



सत्यमेव जयते

DISTRICT SURVEY REPORT, WEST KARBI ANGLONG, HAMREN

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

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This District Survey Report (DSR) of West Karbi Anglong District, Hamren 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

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Sr. Director, NABET
Dated: September 15, 2022

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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

Table of Content

Chapter No	Subject	Page No
1	Preface	1-2
2	Introduction	3-18
GENERAL PART		
3	General Profile of the District	19-46
	a. General Information	19-22
	b. Climate Condition	23-24
	c. Rainfall: Month wise	24-25
	d. Topography & Terrain	25-26
	e. Water courses and Hydrology	26-27
	f. Ground water Development	27-29
	g. Drainage System	30
	h. Demography	30-33
	i. Cropping pattern	33-34
	j. Land Form and Seismicity	34-35
	k. Major Flora of West Karbi Anglong	35-37
	l. Fauna	37-46
4	Physiography of the District	47-49
	4.1 General Landforms	47
	4.2 Soil and rock pattern	47-49
	4.3 Different geomorphology units	49-51
5	Land Use Pattern of The District	52-58
	5.1 Forest	55-57
	5.2 Agriculture and Irrigation	57-58
	5.3 Horticulture	58

	5.4 Mining	58
6	Geology	59-64
PART A- RIVERBED DEPOSITS		
7	Mineral Wealth	65-94
	7.1 Overview of mineral resources	65
	7.2 Details of Resources of Sand and other riverbed minerals	65-94
	7.2.1 Sand and other Riverbed Minerals	67-94
	I. Drainage System	67-70
	II. Annual deposition of riverbed minerals	70
	A. Geomorphological studies	70-88
	i. Place of Origin	70-71
	ii. Catchment Area	71-72
	iii. General profile of river stream	72-73
	iv. Annual deposition factor	73-77
	v. Replenishment Study as per EMGSM guidelines 2020	77-88
	B. Geological studies	89
	i. Lithology of the catchment area	89
	ii. Tectonics and structural behaviour of rocks	89
	C. Climate Factors	89-90
	i. Intensity of rainfall	89-90
	ii. Climate zone	90
	iii. Temperature variation	90
	III. Riverbed Mineral Potential	91-94
8	Overview Of Mining Activity in The District	95-96
	8.1 General overview	95
	8.2 List of existing mining leases of the districts (location, area, period for each minor mineral)	95
	8.3 Detail of production of sand and other minerals during last three years	95-96

9	Details Of Revenue Generated from Mineral Sector During Last Five Years	97-98
10	Transport	99
11	In-situ Minerals	100
	11.1 Mineral Reserve	100
	11.2 Mineral Potential	100
12	Remedial measure to mitigate the impact of Mining	101-104
13	Suggested reclamation plan for already mined out areas	105
14	Risk assessment & disaster management plan	106-107
15	Conclusions and Recommendations	108-109
16	Reference	110-112

List of Figure

Figure No	Subject	Page No
Figure 01	Steps followed in preparation of DSR	13
Figure 02	Pictorial Description of Land Use Classification Methods	14-15
Figure 03	Pictorial Description of Geomorphological Units Classification Methods	16
Figure 04	Schematic Representation of Public Consultation	18
Figure 05	Location Map of Hamren (Karbi Anglong West)	20
Figure 06	Administrative Map of West Karbi Anglong, Hamren	22
Figure 07	Maximum & Minimum Temperature	24
Figure 08	Maximum & Minimum Rainfall	25
Figure 09	Slope Map of the District	26
Figure 10	Hydrogeology Map of the District	27
Figure 11	Water Level Depth Map of the District (Pre-Monsoon)	28
Figure 12	Water Level Depth Map of the District (Post-Monsoon)	29
Figure 13	Drainage Network Map of District	30
Figure 14	Gender-wise population of the district as per census 2011	32
Figure 15	Sex ratio population of the district as per census 2011	32
Figure 16	Graphical Representation of distribution of male & female literates of the district	33
Figure 17	Seismic map of Assam and North East Part	35
Figure 18	Wildlife Sanctuaries and National Parks of Assam	46
Figure 19	Soil Map of the District	49
Figure 20	Geomorphological Map of the District	51
Figure 21	Land Use & Land Cover Map of the District	53
Figure 22	Land use pattern of West Karbi Anglong of the district (represented in sq.km)	54

