegal and unsustainable sand mining continued despite the 2016 guidelines and many court cases. Since 2016, the National Green Tribunal, in many of the cases, stressed on the need of regulating sand mining and passed several orders. The court in some cases even expressed concern over the death of officials who tried to stop illegal mining and noted that on the ground level, illegal mining is still going on. The guidelines are thus a result of many such orders by the NGT wherein the tribunal passed directions to control it.

The new guidelines also laid special emphasis on the protection of rivers and species from sand mining as it called for surveys for identifying the stretches with freshwater turtles or turtle nesting zones. "Similarly, stretches shall be identified for other species of significant importance to the river ecosystem. Such stretches with adequate buffer distance shall be declared as no-mining zone and no mining shall be permitted," the guidelines said.

It also called for a survey report in every district for identifying the sand bearing area but also the "mining and no mining zones" considering various environmental and social factors like the distance of the mining area from the protected area, forest, bridges, important structures and habitation. According to the Sand Mining Framework 2018 of the central Government's Ministry of Mines, in India, there is a shortage of sand in the country, similar to the situation in other developed and developing countries. It estimated that the demand of sand in the country is around 700 million tons (in the financial year 2017) and it is increasing at the rate of 6-7 percent annually even as the quantity of natural generation of sand is static.

Due to uncertainties and inadequateness in supply, the selling rate of the material varies significantly leading to black marketing and illegal mining of the mineral. It noted that illegal and uncontrolled extraction of sand has an adverse environmental impact.

Protect the rivers from illegal sand mining

The main sources of sand in India are considered to be rivers (riverbed and flood plain), lakes and reservoirs, agricultural fields, coastal/marine sand and manufactured sand.

The guidelines focus on identifying sand mining sources, its quantification and feasibility for mining considering various environmental factors like proximity of protected area, wetlands, creeks, forest etc. and presence of important structures, places of archaeological importance, habitation, prohibited area etc.

To protect the rivers from illegal sand mining, the guidelines said that abandoned stream channels on the floodplains should be preferred rather than active channels and their deltas and floodplains.

CHAPTER 8: OVERVIEW OF THE MINING ACTIVITY IN THE DISTRICT

8.1 GENERAL OVERVIEW

To prepare the DSR of Tinsukia district of Assam, geological studies along with structural studies in the quest from knowing more and more pertaining to tectonic set up of this regime, suitability for river bed sand mining and time of deposition of different types of minerals are also important. The common hydrological regime plays a pivotal role for deposition of sand and other minor minerals mainly pebbles, cobbles, gravel and boulder. Assam, from climatological aspect gives a best fit result for economic sand deposits. Here, brown sand is noticeable in the riverbed of Doom Dooma river, Dibang river etc. Silt is also present in significant amount in Brahmaputra River. Clay can be extracted from Deopani River. Sand Gravel is extracted from Deopani River. The spatiality of rain is controlled here by the orientation of the axis of monsoon trough. River bed sand mining or sand mining adjacent to a river or stream has a direct impact on the physical characteristics of the stream such as channel geometry, bed elevation, substratum composition and stability, in-stream roughness of the bed, pro velocity, discharge capacity, sediment transport capacity, turbidity, temperature etc. Alteration or modification of the said attributes may cause hazardous impact on ecological equilibrium of riverine regime.

8.2 LIST OF THE EXISTING MINING LEASES OF THE DISTRICT (LOCATION, AREA, PERIOD FOR EACH MINOR MINERAL):

The existing Sand Mahals, Sand Gravel, Ordinary Earth of the respective ranges in Tinsukia District are attached in **ANNEXURE II.**

8.3 DETAILS OF PRODUCTION OF SAND AND OTHER MINERALS OF TINSUKIA DISTRICT, ASSAM:

- **Total Mineral production of River bed Minerals in the district:**
  - **Production of Doom Dooma Forest Division:**

Table No. 29: Production of Doom Dooma Forest Division of the District for the year 2020-21

Sl. No.	Name of the Mineral	Production (In CuM)
1	Sand	4500
2	Sand Gravel	500
3	Silt	6500

Table No. 30: Production of Doom Dooma Forest Division of the District for the year 2021-22

Sl. No.	Name of the Mineral	Production (In CuM)
1	Sand	4500.00
2	Sand Gravel	500.00
3	Silt	6500.00

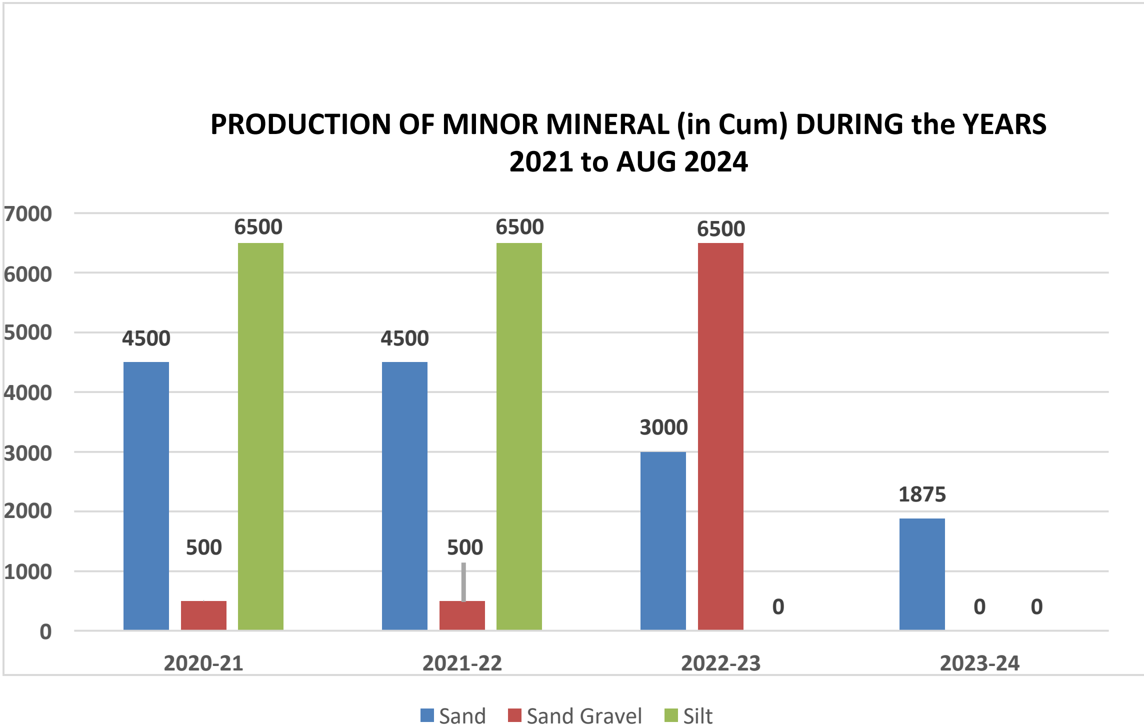
Table No. 31: Production of Doom Dooma Forest Division of the District for the year 2022-23

Sl. No.	Name of the Mineral	Production (In CuM)
1	Sand	3000.00
2	Sand Gravel	6500.00

Table No. 32: Production of Doom Dooma Forest Division of the District for the year 2023-24

Sl. No.	Name of the Mineral	Production (In CuM)
1	Sand	1875.00

Figure 27: Graphical representation details of production of sand or minor minerals during the years 2021-Aug'2024



- **Production of Digboi Forest Division:**

Table No. 33: Production of Digboi Forest Division in case of River Bed Minerals of the District for the year 2022-23

Sl. No.	Name of the Mineral	Production (In CuM)
1	**Sand**	10000

Table No. 34: Production of Digboi Forest Division in case of River Bed Minerals of the District for the year 2023-24

Sl. No.	Name of the Mineral	Production (In CuM)
1	**Sand**	34500

- **Total Mineral production of Digboi Forest Division in case of In-Situ Minerals (Minerals other than river bed minerals) in the district:**

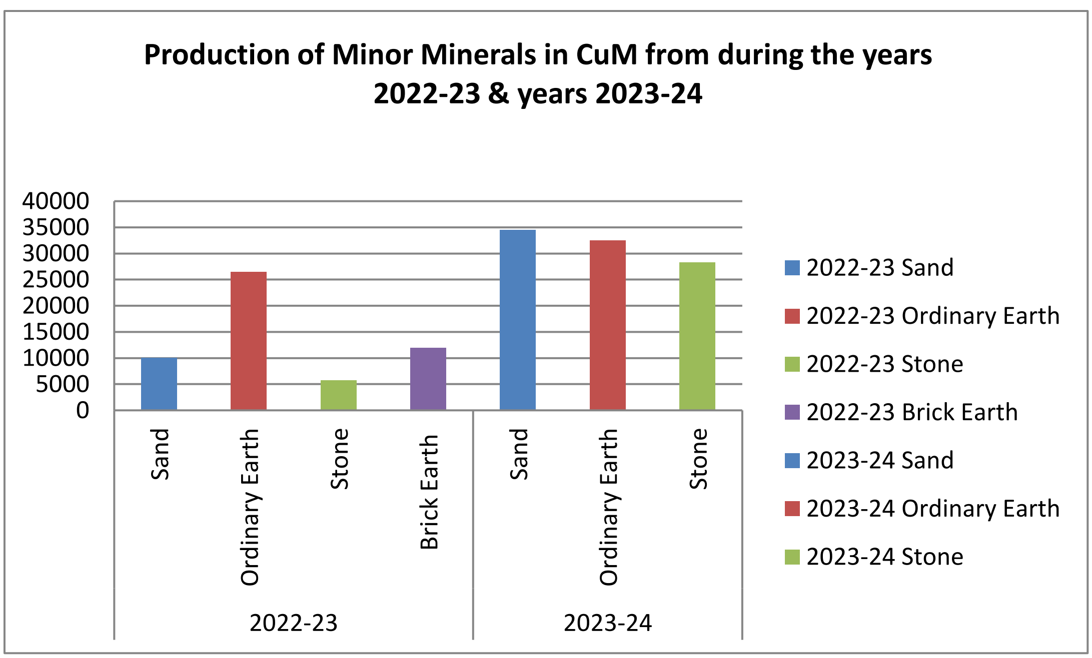
Table No. 35: Production of Digboi Forest Division in case of In Situ Minerals of the District for the year 2022-23

Sl. No.	Name of the Mineral	Production (In CuM)
1	Ordinary Earth	26526
2	Stone	5750
3	Brick Earth	11992

Table No. 36: Production of Digboi Forest Division in case of In Situ Minerals of the District for the year 2023-24

Sl. No.	Name of the Mineral	Production (In CuM)
1	Ordinary Earth	32500
2	Stone	28312

Figure 28: Graphical representation details of production of sand or minor minerals during the years 2022-23 & years 2023-24



CHAPTER 9: DETAILS OF REVENUE GENERATED FROM MINERAL SECTOR DURING LAST THREE YEARS

9.1 REVENUE GENERATION FROM MINERAL SECTOR:

- **Revenue generated in the district for River Bed Minerals (Sand, Sand Gravel, Silt)**
  - **Revenue of Doom Dooma Forest Division:**

Table No. 37: Revenue Generated of Doom Dooma Forest Division for River Bed Minerals in the District for year 2020-2021

Sl. No.	Name of theMineral	Rate (In Rs.)	Royalty (In Rs.)
1	Sand	550.00	24,75,510.00
2	Sand Gravel	617.00	3,08,252.00
3	Silt	25.00	1,63,250.00

Table No. 38: Revenue Generated of Doom Dooma Forest Division for River Bed Minerals in the District for year 2021-2022

Sl. No.	Name of theMineral	Rate	Royalty (In Rs.)
1	Sand	550.00	23,52,508.00
2	Sand Gravel	308.00	1,54,126.00
3	Silt	50.00	3,26,500.00

Table No. 39: Revenue Generated of Doom Dooma Forest Division for River Bed Minerals in the District for year 2022-2023

Sl. No.	Name of theMineral	Rate	Royalty (In Rs.)
1	Sand	495.00	14,86,252.00
2	Sand Gravel	25.00	1,63,250.00

Table No. 40: Total Royalty and Revenue Generated of Doom Dooma Forest Division for in the district

Financial Year	Material types	Royalty (Rs.)	Cess (Rs.)	Total Revenue	Production (In MTs)
2020-2021	Sand	24,75,510.00	nil	24,75,510.00	4500.00cm
	Sand Gravel	3,08,252.00	nil	3,08,252.00	500.00cm
	Silt	1,63,250.00	nil	1,63,250.00	6500.00cm
2021-2022	Sand	23,52,508.00	nil	23,52,508.00	4500.00cm
	Sand Gravel	1,54,126.00	nil	1,54.126.00	500.00cm
	Silt	3,26,500.00	nil	3,26.500.00	6500.00cm
2022-2023	Sand	14,86,252.00	nil	14,86,252.00	3000.00cm
	Sand Gravel	1,63,250.00	nil	1,63,250.00	6500.00cm
2023-2024	Sand	12,00,313.00	nil	12,00,313.00	1875.00cm

- **Revenue of Digboi Forest Division:**

Table No. 41: Revenue Generated of Digboi Forest Division for River Bed Minerals in the District for year 2022-2023

Sl. No.	Name of theMineral	Rate (In Rs.)	Royalty (In Rs.)
1	Sand	140.00	1400000.00

Table No. 42: Revenue Generated of Digboi Forest Division for River Bed Minerals in the District for year 2023-2024

Sl. No.	Name of theMineral	Rate (In Rs.)	Royalty (In Rs.)
1	Sand	140.00	4830000.00

Table No. 43: Revenue Generated of Digboi Forest Division for In-situ Minerals (Stone, Ordinary Earth, Brick Earth) in the District for year 2022-2023

Sl. No.	Name of theMineral	Rate	Royalty (In Rs.)
1	Clay	30.00	795780.00
2	Stone	200.00	1150000.00
3	Brick Earth	30.00	2100060.00

Table No. 44: Revenue Generated of Digboi Forest Division for In-situ Minerals (Stone, Ordinary Earth, Brick Earth) in the District for year 2023-2024

Sl. No.	Name of theMineral	Rate	Royalty (In Rs.)
1	Stone	200.00	6500000.00
2	Brick Earth	30.00	843960.00

Table No. 45: Year wise Royalty received of Digboi Forest Division in the district

Financial Year	Royalty (In Rs.)
2020-2021	5246600.00
2021-2022	2762540.00
2022-2023	5445840.00
2023-2024	12179360.00

CHAPTER 10: TRANSPORT

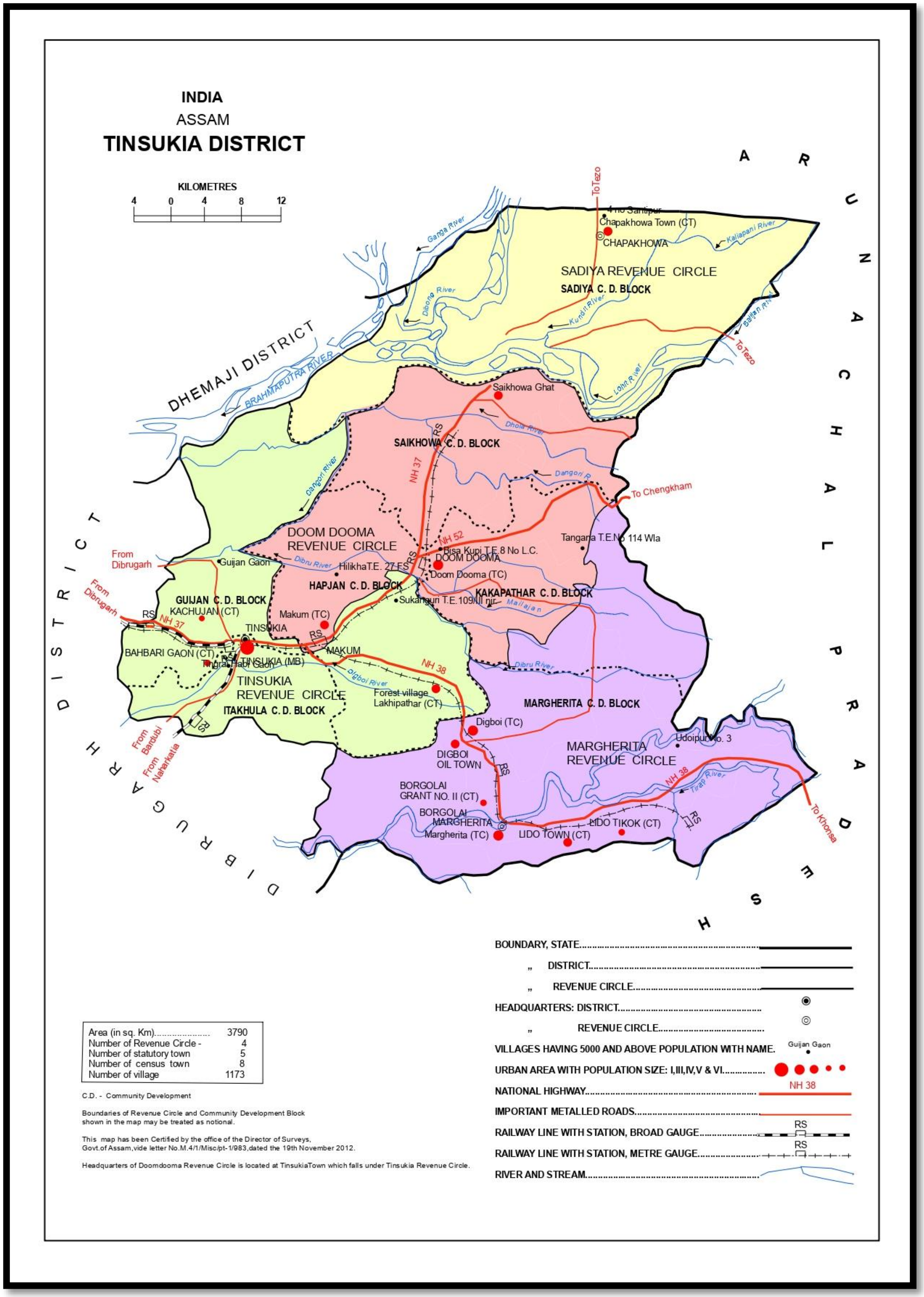
A major road like the National Highway No. 38 runs in southern part of the district (Figure). National Highway-37 runs through the district connecting Dibrugarh with Central Part of Tinsukia District with Saikhowa Ghat in Tinsukia district. Another National Higway No.52 is connecting to Chengkham in Arunachal Pradesh. Road networks are passing through the center of the district connecting Bardubi of Dibrugarh District, Tezo in Arunachal Pradesh. This district is also well connected with day and night bus service with other places such as Guwahati, Dibrugarh, North Lakhimpur, Tezpur, Tinsukia, Nagaon, Itanagar (Arunachal Pradesh) etc. There are also private bus services that are used for transportation to and from the place. Guwahati from the district head quarter is about 526.2 km.

The Northeast Frontier Railway (NFR) passes through the middle of the district. There are 18 railway stations present in this District. Under Tinsukia District, there are two railway junctions in total: Makum (MJN) and New Tinsukia (NTSK). Both have excellent connections to Assamese cities and other Indian states.

Tinsukia District does not have any airport. Mohanbari Airport at Dibrugarh district is the nearest airport and is situated about 36 km away from the District Headquarter. The nearest International airport is Lokpriya Gopinath Bordoloi International Airport, Guwahati which is about 501 km away from the District Headquarter.

Existing sand mining area of the district are connected with the state highways by blacktop or village/link roads. However, there is a scope for development of infrastructural structure. Mining of riverbed sand in the potential areas can generate considerable revenue and can be utilized for development of road network and infrastructure of the district.

Figure 29: Transport Map of Tinsukia District



*(**Source:** Census report of Tinsukia District)*

CHAPTER 11: IN-SITU MINERALS

11.1 MINERAL RESERVE

The sediments of Tertiary Age formed a treasury of few economic mineral deposits in Assam State. Tinsukia District is no exception of these. Oil and Natural Gas are present in this district as commercial oils were established in Digboi area for hydrocarbon. Coal is also present in this district in Makum Coal Field Area. Ordinary Earth is also present in this district as in-situ mineral. Ordinary Earth is used for filling and levelling purposes in construction or embankment, roads, railway or buildings. Brick Earth is also present in this district for manufacturing the bricks. *(**Source**: Miscellaneous Publication of GSI)*

Mineral resources of the district are explained below.

Coal: The Makum Coalfield area in Assam is located in the eastern Himalayan province, along the western side of the Patkai Range in the district of Tinsukia district. The coal seams in this area belong to the Tikak Parbat Formation and Bargolai Formation of Barail Group, and the mine consists of both opencast and underground mines of Tertiary Coal Deposit. These Tertiary strata are folded and distributed into a number of thrust slices. Mishra and Ghosh (1996) state that this belt continues for over 300 km in an ENE-WSW direction. Good quality coal is observed with low ash and moisture content along with high sulphur. The total reserve of these seams is approximately 316 million tones and proven reserved 305 million tones. Four collieries are present in this coal field, including Namdang Colliery, Borgolai Colliery, Ledo Colliery and Tipong Colliery. Another coal resource, Saraipung Tarajan, has 0.5 million tons of proven reserve and is located in the Tinsukia District. With a moisture content of 6.5%, an ash content of around 4.7%, and a fixed carbon content of roughly 44.8%, the coal is quite workable. It happens sporadically throughout a 7-kilometer strike length.

Oil and Natural Gas: The Tinsukia district was home to Digboi Oil Field, one of India's biggest oil fields. A refinery that is as ancient as Asia. Initially, it was unintentionally found in 1867 when a railroad was being built nearby. Its length is 13 km, its width is around 1 km, and it is roughly 9 km in length. It's on anticline that's tightly folded. In the north-west direction, the Naga thrust has severed this anticline's steeper flank. Tipam sandstone, which is Miocene in age, is the oil-bearing deposit. As the first refinery in India, it was put into service in 1901.

Dirok Gas Field was located in block AAP-ON-94/1 B in the Tinsukia district, this field is operated by the Hindustan Oil Exploration Company (HOEC) in partnership with Oil India Limited (OIL) and Indian Oil Corporation Limited (IOCL). The field is thought to contain 11.88 million metric barrels of oil equivalent. As part of the field's Phase II development, three additional development wells are being drilled in addition to a 35-kilometer pipeline being built to Duliajan.

11.2 MINERAL POTENTIAL

Potential minor mineral occurrences have been demarcated in this district survey report. This DSR encompasses the presence of different types of in-situ minor minerals such as pebble, cobbles boulder and silt and ordinary earth etc.

Pebbles, cobbles, boulders are generally found in river channel deposit. It is generally used for building material purposes and also as the road metals.

Ordinary earth is also present in this district. It is generally used for making bricks for building construction and also for embankments, roads railway or buildings etc.

CHAPTER 12: REMEDIAL MEASURE TO MITIGATE THE IMPACT OF MINING

12.1 Environment Sensitivity

Tinsukia district represents a unique geo-environmental setup. The district has a dense vegetation cover; almost 41.78% of total geographical area falls under forest. A significant part of Dibru-Saikhowa National Park falls under the district. Bherjan- Borajan- Padumoni Wildlife Sanctuary is also situated in the district. It consists of very rich biodiversity including various rare and endangered flora and fauna. As human population increases, forests are being depleted for the extension of agricultural lands, introduction of new settlements, roadways etc. the Government of Assam has complied several legal frameworks to protect the reserve forests and other eco-sensitive zones from all sorts of forest degradation including encroachment, illegal felling, lopping, grazing, illegal collection of NTFP, illegal clearance of forests for coal mining, illegal removal of minor minerals etc.