Figure No	Subject	Page No
Figure 23	Forest Cover Map of the District	56
Figure 24	Geological Map of The District	63
Figure 25	Rocks and Minerals Map of The District	66
Figure 26	Drainage Map of West Karbi Anglong District	69
Figure 27	Catchment area Map of the main rivers Kopili, Borpani, Amreng, Amlong of West Karbi Anglong district, Assam	72
Figure 28	Elevation of river Map of the West Karbi Anglong district, Assam	73
Figure 29	Hjulström Curve	74
Figure 30	Mode of Sediment Transport in Rivers	76
Figure 31	Transport Map of the District	99

List of Tables

Table No	Subject	Page No
Table 01	Statutory Framework and Guidelines on DSR With Time Scale	4-6
Table 02	Administrative units of the Hamren (Karbi West) District	20
Table 03	Sub-Division and PS-wise Police Station and Police Out-post of West Karbi Anglong	21
Table 04	Sub-Division-Wise Development Block and its headquarters of West Karbi Anglong	21
Table 05	Sub-Division-wise Revenue Circle and it's Headquarters of West Karbi Anglong	21
Table 06	Sub-Division-wise Mouza of West Karbi Anglong	21
Table 07	3-Autonomous District (ST) Parliamentary and Legislative Assembly Constituency	22
Table 08	Maximum & Minimum Temperature and Rainfall	23
Table 09	Average rainfall by month in the district of West Karbi Anglong (Year: 2017)	24
Table 10	Demographic pattern of the district	31
Table 11	Town-wise population, of SC & ST of West Karbi Anglong	28
Table 12	Town-wise population, of SC & ST of the District	33
Table 13	Religious data of Hamren, West Karbi Anglong	33
Table 14	Seismic Zone Intensity on MM scale	34
Table 15	Checklist of faunal species	37-39
Table 16	Checklist of avian species	39-45
Table 17	Land Use Pattern of the district	54
Table 18	Area under State Reserve Forests under West Karbi Anglong	56
Table 19	District Council Reserve Forests under West Karbi Anglong	56
Table 20	Proposed Reserve Forests under West Karbi Anglong	57
Table 21	Net irrigated area for the blocks of West Karbi Anglong	57
Table 22	Status of sources of irrigation in West Karbi Anglong	58
Table 23	Stratigraphic succession of West Karbi Anglong	60-62

Table No	Subject	Page No
Table 24	Drainage system with description of main rivers	70
Table 25	Salient Features of important rivers and streams	70
Table 26	Place of Origin of important rivers and streams	71
Table 27	Catchment areas of main rivers of West Karbi Anglong district, Hamren	71
Table 28	Estimation of Sand/ RBM zones Reserves in Pre & Post Monsoon periods in sand/ RBM zones	76-87
Table 29	Sediment Load Comparison Pre & Post monsoon period for different rivers of West Karbi Anglong District	88
Table 30	Annual deposition	90
Table 31	Resources of Potential Riverbed Mineral	91
Table 32	Production of the District for the year 2020-21	95
Table 33	Production of the District for the year 2021-22	95
Table 34	Production of the District for the year 2022-23	96
Table 35	Production of the District for the year 2023-24	96
Table 36	Production of the District for the year 2020-21	96
Table 37	Production of the District for the year 2021-22	96
Table 38	Production and Revenue of District for the year 2020-21	97
Table 39	Production and Revenue of district for the year 2021-22	97
Table 40	Production and Revenue of district for the year 2022-23	97
Table 41	Production and Revenue and District for the year 2020-21	98
Table 42	Production and Revenue of district for the year 2021-22	98
Table 43	Production and Revenue of district for the year 2022-23	98

List of Annexure

Sl. No.	Particulars	Page No.
Annexure-I	Details of Sand/M –Sand Source	114 - 115
Annexure-II	List of Potential Mining Leases (Existing)	116 - 129
Annexure-III	List of Cluster & Contiguous Cluster details	130 - 131
Annexure-IV	Transportation Routes for individual leases and leases in Cluster	132 - 133
Annexure- V	Final List of Potential Mining Leases (Existing & Proposed)	134 - 144
Annexure- VI	Final List of Cluster & Contiguous Cluster (Proposed)	145 - 146
Annexure-VII	Final Transportation Routes for individual leases and leases in Cluster(s): (Proposed)	147 - 148
Annexure-VIII	Layout map of existing, Proposed Mineral Zone with Transport routes	149 - 269
Annexure- IX	Cross-section & L-sections of RBM Zones	270 - 299
Annexure- X	Field Photographs	300 - 306

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
<i>e.g.,</i>	:	<i>'exempli gratia'</i> (Latin phrase) means 'for example'
EC	:	Environmental Clearance
<i>et.al.</i>	:	<i>'et alia'</i> (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>i.e.,</i>	:	<i>'id est'</i> (Latin phrase) means 'that is'/'in other words'
ICAR	:	Indian Council of Agricultural Research

ABBREVIATIONS & SYMBOLS USED	:	FULL FORMS
Inch	:	inches
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
MoEFCC	:	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 ' <i>videre licet</i> ', 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 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 West Karbi Anglong 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

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

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 West Karbi Anglong 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 West Karbi Anglong 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 West Karbi Anglong 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 14 th 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-authorized 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.