Due to unprecedented growth of population during the last few decades, nature has started reacting sharply to the accumulated human guilt. Soil erosion and its conservation play an important role. The land use practices play the most important role in determining the stability factors in respect of landslide hazards.

12.2 Sand and Stone mining Impact

Another serious environmental problem around the globe in recent years is of sand and gravel mining. Sand mining is a process of extraction of sand from an open pit, river bed, sea beaches, ocean floor, river banks, deltas and island dunes. The extracted sand could be utilized for various types of manufacturing, such as concrete used in the construction of building and other structures. The sand can also be used as an abrasive. The demand for sand will increase with population growth and urbanization. The high demand of sand has led to unsustainable sand mining process resulting in illegal mining.

Although most jurisdictions have legal limit on the location and volume of sand that can be mined, illegal sand extraction is taking place in many parts of the country due to rapid urbanization and industrialization.

Removal or extraction of too much sand from rivers leads to erosion of river banks. Deltas can recede due to sand mining. These destructive effects of sand mining ultimately result in loss of fertile land and property. It also destabilizes the ground and causes failure of engineering structures.

In-stream mining directly alters the channel geometry and bed elevation. Removing sediment from the channel disrupts the pre-existing balance between sediment supply and transporting capacity, typically inducing incision upstream and downstream of the extraction site. The resultant incision alters the frequency of floodplain inundation along the river courses, lowers valley floor water table and frequently leads to destruction of bridges and channelization structures.

In Tinsukia district any minor minerals mining operation would be done under strict supervision of forest officer following all rules and regulations stipulated in Assam Minor Mineral Concession Rules to avoid any environmental and ecosystem degradation.

12.3 Remedial measure

12.3.1. Sustainable Mining Practices:

- The depth mining in riverbed shall not exceed 3 meter or base flow level whichever is less, provided that where the Joint Inspection Committee certifies about excessive deposit or over accumulation of mineral in certain reaches requiring channelization, it can go above 3 meters.
- Mining shall be done in layers of 1 meter depth to avoid ponding effect and after first layer is excavated, the process will be repeated for the next layers.
- No stream should be diverted for the purpose of sand mining. No natural water course and/ or water resources are obstructed due to mining operations.
- No blasting shall be resorted to in river mining and without permission at any other place.

12.3.2 Monitoring the Mining of Mineral and its Transportation:

- For each mining lease site, the access should be controlled in a way that vehicles carrying mineral from that area are tracked and accounted for.
- There should be regular monitoring of the mining activities in the State to ensure effective compliance of stipulated EC conditions and of the provisions under the Minor Mineral Concessions Rules framed by the State Government.

12.3.3 Noise Management:

- Noise arising out of mining and processing shall be abated and controlled at source to keep within permissible limit.
- Restricted sand mining operation has to be carried out between 6 am and 7 pm.

12.3.4 Air Pollution and Dust Management:

- The pollution due to transportation load on the environment will be effectively controlled and water sprinkling will also be done regularly.
- Air pollution due to dust, exhaust emission or fumes during mining and processing phase should be controlled and kept in permissible limits specified under environmental laws.
- The mineral transportation shall be carried out through covered trucks only and the vehicles carrying the mineral shall not be overloaded. Wheel washing facility should be installed and used.

12.3.5 Bio-Diversity Protection:

- Restoration of flora affected by mining should be done immediately. Five times the number of trees destroyed by mining to be planted preferably of indigenous species. Each EC holder shall have to undertake plantation of trees over at least 20% of the total area of lease in the same plot or plots utilised for such working.

- No mining lease shall be granted in the forest area without forest clearance in accordance with the provisions of the Forest Conservation Act, 1980 and the rules made there under.

- Protection of natural home of any wild animal shall have to be ensured.

- No felling of tree near quarry is allowed. For mining lease within 10km of the National Park / Sanctuary or in Eco-Sensitive Zone of the Protected Area, recommendation of Standing Committee of National Board of Wild Life (NBWL) has to be obtained as per the Hon'ble Supreme Court order in I.A. No. 460 of 2004.

- Spring sources should not be affected due to mining activities. Necessary protection measures are to be incorporated.

12.3.6. Management of Instability and Erosion:

- Removal, stacking and utilization of top soil should be ensured during mining. Where top soil cannot be used concurrently, it shall be stored separately for future use keeping in view that the bacterial organism should not die and should be spread nearby area.

- The EC should stipulate conditions for adequate steps to check soil erosion and control debris flow etc. by constructing engineering structures.

- Use of oversize material to control erosion and movement of sediments.

- No overhangs shall be allowed to be formed due to mining and mining shall not be allowed in area where subsidence of rocks is likely to occur due to steep angle of slope.

- No extraction of stone / boulder / sand in landslide prone areas.

- Controlled clearance of riparian vegetation to be undertaken.

12.3.7. Waste Management:

- Site clearance and tidiness is very much needed to have less visual impact of mining**.**

- Dumping of waste shall be done in earmarked places as approved in Mining Plan.

- Rubbish burial shall not be done in the rivers.

12.3.8. Pollution Prevention:

- Take all possible precautions for the protection of environment and control of pollution.

- Effluent discharge should be kept to the minimum and it should meet the standards prescribed.

12.3.9. Protection of Infrastructure:

- Mining activities shall not be done for mine lease where mining can cause danger to site of flood protection works, places of cultural, religious, historical, and archaeological importance.

- For carrying out mining in proximity to any bridge or embankment, appropriate safety zone should be worked out on case-to-case basis, taking into account the structural parameters, location aspects and flow rate, and no mining should be carried out in the safety zone so worked out.

Mining shall not be undertaken in a mining lease located in 300-500 meter of bridge, 300 meter upstream and downstream of water supply / irrigation scheme, 100 meters from the edge of National Highway and railway line, 50 meters from a reservoir, canal or building, 25 meters from the edge of State Highway and 10 meters from the edge of other roads except on special exemption by the Sub-Divisional level Joint Inspection Committee.

CHAPTER 13: SUGGESTED RECLAMATION PLAN FOR ALREADY MINED OUT AREAS

As per statute all mines/quarries are to be properly reclaimed before final closure of the mine. Reclamation plans should include:

1. Baseline survey of river cross section. The study of cross section is basis for delineating channel form. Cross-sections must be surveyed between two monumented endpoints set on the river banks, and elevations should be referenced based on benchmark set in the area;

2. The proposed mining cross-section data should be plotted over the baseline data to illustrate the vertical extent of the proposed excavation;

3. The cross-section of the replenished bar should be the same as the baseline data. This illustrates that the bar elevation after the bar is replenished will be the same as the bar before extraction;

4. A planimetric map showing the aerial extent of the excavation and extent of the riparian buffers;

5. Planting plan developed by a plant ecologist familiar with the flora of the river for any areas such as roads that need to be restored;

6. Each EC holder shall have to undertake plantation of trees over at least 20% of the total area of the plot or plots of land as subject to such working in accordance with a plan approved by the concerned Divisional Forest Officer holding jurisdiction, provided further the competent authority i.e., The Divisional Forest Officer may fix up norms for plantation of trees in a particular area regarding choice of species, spacing, nos of trees and maintenance etc.

7. A monitoring plan has to establish.

CHAPTER 14: RISK ASSESSMENT & DISASTER MANAGEMENT PLAN

Risk analysis is the systematic study of risks encountered during various stages of mining operation. Risk analysis seek to identify the risks involved in mining operations, to understand how and when they arise, and estimate the impact (financial or otherwise) of adverse outcomes. The sand mining operation in the district is mainly done manually.

14.1. Identification of risk due to river sand mining

There is no land degradation due to mining activities as mining is done only on river bed dry surface. There will be no OB or waste generation as the sand is exposed in the river bed and is completely saleable. There will be neither any stacking of soil nor creation of OB dumps. The mining activity will be carried out up to a maximum depth of 3m below the surface level. So, there is no chance of slope failure, bench failure in the mines. However, there are some identified risks in the mining activity which are as follows:

1. Accident during sand loading and transportation
2. Inundation/ Flooding
3. Quick Sand Condition

14.2. Mitigation measures

14.2.1. Measures to prevent accidents during loading and transportation:

- ❖ During the loading, trucks should be brought to a lower level so that the loading operation suits the ergonomic condition of the workers.
- ❖ The workers will be provided with gloves and safety shoes during loading.
- ❖ Opening of the side covers of the truck should be done carefully and with warning to prevent injury to the loaders.
- ❖ Mining operations will be done during daylight only.
- ❖ The truck will be covered with tarpaulin and maintained to prevent any spillage.
- ❖ To avoid danger while reversing the trackless vehicles especially at the embankment and tipping points, all areas for reversing of lorries should be made man free as far as possible.
- ❖ All transportation within the main working will be carried out directly under the supervision and control of the management.
- ❖ Overloading should not be permitted and the maximum permissible speed limit should be ensured.

- There will be regular maintenance of the trucks and the drivers will have valid driving license

14.2.2. Measures to prevent incidents during Inundation/ Flooding:

- To minimize the risk of flooding/ inundation following measures should be under taken:
- Mining will be completely closed during the monsoon months.
- Proper weather information, particularly on rain should be kept during the operational period of mines so that precautionary measures will be undertaken.

14.2.3. Measures for mitigation to quick sand condition:

- Quicksand zone and deep-water zone will be clearly demarcated and all the mine workers will be made aware of the location.
- Mining will be done strictly as per the approved mining plan.

14.3. Disaster Management Plan

As the depth of mining will be maximum of 3m below the surface level considering local condition, the risk related to mining activity is much less. The mining operation will be carried out under the supervision of experienced and qualified Mines Manager having Certificate of Competency to manage the mines granted by DGMS. All the provisions of Mines Act 1952, MMR 1961 and Mines Rules 1955 and other law applicable to mine will strictly be complied. During heavy rainfall and during the monsoon season the mining activities will be closed. Proper coordination with Irrigation Department should be maintained so that at the time of releasing water, if any, from the dam suitable warning/information is given in advance. Special attention and requisite precautions shall be taken while working in areas of geological weakness like existence of slip, fault etc. The mining site will be supplied with first aid facilities and the entire mines worker will have access to that.

CHAPTER 15: CONCLUSION & RECOMMENDATIONS

15.1 CONCLUSION

Sand mining or River Bed Minerals mining (used here as a generic term that includes mining of any riverine aggregates regardless of particle size) is a global activity that is receiving increasing media attention due to perceived negative environmental and social impacts. As calls grow for stronger regulation of mining, there is a need to understand the scientific evidence to support effective management. This paper summarizes the results of a structured literature review addressing the question, the review found that most investigations have focused on temperate rivers where sand or river bed mineral mining occurred historically but has now ceased. Channel incision was the most common physical impact identified; other physical responses, including habitat disturbance, alteration of riparian zones, and changes to downstream sediment transport, were highly variable and dependent on river characteristics. Ecosystem attributes affected included macro invertebrate drift, fish movements, species abundance and community structures, and food web dynamics. Studies often inferred impacts on populations, but supporting data were scarce. Limited evidence suggests that rivers can sustain extraction if volumes (weight) are within the natural sediment load variability. Significantly, the countries and rivers for which there is science-based evidence related to sand or river bed mineral mining are not those where extensive sand mining or gravel, pebbles, boulder extraction is currently reported. The lack of scientific and systematic studies of mining in these countries prevents accurate quantification of mined volumes (weight) or the type, extent, and magnitude of any impacts. Additional research into how river bed mining is affecting ecosystem services, impacting biodiversity and particularly threatened species, and how mining impacts interact with other activities or threats is urgently required.