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

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 17 th 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

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

	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 7 th , 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:

- (i) 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.
- (ii) Particulars of the receipt heads of the Government to which the payments are to be credited.
- (iii) Grant, compensation of damage to the land owner for the land covered by the permit.
- (iv) Felling the trees, pumping of ground water.
- (v) Restriction of surface operations in any area provided by any authority.
- (vi) Entering and working in any forest area.
- (vii) Reporting all accidents, use of explosives.
- (viii) Indemnity to the Government against claim of third parties.
- (ix) Mineral to be stacked, measured and dispatched.
- (x) Applicability of the provisions of all other statutes/rules framed by the Central and State Government.
- (xi) Reclamation or restoration of the mining areas and security thereof.
- (xii) Development and conservation of minerals and environment and ecology of the area.
- (xiii) Extent of the area or land from where the minor mineral shall be extracted.

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

- (xiv) 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.
- (xv) Release of security by the authority issuing permit after having satisfied that the permit holder has fulfilled all the conditions of the permit satisfactorily.
- (xvi) 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.

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

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.

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

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 the 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 depth 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 bunting metal, we can mix sand with clay binder for frameworks used in the foundries.

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

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.

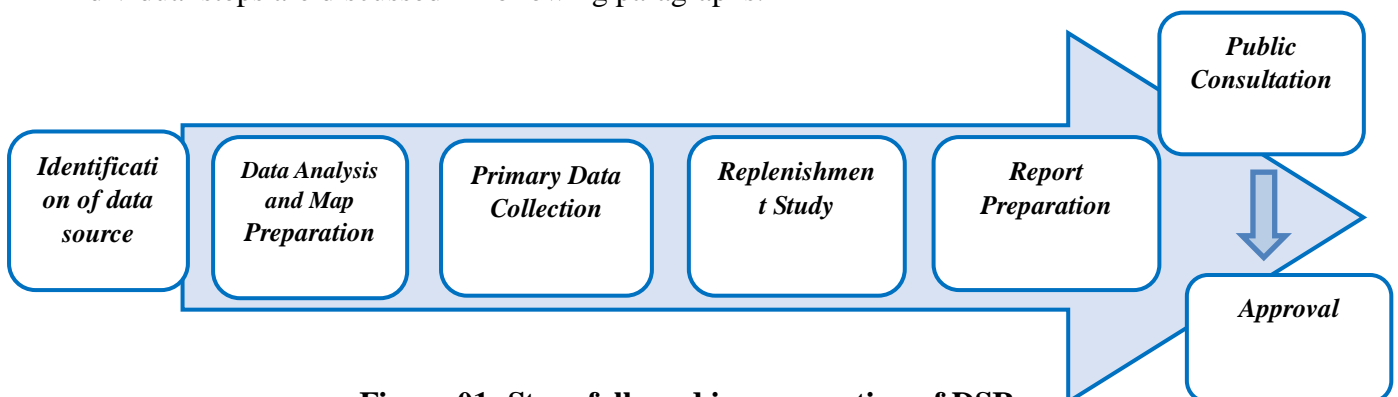
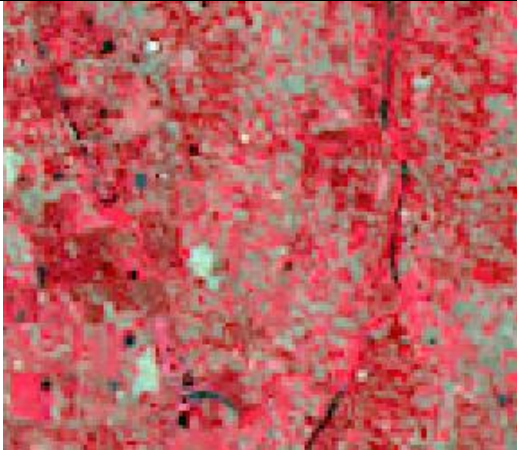



Figure 01: Steps followed in preparation of DSR

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.