The rapid rise in urbanization and construction of large-scale infrastructure projects are driving increasing demands for construction materials globally. United Nations Environment Programme (UNEP; 2014) estimated that between 32 and 50 billion tonnes of sand and gravel are extracted globally each year with demand increasing, especially in developing countries (Schandl et al., 2016). Rivers are a major source of sand and gravel for numerous reasons: cities tend to be located near rivers so transport costs are low; river energy grinds rocks into gravels and sands, thus eliminating the cost of mining, grinding, and sorting rocks; and the material produced by rivers tends to consist of resilient minerals of angular shape that are preferred for construction (whereas wind-blown deposits in deserts are rounder and less suitable. Sand mining or river bed minerals mining activities are one of many recognized pressures affecting riverine ecosystems, where biodiversity is already in rapid decline (World Wildlife Fund, 2018). Increasingly, there are media reports about the negative environmental and social impacts of river bed mining, and as calls grow for stronger regulation of mining (Schandl et al., 2016), there is a need to understand the scientific evidence of mining impacts to underpin management.

Impacts of sand mining or river bed mineral mining on rivers may be two types such as direct or indirect. Direct impacts are those in which the extraction of material is directly responsible for the ecosystem impact, such as due to the removal of flood plains habitat. Indirect impacts are related to ecosystem changes that are propagated through the system due to physical changes in the river system resulting from sand extraction. For example, the removal of material from a river can alter the channel, river hydraulics, or sediment budget which in turn can alter the distribution of habitats and ecosystem functioning. These types of impacts can be difficult to attribute to river bed mining, as they may require long time frames to emerge, and other interventions can result in similar changes. The situation is further complicated by the existence of geomorphic thresholds in river systems (Schumm, 1979). Alterations linked to removal of sand, gravel, pebbles, boulder from rivers may not be gradual and/or linear, and only limited changes may be observed for an extended period, but once a threshold is reached, change may become rapid and irreversible. Whether the impacts of sand or river bed mineral mining are positive, neutral, or negative depends on the situation and perceptions of different stakeholders.

During the preparation of the present report prominent rivers/ streams has been studied in detail. These mineral concessions shall also reduce demand load and will be helpful to minimize illegal extraction of minerals, failure of which may result in to illegal mining at odd hours and shall be haphazard and more detrimental to the local ecology. Irrespective of it following geo-scientific considerations are also suggested to be taken into account during the river bed mining in a particular area:

1. Abandoned stream channels or terrace and inactive floodplains may be preferred rather than active channels and their deltas and floodplains.

2. Stream should not be diverted to form inactive channel.

3. Mining below subterranean water level should be avoided as a safeguard against environmental contamination and over exploitation of resources.

4. Mining area should be demarcated on the ground with Pucca pillars so as to avoid illegal unscientific mining.

15.2 Recommendation:

1. The mining lease distribution for the district must be carried out by involving a district level committee constituted with inter-disciplinary members of various departments including irrigation and waterways, DL&LRO, forest, biodiversity, wetland management, SWID or any other relevant department which the district authority may find suitable to include.

2. While recommending for Mining Leases, the District Level Committee should ensure the protection of Biodiversity Zones as recorded by relevant Government Agenesis from time to time.

3. It is recommended to have a periodical review along with primary data collection during pre- and post-monsoon periods to record the seasonal variance of the sedimentation rate on annual basis and update replenishment rate of the district.

4. Efforts should be given to restrict distribution of mining leases along the confluence zone of the rivers where rich aquatic habitats are reported.

CHAPTER 16: REFERENCES

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ANNEXURE – I

- **Details of Sand / M – Sand Source**

  a) **Rivers,**

  b) **De-siltation location: (Lakes/Ponds/Dams etc.)**

  c) **Patta Lands/khatedari Land**

  d) **M-Sand Plants**

a) Rivers:

Sl No	River Name / M-Sand plant	Total stretch of River (in Km)	Type Of River
1	Doom Dooma	16.7	Perennial
2	Deopani River	4	Perennial
3	Dibang River	20	Perennial
4	Dibru River	17.5	Perennial
5	Moilajan River	12.6	Perennial
6	Buridehing River	4.61	Perennial

b) List of De-siltation location (Lake, Pond, Dams, River)

Name	Maintain /Controlled by Sate Govt./PSU etc.	Location	District	Lake/Pond/Dams/River/Canal	Tehsil	Size (Ha)	Existing /Proposed
DD/3	Controlled by State Govt.	The boundary of the **DD/3** Di-Siltation area is 4.5 ha area starts from the **27º34'5.50", 95º35'34.80"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º33'50.5", 95º34'01.0"** Geo-coordinate**.**	Tinsukia	River	Doomdooma	4.85	Existing
DD/2 Permit area	Controlled by State Govt.	The boundary of the **DD/2** Di-Siltation area 2.53 ha is starts from the **27º33'43.59", 95º33'32.18"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º33'49.80", 95º33'12.90"** Geo-coordinate**.**	Tinsukia	River	Doomdooma	2.53	To be Proposed

DD/1 Permit area	Controlled by State Govt.	The boundary of the **DD/1** Di-Siltation area is 1.34 ha area starts from the **27º33'32.21", 95º33'3.899"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º33'49.30", 95º33'06.80"** Geo-coordinate**.**	Tinsukia	River	Doomdooma	1.34	Proposed
DD/5	Controlled by State Govt.	The boundary of the **DD/5** Di-Siltation area is 4.98 ha area starts from the **27º32'43.60", 95º33'00.90"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º32'28.00", 95º33'46.30"** Geo-coordinate**.**	Tinsukia	River	Doomdooma	4.98	Proposed
DD/6	Controlled by State Govt.	The boundary of the **DD/6** Di-Siltation area is 4.98 ha area starts from the **27º32'4.93", 95º34'14.74"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º31'38.73", 95º34'47.37"** Geo-coordinate**.**	Tinsukia	River	Doomdooma	4.98	To be Proposed
KH/1	Controlled by State Govt.	The boundary of the **KH-1** Di-Siltation area is 3.45 ha area starts from the **27º24'30.00", 95º51'33.90"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º23'36.779", 95º49'44.368"** Geo-coordinate**.**	Tinsukia	River		3.45	Proposed
SD/5	Controlled by State Govt.	The boundary of the **SD/5** Di-Siltation area is 4.49 ha area starts from the **27º56'46.72", 95º39'9.54"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º56'38.87", 95º39'16.72"** Geo-coordinate**.**	Tinsukia	River	Sadiya	4.49	Proposed

SD/6	Controlled by State Govt.	The boundary of the **SD/6** Di-Siltation area is 4.5 ha area starts from the **27º54'6.52", 95º38'10.34"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º53'50.43", 95º38'5.76"** Geo-coordinate**.**	Tinsukia	River	Sadiya	4.5	Proposed
SD/1	Controlled by State Govt.	The boundary of the **SD/1** Di-Siltation area is 4.0 ha area starts from the **27º54'24.10", 95º38'21.80"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º54'19.31", 95º38'17.06"** Geo-coordinate**.**	Tinsukia	River	Sadiya	4	Proposed
SD/7	Controlled by State Govt.	The boundary of the **SD/7** Di-Siltation area is 3.0 ha area starts from the **27º53'43.25", 95º38'00.28"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º53'36.74", 95º38'7.22"** Geo-coordinate**.**	Tinsukia	River	Sadiya	3	To be proposed
SD/8	Controlled by State Govt.	The boundary of the **SD/8** Di-Siltation area is 2.5 ha area starts from the **27º56'5.26", 95º38'51.73"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º56'0.12", 95º38'57.34"** Geo-coordinate**.**	Tinsukia	River	Sadiya	2.5	To be proposed
SD/3	Controlled by State Govt.	The boundary of the **SD/3** Di-Siltation area is 4.8 ha area starts from the **27º56'27.4", 95º39'22.3"** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º56'5.51", 95º39'29.56"** Geo-coordinate**.**	Tinsukia	River	Sadiya	4.8	To be proposed

SD/4	Controlled by State Govt.	The boundary of the **SD/4** Di-Siltation area is starts from the **27º48’48.60”, 95º40’09.20”** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º48’51.8”, 95º40’07.7”** Geo-coordinate**.**	Tinsukia	River	Sadiya		To be proposed
DD/4	Controlled by State Govt.	The boundary of the **DD/4** Di-Siltation area is 5.1 ha starts from the **27º33’18.70”, 95º36’44.90”** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º33’31.60”, 95º35’54.30”** Geo-coordinate**.**	Tinsukia	River	Doomdooma	5.1	To be proposed
Kp-1	Controlled by State Govt.	The boundary of the **Kp-1** Di-Siltation area is 1.8 ha starts from the **27º35’54.30”, 95º37’29.70”** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º35’45.8”, 95º37’14.7”** Geo-coordinate**.**	Tinsukia	River	Doomdooma	1.8	To be proposed
DD/7	Controlled by State Govt.	The boundary of the **DD/7** Di-Siltation area is 5.1 ha starts from the **27º33’16.07”, 95º36’44.52”** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º32’55.80”, 95º37’05.69”** Geo-coordinate**.**	Tinsukia	River	Doomdooma	4.46	To be proposed
DD/8	Controlled by State Govt.	The boundary of the **DD/8** Di-Siltation area is 2.46 ha starts from the **27º30’05.90”, 95º36’54.90”** Geo-coordinate and then runs along with down-stream of the river **Doomdooma** up to **27º29’43.19”, 95º36’46.90”** Geo-coordinate**.**	Tinsukia	River	Doomdooma	2.46	To be proposed

c) List of Patta Lands / Khatedari land

Owner	Area Kanal / Nala / Tilla	GPS Coordinates	Material / Forest Produce/ Mineral	District	Tehsil	Village	Agricultural Land (Yes / No)
NA							

d) M-Sand plants with location:

Sl. No.	Plant Name	Owner	District	Tehsil	Village	Geolocation		Quantity (Tonnes /Annum)
						Latitude	Longitude	
NA								

ANNEXURE – II

- **List of Potential Mining Leases (existing)**
  - **Rivers**
  - **Patta Lands/Khatedari Land: (existing)**
  - **De-Siltation Location: (Lakes/Ponds/Dams etc.) (existing)**
  - **M-Sand Plants: (existing)**

➢ **List of existing mining zones of the district with location, area, period for each minor mineral (River Bed)**

Sl.No.	River Details	Name of the mines or Desilting sites	Area (Ha)	Geolocation		Distance in (km) from PA/BR/WC	Distance from Forest Area (in km)	Mining Leases within 500 meters (if yes cluster area)	Production as per EC (MT)	Mineral to be mined (Sand/ Bajri/ RBM etc)	Existing /Proposed
				Latitude	Longitude						
1	Doom-dooma	DD/3	4.85	27º34’3.43”N 27°33'50.50"N 27°33'49.86"N 27°34'3.06"N	95º35’6.12”E 95°34'1.00"E 95°34'1.10"E 95°35'36.55"E	No PA/BR/WC available in 500m	No forest available in 500m	No	10500 cum	Sand	Existing
2	Doom-dooma	DD/2 Permit area	2.5	27°33'49.50"N 27°33'49.80"N 27°33'43.59"N 27°33'43.13"N	95°33'12.50"E 95°33'12.90"E 95°33'32.18"E 95°33'31.53"E	No PA/BR/WC available in 500m	No forest available in 500m	No	—	Sand	Existing
3	Dibru	DD/1 Permit area	1.34	27°33'32.06"N 27°33'32.22"N 27°33'49.68"N 27°33'49.30"N	95°33'3.12"E 95°33'3.90"E 95°33'6.13"E 95°33'6.80"E	No PA/BR/WC available in 500m	No forest available in 500m	No	4000 cum	Sand	Existing
4	Dibru	DD/5	4.98	27°32'43.60"N 27°32'43.88"N 27°32'28.00"N 27°32'27.48"N 27°32'35.03"N	95°33'0.90"E 95°33'1.94"E 95°33'46.30"E 95°33'45.06"E 95°33'16.58"E	No PA/BR/WC available in 500m	No forest available in 500m	No	105000 cum	Sand	Existing
5	Dibru	DD/6	4.98	27°32'4.93"N 27°32'3.73"N 27°31'38.73"N 27°31'37.51"N	95°34'14.74"E 95°34'14.09"E 95°34'47.37"E 95°34'47.09"E	No PA/BR/WC available in 500m	No forest available in 500m	No	105000 cum	Sand	Existing

6	Burhi-dihing	KH/1	3.45	27°24'30.00"N 27°23'45.79"N 27°24'3.300"N 27°24'28.76"N 27°23'44.27"N 27°24'1.142"N 27°24'35.54"N 27°24'33.69"N 27°23'43.39"N 27°23'42.78"N 27°23'35.007"N 27°23'36.779"N	95°51'33.90"E 95°49'8.543"E 95°48'34.600"E 95°51'34.173"E 95°49'7.362"E 95°48'34.045"E 95°50'22.139"E 95°50'22.365"E 95°49'53.653"E 95°49'55.43"E 95°49'43.968"E 95°49'44.368"E	No PA/BR/WC available in 500m	No forest available in 500m	No	75000 Cum	Sand gravel	Existing
7	Deopani	SD/5	4.49	27°56'46.72"N 27°56'38.85"N 27°56'38.87"N 27°56'46.64"N	95°39'9.54"E 95°39'10.40"E 95°39'16.72"E 95°39'16.87"E	No PA/BR/WC available in 500m	No forest available in 500m	No	75000 cum	Sand gravel	Existing
8	Deopani	SD/6	4.5	27°54'6.52"N 27°54'5.81"N 27°53'51.42"N 27°53'50.43"N	95°38'10.34"E 95°38'13.09"E 95°38'2.36"E 95°38'5.76"E	No PA/BR/WC available in 500m	No forest available in 500m	No	75000 cum	Sand gravel	Existing
9	Deopani	SD/1	4	27°54'24.10"N 27°54'21.85"N 27°54'21.20"N 27°54'19.31"N	95°38'21.80"E 95°38'19.58"E 95°38'28.63"E 95°38'17.06"E	No PA/BR/WC available in 500m	No forest available in 500m	No	75000 cum	Sand gravel	Existing
10	Deopani	SD/7	3	27°53'43.25"N 27°53'41.22"N 27°53'39.83"N 27°53'36.74"N	95°38'0.28"E 95°38'8.79"E 95°37'59.17"E 95°38'7.22"E	No PA/BR/WC available in 500m	No forest available in 500m	No	20000 cum	Sand gravel	Existing
11	Deopani	SD/8	2.5	27°56'5.26"N 27°56'4.36"N 27°56'0.84"N 27°56'0.12"N	95°38'51.73"E 95°38'58.74"E 95°38'50.79"E 95°38'57.34"E	No PA/BR/WC available in 500m	No forest available in 500m	No	—	Sand gravel	Existing

12	Deopani	SD/3	4.8	27º56’27.4”N 27°56'9.40"N 27°56'25.85"N 27°56'5.51"N	95º39’22.3”E 95°39'32.10"E 95°39'19.45"E 95°39'29.56"E	No PA/BR/WC available in 500m	No forest available in 500m	No	—	Sand Gravel	Existing
13	Deopani	SD/4	2.43	27º48’48.6”N 27°48'52.90"N 27°48'55.20"N 27°48'51.80"N	95º40’09.2”E 95°39'57.40"E 95°40'0.00"E 95°40'7.70"E	No PA/BR/WC available in 500m	No forest available in 500m	No	—	Ordinary clay	Existing
14	Moilajan	DD/4	5.1	27º33’18.70”N 27°33'31.60"N 27°33'18.32"N 27°33'30.92"N	95º36’44.90”E 95°35'54.30"E 95°36'46.76"E 95°35'55.40"E	No PA/BR/WC available in 500m	No forest available in 500m	No	14000 cum	Sand	Existing
15	Doom-dooma	Kp-1	1.8	27º35’54.3”N 27°35'55.00"N 27°35'45.70"N 27°35'45.80"N	95º37’29.70” 95°37'31.70"E 95°37'14.10"E 95°37'14.70"E	No PA/BR/WC available in 500m	No forest available in 500m	No	4000 cum	Sand	Existing
16	Moilajan	DD-7	4.46	27º33’16.07”N 27°33'15.59"N 27°32'56.37"N 27°32'55.80"N	95º36’44.52”E 95°36'43.67"E 95°37'5.08"E 95°37'5.69"E	No PA/BR/WC available in 500m	No forest available in 500m	No	—	Sand	Existing
17	Dibru	DD-8	2.46	27º30’05.90”N 27°29'43.19"N 27°29'43.66"N 27°30'5.61"N	95º36’54.90”E 95°36'46.90"E 95°36'46.06"E 95°36'53.92"E	No PA/BR/WC available in 500m	No forest available in 500m	No	—	Sand	Existing
18	Kundil River	SD/2	2.5	27°49'28.74"N 27°49'27.23"N 27°49'18.60"N 27°49'21.88"N	95°39'54.63"E 95°39'57.27"E 95°39'51.23"E 95°39'49.49"E	No PA/BR/WC available in 500m	No forest available in 500m	No	—	Ordinary clay	Existing
19	Dehing River	DIG/A	4.16	27°24'15.36"N 27°24'12.59"N 27°24'6.88"N 27°24'4.46"N	95°53'47.60"E 95°53'50.58"E 95°53'35.51"E 95°53'37.20"E	No PA/BR/WC available in 500m	No forest available in 500m	No	30421 m3	Sand	Existing

20	Dehing River	DIG/B	4.36	27°22'13.67"N 27°22'12.52"N 27°22'11.39"N 27°22'10.43"N 27°22'5.25"N 27°22'4.78"N 27°21'56.88"N 27°21'55.57"N	95°56'57.00"E 95°56'56.83"E 95°56'47.70"E 95°56'48.28"E 95°56'34.16"E 95°56'32.13"E 95°56'38.67"E 95°56'38.31"E	No PA/BR/WC available in 500m	No forest available in 500m	No	30000m3	Sand	Existing
21	Dehing River	DIG/C	4.75	27°22'10.27"N 27°22'9.04"N 27°22'8.77"N 27°22'7.51"N 27°22'7.19"N 27°22'6.91"N 27°22'4.51"N 27°21'55.66"N 27°21'54.69"N	95°56'32.04"E 95°56'30.60"E 95°56'23.04"E 95°56'22.99"E 95°56'7.65"E 95°56'6.69"E 95°56'6.77"E 95°56'16.51"E 95°56'17.68"E	No PA/BR/WC available in 500m	No forest available in 500m	No	23356m3	Sand	Existing
22	Dehing River	DIG/D	4.5	27°22'9.49"N 27°22'10.42"N 27°22'18.87"N 27°22'19.94"N 27°22'20.75"N 27°22'19.35"N 27°22'17.42"N 27°22'18.20"N	95°55'25.65"E 95°55'24.46"E 95°55'31.51"E 95°55'31.37"E 95°55'48.40"E 95°55'46.64"E 95°55'59.96"E 95°56'0.55"E	No PA/BR/WC available in 500m	No forest available in 500m	No	20000m3	Sand	Existing

23	Dehing River	DIG/E	4.5	27°19'36.31"N 27°19'36.83"N 27°19'30.53"N 27°19'19.45"N 27°19'7.14"N 27°18'55.37"N 27°18'54.82"N 27°19'6.99"N 27°19'19.16"N 27°19'30.00"N 27°19'38.30"N	95°51'6.75"E 95°51'6.89"E 95°51'22.01"E 95°51'31.21"E 95°51'22.32"E 95°51'33.54"E 95°51'33.49"E 95°51'23.02"E 95°51'31.70"E 95°51'21.50"E 95°51'23.92"E	No PA/BR/WC available in 500m	No forest available in 500m	No	120955 m3	Sand	Existing
24	Dehing River	DIG/J	4.45	27°17'48.93"N 27°17'45.98"N 27°17'42.52"N 27°17'39.09"N	95°40'33.01"E 95°40'36.80"E 95°40'24.43"E 95°40'28.37"E	No PA/BR/WC available in 500m	No forest available in 500m	No	19700 m3	Sand	Existing
25	Dehing River	DIG/K	4.75	27°17'58.45"N 27°17'54.45"N 27°17'54.23"N 27°17'58.25"N	95°41'45.74"E 95°41'45.64"E 95°41'32.86"E 95°41'32.17"E	No PA/BR/WC available in 500m	No forest available in 500m	No	43459 m3	Sand	Existing
26	Dehing River	DIG/L	4.5	27°18'8.09"N 27°18'6.69"N 27°18'5.93"N 27°18'2.21"N 27°18'1.10"N 27°18'0.73"N 27°17'56.05"N	95°42'5.62"E 95°42'7.76"E 95°42'2.75"E 95°41'59.91"E 95°41'57.95"E 95°42'5.38"E 95°42'2.90"E	No PA/BR/WC available in 500m	No forest available in 500m	No	31808 m3	Sand	Existing
27	Dehing River	DIG/N	4.5	27°22'47.92"N 27°22'47.99"N 27°22'26.12"N 27°22'26.06"N	95°46'57.21"E 95°46'59.84"E 95°47'0.19"E 95°46'57.96"E	No PA/BR/WC available in 500m	No forest available in 500m	No	41610 m3	Sand	Existing
28	Dehing River	DIG/O	4.5	27°22'47.92"N 27°20'3.82"N 27°19'55.83"N 27°19'55.86"N	95°42'54.38"E 95°42'51.45"E 95°42'48.33"E 95°43'58.89"E	No PA/BR/WC available in 500m	No forest available in 500m	No	33731 m3	Sand	Existing

29	Dehing River	DIG/P	4.43	27°24'2.15"N 27°24'0.92"N 27°23'41.32"N 27°23'40.21"N	95°53'31.21"E 95°53'32.39"E 95°52'59.62"E 95°53'0.05"E	No PA/BR/WC available in 500m	No forest available in 500m	No	19662 m3	Sand	Existing
30	Dehing River	DIG/R	4.75	27°21'49.74"N 27°21'49.67"N 27°21'38.44"N 27°21'39.40"N	95°55'23.56"E 95°55'24.34"E 95°54'24.42"E 95°54'24.78"E	No PA/BR/WC available in 500m	No forest available in 500m	No	21082 m3	Sand	Existing
31	Dehing River	DIG/S	4.5	27°18'32.11"N 27°18'30.47"N 27°18'15.41"N 27°18'14.04"N	95°42'28.61"E 95°42'30.44"E 95°42'14.35"E 95°42'16.45"E	No PA/BR/WC available in 500m	No forest available in 500m	No	33657 m3	Sand	Existing
32	Dehing River	DIG/V	4.5	27°24'1.80"N 27°24'8.46"N 27°24'17.85"N 27°24'19.06"N 27°24'13.78"N 27°24'2.63"N	95°49'54.34"E 95°49'55.38"E 95°50'0.97"E 95°49'58.77"E 95°49'54.96"E 95°49'52.37"E	No PA/BR/WC available in 500m	No forest available in 500m	No	24189 m3	Sand	Existing
33	Dehing River	DIG/X	4.5	27°20'12.69"N 27°20'11.83"N 27°20'8.34"N 27°20'8.25"N 27°20'5.90"N 27°19'59.01"N 27°19'58.58"N 27°19'55.98"N 27°19'55.10"N 27°19'54.45"N 27°19'53.46"N 27°19'53.47"N 27°19'52.07"N	95°50'33.23"E 95°50'30.06"E 95°50'31.71"E 95°50'36.79"E 95°50'35.18"E 95°50'35.50"E 95°50'36.88"E 95°50'33.64"E 95°50'35.13"E 95°50'30.64"E 95°50'32.73"E 95°50'27.64"E 95°50'28.40"E	No PA/BR/WC available in 500m	No forest available in 500m	No	12095 m3	Sand	Existing