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

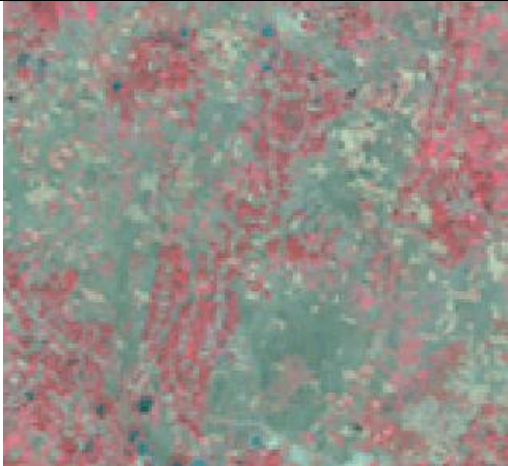



	
Agricultural Fallow Land - Based on their Geometrical shape, Yellowish green color tone, Agricultural Fallow Land has been identified.	Badland Topography- Area with Non geometrical shape and Yellowish green color tone has been identified as Bad Land Topography.
	
Settlement – Area with some geometrical 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

Geomorphological Map: 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.

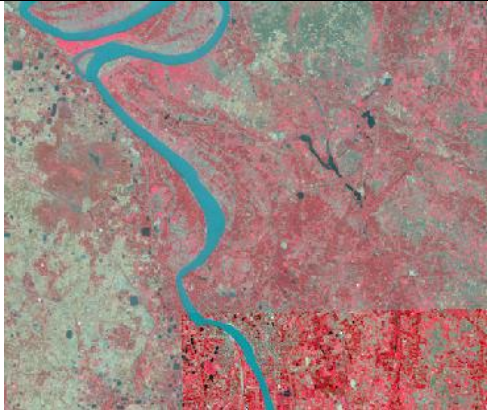

	
<p>Flood plain-Flood plain is a generally flat area of land next to a river or stream. It stretches from the banks of the river to the outer edges of the valley.</p>	<p>OX-BOW Lake- An ox-bow lake starts out as a curve, or meander, in a river. This “U” shaped body of water identified as Ox- Box Lake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

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

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

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 one month 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:

The State of Assam, covering an area of 78,523 sq. km, is the gateway to other six states of the North Eastern Region of India and collectively known as seven sisters. In 2013, Assam government introduced Assam minor mineral concession rule, 2013 under rule 52(1). Sand is naturally occurring granular material composed of finely divided mineral and rock particles between 115 μ to 4.75 mm in diameter (IS 383-1970). Sand is formed due to weathering of rocks due to mechanical forces. In the process the weathered rocks form gravel at first and then sand. It is also felt that the greater use of substitute material (manufactured sand, artificial sand etc.) and construction technology and sustainable use of the resource could drastically reduce adverse impact of mining on the environment. The entire geological report comprises the history of river bed, river bank sand deposits & gravel deposits in the form of paleo-placer or fossilized channels & in-situ minor minerals if any. To prepare the District Survey Report (DSR) of West Karbi Anglong district, Assam (Fig. 1), the concept of GREEN FIELD THEORY has been taken into account just to depict the history of overall geology followed by disposition of different types of lithounits.

Hamren is the headquarter of the newly formed district, which is well connected with other parts of the state and country with rail and road link. The district has only one sub-division, namely Hamren sub-division, and Donkamukam is the only revenue circle of the district. The district covers an area of 3035 sq. km (Fig. 2). The district is part of Karbi Anglong Autonomous Council and administered according to the provisions of Sixth Schedule of the Indian Constitution. The district is administered under Karbi Anglong Autonomous Council. CEM is the Chief executive of the district, supported by fourteen other executive members of the Council. The Principal Secretary (generally an officer selected from IAS cadre) of Karbi Anglong Autonomous Council is the administrative head of the district. The Deputy Commissioner is responsible for the maintenance of law & order, and administration of justice. The district is situated between 26°20' N to 27°10' N latitudes and 93°57' E to 94°37' E longitudes and lies in the eastern part of the state of Assam.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