34	Dehing River	DIG/Y	4.35	27°23'49.99"N 27°23'48.81"N 27°23'46.13"N 27°23'43.94"N 27°23'43.56"N 27°23'41.70"N 27°23'39.80"N 27°23'38.21"N	95°48'58.76"E 95°48'57.10"E 95°49'3.93"E 95°49'3.01"E 95°49'9.41"E 95°49'8.33"E 95°49'21.83"E 95°49'21.47"E	No PA/BR/WC available in 500m	No forest available in 500m	No	19307 m3	Sand	Existing
35	Dehing River	DIG/27	4.5	27°18'2.38"N 27°17'59.37"N 27°17'57.96"N 27°17'53.80"N	95°41'17.84"E 95°41'16.56"E 95°41'31.22"E 95°41'25.45"E	No PA/BR/WC available in 500m	No forest available in 500m	No	14805 m3	Sand	Existing
36	Dehing River	DIG/28	3.77	27°18'58.97"N 27°18'58.46"N 27°18'46.37"N 27°18'44.99"N	95°42'38.48"E 95°42'41.22"E 95°42'33.95"E 95°42'37.65"E	No PA/BR/WC available in 500m	No forest available in 500m	No	16733 m3	Sand	Existing
37	Doom Dooma River	DBR/51/Doomdooma River/Hanchara Ghat/ Sand MCA of 2022-29	4.97	27°34'30.27"N 27°34'23.95"N 27°34'24.08"N 27°34'29.77"N 27°34'30.75"N 27°34'24.04"N 27°34'24.14"N 27°34'27.63"N 27°34'27.93"N 27°34'25.38"N 27°34'31.00"N 27°34'32.11"N 27°34'29.79"N 27°34'24.87"N 27°34'25.43"N 27°34'31.13"N	95°31'44.04"E 95°31'51.34"E 95°31'57.62"E 95°31'58.08"E 95°32'1.18"E 95°32'7.85"E 95°32'10.33"E 95°32'20.66"E 95°32'18.74"E 95°32'9.14"E 95°32'3.56"E 95°31'59.35"E 95°31'57.06"E 95°31'56.25"E 95°31'51.44"E 95°31'44.64"E	No PA/BR/WC available in 500m	No forest available in 500m	No	19600 P/A	Sand	Existing

38	Doom Dooma River	DBR/50 /Doomdooma River/Doomdooma Ghat/Sand MCA	4.97	27°34'11.56"N 27°34'13.39"N 27°34'13.08"N 27°34'11.64"N 27°34'10.56"N 27°34'15.09"N 27°34'17.09"N 27°34'21.08"N 27°34'22.69"N 27°34'23.57"N 27°34'25.19"N 27°34'28.24"N 27°34'27.52"N 27°34'24.57"N 27°34'22.19"N 27°34'17.24"N 27°34'16.52"N 27°34'15.57"N 27°34'14.19"N 27°34'9.24"N 27°34'12.52"N 27°34'10.57"N	95°32'50.57"E 95°32'48.62"E 95°32'45.65"E 95°32'41.96"E 95°32'38.79"E 95°32'34.88"E 95°32'25.25"E 95°32'30.97"E 95°32'31.07"E 95°32'31.77"E 95°32'28.61"E 95°32'26.66"E 95°32'25.83"E 95°32'27.93"E 95°32'30.75"E 95°32'24.98"E 95°32'24.40"E 95°32'25.55"E 95°32'34.92"E 95°32'39.07"E 95°32'48.02"E 95°32'49.38"E	No PA/BR/WC available in 500m	No forest available in 500m	No	29392 P/A	Sand	Existing

b) List of Patta Lands / Khatedari land

Owner	Area Kanal / Nala/Tilla	GPS Coordinates	Material/Forest Produce/ Mineral	Total Mineral to be Mined (in m3)	District	Tehsil	Village	Agricultural Land (Yes / No)
NA								

c) List of De-siltation location (Lake, Pond, Dams, River)

Name	Maintain/ Controlled by Sate Govt./PSU etc.	Location	District	Lake/Pond/ Dams/River /Canal	Tehsil	Size (Ha)	Existing /Proposed
DD/3	Controlled by State Govt.	The boundary of the **DD/3** Di-Siltation area is 4.5 ha area starts from the **27º34'5.50", 95º35'34.80"** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º33'50.5", 95º34'01.0"** Geo-coordinate**.**	Tinsukia	River	Doomdooma	4.85	Existing
DD/2 Permit area	Controlled by State Govt.	The boundary of the **DD/2** Di-Siltation area 2.53 ha is starts from the **27º33'43.59", 95º33'32.18"** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º33'49.80", 95º33'12.90"** Geo-coordinate**.**	Tinsukia	River	Doomdooma	2.53	To be Proposed
DD/1 Permit area	Controlled by State Govt.	The boundary of the **DD/1** Di-Siltation area is 1.34 ha area starts from the **27º33'32.21", 95º33'3.899"** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º33'49.30", 95º33'06.80"** Geo-coordinate**.**	Tinsukia	River	Doomdooma	1.34	Proposed

DD/5	Controlled by State Govt.	The boundary of the **DD/5** Di-Siltation area is 4.98 ha area starts from the **27º32’43.60”, 95º33’00.90”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º32’28.00”, 95º33’46.30”** Geo-coordinate**.**	Tinsukia	River	Doomdo oma	4.98	Proposed
DD/6	Controlled by State Govt.	The boundary of the **DD/6** Di-Siltation area is 4.98 ha area starts from the **27º32’4.93”, 95º34’14.74”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º31’38.73”, 95º34’47.37”** Geo-coordinate**.**	Tinsukia	River	Doomdo oma	4.98	To be Proposed
KH/1	Controlled by State Govt.	The boundary of the **KH-1** Di-Siltation area is 3.45 ha area starts from the **27º24’30.00”, 95º51’33.90”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º23’36.779”, 95º49’44.368”** Geo-coordinate**.**	Tinsukia	River		3.45	Proposed
SD/5	Controlled by State Govt.	The boundary of the **SD/5** Di-Siltation area is 4.49 ha area starts from the **27º56’46.72”, 95º39’9.54”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º56’38.87”, 95º39’16.72”** Geo-coordinate**.**	Tinsukia	River	Sadiya	4.49	Proposed
SD/6	Controlled by State Govt.	The boundary of the **SD/6** Di-Siltation area is 4.5 ha area starts from the **27º54’6.52”, 95º38’10.34”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º53’50.43”, 95º38’5.76”** Geo-coordinate**.**	Tinsukia	River	Sadiya	4.5	Proposed

SD/1	Controlled by State Govt.	The boundary of the **SD/1** Di-Siltation area is 4.0 ha area starts from the **27º54'24.10", 95º38'21.80"** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º54'19.31", 95º38'17.06"** Geo-coordinate**.**	Tinsukia	River	Sadiya	4	Proposed
SD/7	Controlled by State Govt.	The boundary of the **SD/7** Di-Siltation area is 3.0 ha area starts from the **27º53'43.25", 95º38'00.28"** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º53'36.74", 95º38'7.22"** Geo-coordinate**.**	Tinsukia	River	Sadiya	3	To be proposed
SD/8	Controlled by State Govt.	The boundary of the **SD/8** Di-Siltation area is 2.5 ha area starts from the **27º56'5.26", 95º38'51.73"** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º56'0.12", 95º38'57.34"** Geo-coordinate**.**	Tinsukia	River	Sadiya	2.5	To be proposed
SD/3	Controlled by State Govt.	The boundary of the **SD/3** Di-Siltation area is 4.8 ha area starts from the **27º56'27.4", 95º39'22.3"** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º56'5.51", 95º39'29.56"** Geo-coordinate**.**	Tinsukia	River	Sadiya	4.8	To be proposed
SD/4	Controlled by State Govt.	The boundary of the **SD/4** Di-Siltation area is starts from the **27º48'48.60", 95º40'09.20"** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º48'51.8", 95º40'07.7"** Geo-coordinate**.**	Tinsukia	River	Sadiya		To be proposed

DD/4	Controlled by State Govt.	The boundary of the **DD/4** Di-Siltation area is 5.1 ha starts from the **27º33’18.70”, 95º36’44.90”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º33’31.60”, 95º35’54.30”** Geo-coordinate**.**	Tinsukia	River	Doomdo oma	5.1	To be proposed
Kp-1	Controlled by State Govt.	The boundary of the **Kp-1** Di-Siltation area is 1.8 ha starts from the **27º35’54.30”, 95º37’29.70”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º35’45.8”, 95º37’14.7”** Geo-coordinate**.**	Tinsukia	River	Doomdo oma	1.8	To be proposed
DD/7	Controlled by State Govt.	The boundary of the **DD/7** Di-Siltation area is 5.1 ha starts from the **27º33’16.07”, 95º36’44.52”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º32’55.80”, 95º37’05.69”** Geo-coordinate**.**	Tinsukia	River	Doomdo oma	4.46	To be proposed
DD/8	Controlled by State Govt.	The boundary of the **DD/8** Di-Siltation area is 2.46 ha starts from the **27º30’05.90”, 95º36’54.90”** Geo-coordinate and then runs alongwith down-stream of the river **Doomdooma** up to **27º29’43.19”, 95º36’46.90”** Geo-coordinate**.**	Tinsukia	River	Doomdo oma	2.46	To be proposed

d) M-Sand plants with location

Sl. No.	**Plant Name**	**Owner**	**District**	**Tehsil**	**Village**	**Geolocation**		**Quantity (Tonnes /Annum)**
						Latitude	**Longitude**	
NA								

ANNEXURE – III

- **list of Cluster and Contiguous Clusters**
  - **Clusters:**
  - **Contiguous Clusters:**

- **Cluster details**

River Name	Cluster No.	Lease No.	Location (Riverbed/Patta Land)	Village	Area (in Ha)	Total Excavation (Ton)	Total Mineral Excavation (Ton)
NA							

- **Contiguous Cluster details**

River Name	Contiguous Cluster No.	Clu ster No.	Number of leases in the cluster	Location (Riverbed/Pa tta Land)	Distance between clusters	Village	Area of Cluster (Ha)	Total Mineral Excavat ion (Ton)
NA								

ANNEXURE – IV

- **Transportation Routes for Individual leases and leases in Cluster**

➢ Transportation Routes for individual leases details:

Lease No.	Transportation Route No.	Number of tippers /days of lease	Number of tippers /days of all the lease on route	Length of the Route in Km	Type of Road (black Topped/ unpaved)	Recommendation for road (Black Topped/ unpaved)	The road will be constructed by Govt. / Lease Owner	Route Map & Location
NA								

➢ Transportation Routes for leases in Cluster details:

Cluster No.	Transportation Route No.	Number of tippers / days of cluster	Number of tippers / days of all the clusters on route	Length of Route in km	Type of Road (Black Topped / unpaved)	Recommendation for road (Black Topped / unpaved)	The road will be Constructed by Govt. / Lease Owner	Route Map & Location
NA								

ANNEXURE – V

- **Final list of Potential Mining Zones : (Proposed)**
- **Final list of Patta land: (Proposed)**
- **De-siltation Location: (Lakes/Ponds/Dams etc.)(Proposed)**
- **Final list of Sand/M – Sand Source: (Proposed)**

- **Final List of potential Mining zones: (River Bed)**

Sl. No.	Lease Details (Zone Code)	River Details	Area (In Ha)	Latitude	Longitude	Depth	Distance (In Km) From PA/BR/WC	Distance From Forest Area (In Km)	Mining Leases Within 500 meters (if Yes cluster area In Ha)	Total Excavation in (CUM/Yr) (Mine Depth max as 3m)	Mineable Reserve (cum)	Mineral to be mined (Sand/ Bajri/ RBM etc.)	Existing / Proposed
1	TSK_PRO_01	Deopani	46.5	27°57'1.02"N 27°57'14.67"N 27°56'41.11"N 27°56'24.79"N	95°39'0.85"E 95°39'12.88"E 95°39'21.59"E 95°39'15.16"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	1395000	837000	Sand Gravel	Proposed
2	TSK_PRO_02	Deopani	16.2	27°56'21.89"N 27°56'26.86"N 27°56'2.64"N 27°55'57.10"N	95°39'17.96"E 95°39'24.92"E 95°39'34.62"E 95°39'29.54"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	486000	291600	Sand Gravel	Proposed
3	TSK_PRO_03	Deopani	11.7	27°56'5.70"N 27°56'7.61"N 27°55'53.47"N 27°55'58.31"N	95°38'51.59"E 95°39'1.83"E 95°38'56.44"E 95°38'42.22"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	351000	210600	Sand Gravel	Proposed
4	TSK_PRO_04	Deopani	19.7	27°54'30.76"N 27°54'22.44"N 27°54'10.06"N	95°38'24.32"E 95°38'31.06"E 95°38'29.41"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	591000	354600	Sand Gravel	Proposed
5	TSK_PRO_05	Deopani	57	27°54'9.80"N 27°54'5.95"N 27°53'27.40"N 27°53'38.52"N	95°38'11.57"E 95°38'16.72"E 95°38'9.95"E 95°37'49.60"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	1710000	1026000	Sand Gravel	Proposed
6	TSK_PRO_06	Deopani	7.88	27°49'32.81"N 27°49'29.05"N	95°40'0.44"E 95°39'59.53"E	3	No PA/BR/WC	No forest	No	236400	141840	Ordinary	Proposed

				27°49'17.01"N 27°49'11.15"N	95°39'51.77"E 95°39'40.06"E		available in 500m	available in 500m				clay	
7	TSK_PRO_07	Deopani	11.5	27°48'56.40"N 27°48'53.83"N 27°48'47.76"N 27°48'53.23"N	95°39'55.87"E 95°39'54.51"E 95°40'13.95"E 95°40'20.05"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	345000	207000	SAND	Proposed
8	TSK_PRO_08	Doom-dooma	1.88	27°35'56.01"N 27°35'55.54"N 27°35'43.07"N 27°35'43.54"N	95°37'32.44"E 95°37'32.66"E 95°37'11.39"E 95°37'11.31"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	56400	33840	SAND	Proposed
9	TSK_PRO_09	Doom Dooma River	10.8	27°34'37.66"N 27°34'37.98"N 27°34'7.53"N 27°34'7.23"N	95°31'39.04"E 95°31'40.23"E 95°32'53.57"E 95°32'52.04"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	324000	194400	SAND	Proposed
10	TSK_PRO_10	Doom Dooma River	2.72	27°33'50.97"N 27°33'51.75"N 27°33'43.61"N	95°33'9.23"E 95°33'9.72"E 95°33'34.78"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	81600	48960	SAND	Proposed
11	TSK_PRO_11	Doom Dooma River	2.74	27°33'49.54"N 27°33'48.96"N 27°33'25.96"N 27°33'26.71"N	95°33'6.11"E 95°33'6.79"E 95°33'3.77"E 95°33'3.93"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	82200	49320	SAND	Proposed
12	TSK_PRO_11A	Doom Dooma River	1.86	27°33'19.91"N 27°33'19.67"N 27°32'56.62"N 27°32'57.05"N	95°32'59.07"E 95°32'59.96"E 95°32'59.15"E 95°32'58.54"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	55800	33480	SAND	Proposed
13	TSK_PRO_12	Dibru	6	27°32'48.89"N 27°32'49.25"N 27°32'23.89"N 27°32'23.93"N	95°33'0.13"E 95°33'0.82"E 95°33'49.04"E 95°33'47.67"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	180000	108000	SAND	Proposed
14	TSK_PRO_13	Doom Dooma	12	27°32'4.92"N 27°32'6.25"N	95°34'0.66"E 95°34'0.74"E	3	No PA/BR/WC	No forest	No	360000	216000	SAND	Proposed

		River		27°31'27.00"N 27°31'27.84"N	95°35'14.22"E 95°35'13.04"E		available in 500m	available in 500m					
15	TSK_PRO_13A	Doom Dooma River	7.58	27°31'16.98"N 27°31'17.52"N 27°31'2.54"N 27°31'1.53"N	95°35'17.41"E 95°35'18.65"E 95°36'7.04"E 95°36'7.32"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	227400	136440	SAND	Proposed
16	TSK_PRO_14	Doom Dooma River	5.9	27°30'17.69"N 27°30'17.49"N 27°29'33.74"N 27°29'33.93"N	95°36'42.49"E 95°36'43.35"E 95°36'49.97"E 95°36'49.09"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	177000	106200	SAND	Proposed
17	TSK_PRO_14A	Doom Dooma River	4.22	27°34'33.09"N 27°34'33.61"N 27°34'41.40"N 27°34'41.34"N	95°35'37.58"E 95°35'38.10"E 95°35'53.99"E 95°35'54.61"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	126600	75960	SAND	Proposed
18	TSK_PRO_15	Doom Dooma River	9.85	27°33'51.20"N 27°33'50.21"N 27°33'59.89"N 27°34'0.34"N	95°33'55.56"E 95°33'55.33"E 95°35'16.05"E 95°35'16.37"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	295500	177300	SAND	Proposed
19	TSK_PRO_16	Doom Dooma River	2.23	27°34'3.61"N 27°34'3.54"N 27°34'17.56"N 27°34'17.70"N	95°35'22.33"E 95°35'23.17"E 95°35'44.07"E 95°35'43.38"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	66900	40140	SAND	Proposed
20	TSK_PRO_16A	Doom Dooma River	1.82	27°34'33.09"N 27°34'33.61"N 27°34'41.40"N 27°34'41.34"N	95°35'37.58"E 95°35'38.10"E 95°35'53.99"E 95°35'54.61"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	54600	32760	SAND	Proposed
21	TSK_PRO_17	Moilajan	9.44	27°33'30.75"N 27°33'30.36"N 27°32'48.98"N 27°32'49.19"N	95°35'53.23"E 95°35'53.22"E 95°37'8.16"E 95°37'8.56"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	283200	169920	SAND	Proposed
22	TSK_PRO_18	Dehing River	11.5	27°17'40.35"N 27°17'34.14"N	95°40'20.49"E 95°40'21.23"E	3	No PA/BR/WC	No forest	No	345000	207000	SAND	Proposed

				27°17'45.95"N 27°17'52.17"N	95°40'38.36"E 95°40'36.36"E		available in 500m	available in 500m					
23	TSK_PRO_19	Dehing River	40.6	27°18'3.75"N 27°17'55.10"N 27°18'6.49"N 27°18'8.68"N	95°41'14.00"E 95°41'19.13"E 95°42'7.68"E 95°42'5.87"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	1218000	730800	SAND	Proposed
24	TSK_PRO_20	Dehing River	19.8	27°18'12.41"N 27°18'7.31"N 27°18'28.72"N 27°18'34.76"N	95°42'11.22"E 95°42'10.61"E 95°42'33.75"E 95°42'31.24"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	594000	356400	SAND	Proposed
25	TSK_PRO_21	Dehing River	9.1	27°18'37.64"N 27°18'45.79"N 27°18'55.49"N 27°19'2.29"N	95°42'32.09"E 95°42'40.37"E 95°42'44.43"E 95°42'40.13"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	273000	163800	SAND	Proposed
26	TSK_PRO_22	Dehing River	34.7	27°19'43.39"N 27°19'56.24"N 27°19'58.84"N 27°19'53.28"N	95°42'39.45"E 95°42'34.52"E 95°43'10.23"E 95°43'4.16"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	1041000	624600	SAND	Proposed
27	TSK_PRO_22A	Dehing River	9.15	27°19'43.50"N 27°19'44.84"N 27°19'34.63"N 27°19'32.15"N	95°43'19.65"E 95°43'21.90"E 95°43'33.74"E 95°43'29.26"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	274500	164700	SAND	Proposed
28	TSK_PRO_22B	Dehing River	7.48	27°20'14.77"N 27°20'6.31"N 27°20'11.47"N 27°20'18.74"N	95°45'5.94"E 95°45'11.66"E 95°45'17.57"E 95°45'19.68"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	224400	134640	SAND	Proposed
29	TSK_PRO_22C	Dehing River	4.69	27°21'9.15"N 27°21'5.62"N 27°20'49.34"N 27°20'48.87"N	95°45'31.07"E 95°45'31.79"E 95°45'38.86"E 95°45'38.27"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	140700	84420	SAND	Proposed
30	TSK_PRO_23	Dehing River	10.9	27°22'49.40"N 27°22'48.68"N	95°46'57.20"E 95°47'2.76"E	3	No PA/BR/WC	No forest	No	327000	196200	SAND	Proposed

				27°22'25.29"N 27°22'23.55"N	95°47'2.76"E 95°46'58.36"E		available in 500m	available in 500m						
31	TSK_PRO_23A	Dehing River	3.5	27°22'5.58"N 27°21'54.98"N 27°21'56.41"N	95°47'12.83"E 95°47'15.13"E 95°47'22.07"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	105000	63000	SAND	Proposed
32	TSK_PRO_23B	Dehing River	9.1	27°21'13.67"N 27°21'6.74"N 27°21'10.80"N 27°21'16.26"N	95°46'56.04"E 95°47'4.44"E 95°47'14.02"E 95°47'16.39"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	273000	163800	SAND	Proposed
33	TSK_PRO_24	Dehing River	88.2	27°23'56.90"N 27°23'59.87"N 27°24'29.95"N 27°24'27.45"N	95°48'24.81"E 95°48'23.45"E 95°51'31.37"E 95°51'34.78"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	2646000	1587600	SAND	Proposed
34	TSK_PRO_24A	Dehing River	3.2	27°24'49.99"N 27°24'51.47"N 27°24'44.97"N 27°24'44.76"N	95°52'19.89"E 95°52'23.73"E 95°52'32.03"E 95°52'30.26"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	96000	57600	SAND	Proposed
35	TSK_PRO_24B	Dehing River	7.91	27°24'34.10"N 27°24'38.78"N 27°24'49.15"N 27°24'45.16"N	95°51'45.43"E 95°51'46.76"E 95°52'7.95"E 95°52'7.29"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	237300	142380	SAND	Proposed
36	TSK_PRO_25	Dehing River	22.7	27°24'4.61"N 27°24'4.65"N 27°24'2.03"N 27°23'59.29"N	95°52'33.68"E 95°52'35.86"E 95°53'29.81"E 95°53'30.41"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	681000	408600	SAND	Proposed
37	TSK_PRO_26	Kundil River	21.2	27°24'45.71"N 27°24'40.01"N 27°24'6.40"N 27°24'9.93"N	95°53'56.72"E 95°54'1.47"E 95°53'39.37"E 95°53'36.18"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	636000	381600	SAND	Proposed
38	TSK_PRO_27	Dehing River	43	27°22'12.72"N 27°22'11.32"N	95°57'1.97"E 95°57'1.43"E	3	No PA/BR/WC	No forest	No	1290000	774000	SAND	Proposed

				27°21'42.58"N 27°21'44.12"N	95°54'9.47"E 95°54'10.48"E		available in 500m	available in 500m					
39	TSK_PRO_27A	Dehing River	12.2	27°21'59.10"N 27°22'0.71"N 27°21'52.52"N 27°21'52.12"N	95°53'23.49"E 95°53'23.19"E 95°54'4.94"E 95°54'2.47"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	366000	219600	SAND	Proposed
40	TSK_PRO_28	Dehing River	9.14	27°20'20.79"N 27°20'21.26"N 27°20'4.18"N 27°20'4.25"N	95°50'25.84"E 95°50'27.73"E 95°50'16.65"E 95°50'14.87"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	274200	164520	SAND	Proposed
41	TSK_PRO_28A	Dehing River	3	27°20'23.70"N 27°20'24.46"N 27°20'2.92"N 27°20'3.76"N	95°51'41.07"E 95°51'42.61"E 95°51'24.34"E 95°51'24.01"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	90000	54000	SAND	Proposed
42	TSK_PRO_28B	Dehing River	7.76	27°20'47.80"N 27°20'49.32"N 27°20'35.97"N 27°20'37.35"N	95°52'23.81"E 95°52'26.53"E 95°51'57.30"E 95°51'57.48"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	232800	139680	SAND	Proposed
43	TSK_PRO_29	Dehing River	4.5	27°19'37.54"N 27°19'37.96"N 27°19'14.31"N 27°19'15.00"N	95°51'5.18"E 95°51'5.94"E 95°51'23.94"E 95°51'23.30"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	135000	81000	SAND	Proposed
TOTAL			**632.85**							**18985500**	**11391300**		

➢ Final List of potential Mining zones: (In-Situ)

SL. No.	Zone Code	Name of the Mineral	Area of Mineralization (Ha)	Depth of Mineralization (in Meter)	Geological Reserve (cum)	Mineable Reserve (cum)	Latitude	Longitude
1	TSK_PRO_IS_01	ORDINARY EARTH	43.6	3	1308000	784800	27°28'19.24"N 27°28'20.42"N 27°28'4.04"N 27°27'58.28"N 27°28'4.65"N	95°15'19.60"E 95°15'40.90"E 95°15'54.08"E 95°15'40.12"E 95°15'21.74"E
2	TSK_PRO_IS_02	ORDINARY EARTH	50.7	3	1521000	912600	27°25'23.06"N 27°25'8.90"N 27°25'9.51"N 27°24'43.69"N 27°24'47.56"N 27°25'18.12"N	95°24'19.42"E 95°24'25.26"E 95°24'17.43"E 95°23'59.83"E 95°23'49.87"E 95°24'2.80"E
3	TSK_PRO_IS_03	ORDINARY EARTH	92.8	3	2784000	1670400	27°29'1.27"N 27°28'56.26"N 27°28'21.05"N 27°28'28.48"N	95°31'35.78"E 95°32'6.64"E 95°31'51.58"E 95°31'25.97"E
4	TSK_PRO_IS_04	ORDINARY EARTH	62	3	1860000	1116000	27°25'13.74"N 27°25'5.46"N 27°24'55.96"N 27°24'59.79"N 27°25'10.77"N	95°31'21.61"E 95°31'15.26"E 95°31'37.78"E 95°32'3.72"E 95°32'9.67"E
5	TSK_PRO_IS_05	ORDINARY EARTH	22.5	3	675000	405000	27°33'40.11"N 27°33'35.11"N 27°33'17.05"N 27°33'17.58"N	95°33'15.49"E 95°33'31.59"E 95°33'19.70"E 95°33'10.88"E
6	TSK_PRO_IS_06	ORDINARY EARTH	71	3	2130000	1278000	27°31'6.67"N 27°30'50.51"N	95°46'49.19"E 95°47'32.35"E

							27°30'39.81"N 27°30'39.93"N 27°30'49.02"N	95°47'27.88"E 95°46'59.20"E 95°46'43.38"E
7	TSK_PRO_IS_07	ORDINARY EARTH	64.4	3	1932000	1159200	27°37'8.26"N 27°37'7.92"N 27°36'54.53"N 27°36'37.66"N	95°42'15.92"E 95°42'40.52"E 95°42'57.11"E 95°42'38.11"E
8	TSK_PRO_IS_08	ORDINARY EARTH	73.3	3	2199000	1319400	27°42'44.69"N 27°42'41.72"N 27°42'15.51"N 27°42'8.24"N 27°42'14.20"N	95°38'17.59"E 95°38'42.79"E 95°38'43.46"E 95°38'34.31"E 95°38'20.73"E
9	TSK_PRO_IS_09	ORDINARY EARTH	40.9	3	1227000	736200	27°40'58.11"N 27°40'52.55"N 27°40'59.27"N 27°41'11.20"N 27°41'17.28"N	95°29'45.44"E 95°29'52.16"E 95°30'15.88"E 95°30'16.95"E 95°30'3.86"E
10	TSK_PRO_IS_10	ORDINARY EARTH	38.7	3	1161000	696600	27°44'2.88"N 27°44'12.86"N 27°43'55.81"N 27°43'46.82"N	95°36'23.98"E 95°36'36.91"E 95°36'58.28"E 95°36'47.11"E
11	TSK_PRO_IS_11	ORDINARY EARTH	120	3	3600000	2160000	27°44'24.52"N 27°44'6.30"N 27°43'51.65"N 27°44'9.26"N 27°44'18.33"N	95°43'7.42"E 95°43'6.01"E 95°44'4.52"E 95°44'8.78"E 95°43'57.64"E
12	TSK_PRO_IS_12	ORDINARY EARTH	36.6	3	1098000	658800	27°18'27.29"N 27°18'25.38"N 27°17'52.81"N 27°17'47.16"N	95°42'55.75"E 95°43'8.34"E 95°43'2.08"E 95°42'54.15"E
13	TSK_PRO_IS_13	ORDINARY	51.2	3	1536000	921600	27°23'13.81"N	95°47'47.08"E

		EARTH					27°23'23.33"N 27°23'17.99"N 27°23'4.47"N	95°47'54.60"E 95°48'32.18"E 95°48'18.52"E
14	TSK_PRO_IS_14	ORDINARY EARTH	91	3	2730000	1638000	27°39'32.62"N 27°39'41.76"N 27°39'17.25"N 27°39'0.57"N 27°39'5.07"N	95°44'58.96"E 95°45'15.51"E 95°45'38.13"E 95°45'40.35"E 95°45'5.71"E
15	TSK_PRO_IS_15	ORDINARY EARTH	42	3	1260000	756000	27°39'47.52"N 27°39'57.38"N 27°39'43.05"N 27°39'28.82"N	95°40'21.23"E 95°40'33.61"E 95°40'58.73"E 95°40'51.16"E
16	TSK_PRO_IS_16	ORDINARY EARTH	68.8	3	2064000	1238400	27°52'7.42"N 27°52'2.78"N 27°51'42.02"N 27°51'34.90"N 27°51'48.63"N	95°41'33.49"E 95°41'51.66"E 95°41'49.93"E 95°41'20.83"E 95°41'18.14"E
17	TSK_PRO_IS_17	ORDINARY EARTH	50.4	3	1512000	907200	27°55'58.97"N 27°55'55.22"N 27°55'30.75"N 27°55'34.57"N	95°44'48.72"E 95°45'10.11"E 95°44'52.36"E 95°44'35.34"E
18	TSK_PRO_IS_18	ORDINARY EARTH	65.1	3	1953000	1171800	27°53'46.87"N 27°53'35.77"N 27°53'18.59"N 27°53'25.82"N	95°51'43.26"E 95°52'14.84"E 95°52'4.50"E 95°51'27.71"E
19	TSK_PRO_IS_19	ORDINARY EARTH	80.1	3	2403000	1441800	27°51'5.49"N 27°51'2.43"N 27°50'50.13"N 27°50'41.71"N 27°50'47.84"N	95°47'40.21"E 95°48'26.37"E 95°48'33.24"E 95°47'55.57"E 95°47'34.81"E
20	TSK_PRO_IS_20	ORDINARY	51.9	3	1557000	934200	27°50'16.78"N	95°32'27.66"E

		EARTH					27°50'27.95"N 27°50'9.73"N 27°50'2.39"N	95°32'55.90"E 95°33'7.10"E 95°32'40.13"E
21	TSK_PRO_IS_21	ORDINARY EARTH	47.8	3	1434000	860400	27°27'8.42"N 27°27'0.97"N 27°26'33.65"N 27°26'30.00"N	95°25'4.29"E 95°24'52.82"E 95°24'49.20"E 95°25'2.78"E
22	TSK_PRO_IS_22	ORDINARY EARTH	35.1	3	1053000	631800	27°36'31.20"N 27°36'30.77"N 27°36'12.89"N 27°36'13.51"N	95°35'42.88"E 95°36'9.11"E 95°36'6.25"E 95°35'45.76"E
23	TSK_PRO_IS_23	ORDINARY EARTH	58.5	3	1755000	1053000	27°30'40.75"N 27°30'8.17"N 27°30'0.94"N 27°30'11.81"N 27°30'37.83"N	95°43'35.26"E 95°43'21.06"E 95°43'28.40"E 95°43'48.18"E 95°43'44.41"E
24	TSK_PRO_IS_24	ORDINARY EARTH	44.2	3	1326000	795600	27°32'7.38"N 27°31'50.28"N 27°31'48.42"N 27°31'56.26"N 27°32'7.61"N	95°51'50.06"E 95°51'50.85"E 95°52'21.35"E 95°52'25.13"E 95°52'8.16"E
25	TSK_PRO_IS_25	ORDINARY EARTH	38.3	3	1149000	689400	27°32'52.69"N 27°32'44.03"N 27°32'32.02"N 27°32'35.75"N	95°46'9.59"E 95°46'32.67"E 95°46'30.80"E 95°46'4.70"E
TOTAL			**1440.9**		**43227000**	**25936200**		

- **Final List of proposed Patta Lands/Khatedari land**

Owner	Sl. No.	Area (hectare)	Latitude	Longitude	District	Tehsil	Village	Khasra No	Type of Material	Total Reserve (CUM)	Total Mineral to be mined (CUM)	Existing/ Proposed
NA												

- **Final List of Proposed De-siltation location (Lake, Pond, Dams, River):**

Name	Maintain/Controlled by Sate Govt./PSU etc.	Location	Khasra No.	District	Tehsil	Village	Size (Ha)	Quantity (CUM/Year)	Existing / Proposed
NA									

- **Final List of Proposed M-Sand Plants:**

Sl. No.	Plant Name	Owner	District	Tehsil	Village	Geolocation		Quantity / Capacity (Tonnes/Annum)	Existing / proposed
						Latitude	Longitude		
NA									

ANNEXURE – VI

- **Final list of Cluster and Contiguous Clusters**

- **Cluster details (Riverbed)**

River Name	Cluster No.	Lease No.	Location (Riverbed/Patta Land)	Tehsil	Area (in Ha)	Total Excavation (CUM)	Total Mineable Mineral Excavation (CUM)
NA							

- **Contiguous Cluster details**

River Name	Contiguous Cluster No.	Cluster No.	Number of leases in the cluster	Location (Riverbed /Patta Land)	Distance between clusters	Tehsil	Area of Cluster (Ha)	Total Mineral Excavation (Ton)
NA								

Note: The final Cluster details shall be as per the approved mine plan and as per the environment clearance granted by the competent authority.

ANNEXURE – VII

- **Final Transportation Routes for individual Zones and Zones in Cluster(s): (Proposed)**

➢ Transportation Routes for individual leases details (Riverbed)

Lease No.	Transportation Route No.	Number of tippers /days of lease	Number of tippers /days of all the lease on route	Length of the Route in Km	Type of Road (black Topped/ unpaved)	Recommendation for road (Black Topped/ unpaved)	The road will be constructed by Govt. / Lease Owner	Route Map & Location
NA								

➢ Transportation Routes for leases in Cluster details (Riverbed)

Cluster No.	Transportation Route No.	Number of tippers / days of cluster	Number of tippers / days of all the clusters on route	Length of Route in km	Type of Road (Black Topped / unpaved)	Recommendation for road (Black Topped / unpaved)	The road will be Constructed by Govt. / Lease Owner	Route Map & Location
NA								

Note: The final transportation routes shall be as per the approved mine plan and as per the environment clearance granted by the competent authority.