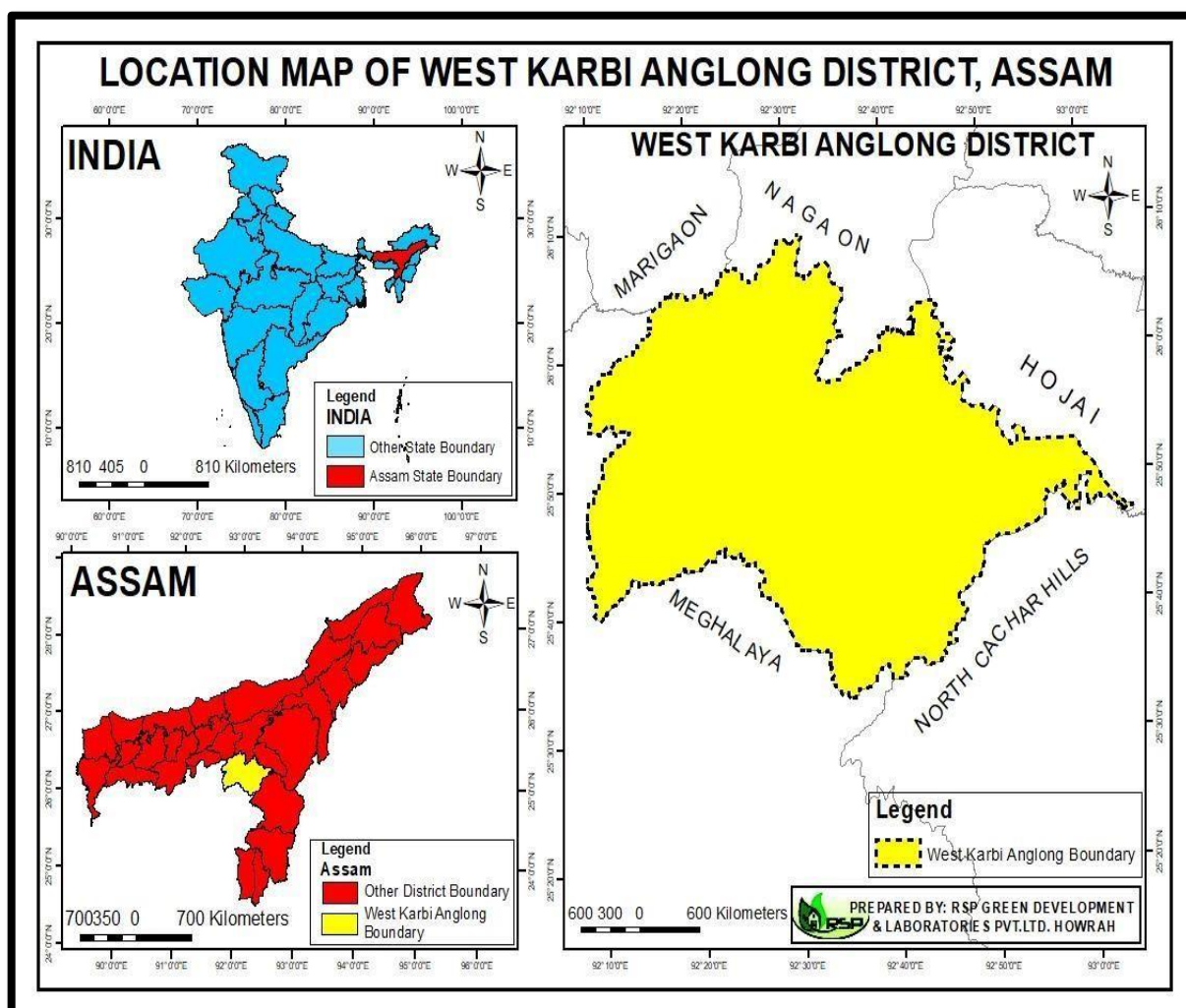


Figure 05: Location Map of Hamren (Karbi Anglong West)

Table No.02: Administrative units of the Hamren (Karbi West) District

Sl. No.	ADMINISTRATIVE UNITS	:	STATISTICS
1	District Head Quarter	:	Hamren
2	Sub divisions	:	01
3	Parliamentary Constituency	:	-
4	Legislative Assembly Constituency	:	01
5	Major Town Committee & Census Town	:	-
6	Minor Town	:	-
7	No. of CD Blocks	:	04
8	Central Information Commission	:	-
9	Revenue Circle	:	01
10	Mouza	:	9

Source: <https://westkarbianglong.assam.gov.in/information-services/general-data-of-west-karbi-anglong>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

Table No.03: Sub-Division and PS-wise Police Station and Police Out-post of Karbi

THE SUBDIVISION	POLICE STATION	POLICE OUT POST
1. Hamren Sub-Division	1. Hamren PS	Donkamokam
	2. Baithalangso PS	Ulukunchi
	3. Manja PS	Amtereng
	4. Kheroni PS	Mailoo
	5. Jirikindeng P.S	Makoilum

Table No.04: Sub-Division-Wise Development Block and its headquarters of Karbi Anglong

NAME OF SUB-DIVISION	NAME OF BLOCKS	HEADQUARTERS
Hamren Sub-Division	Amri Dev. Block	Ulukunchi
	Chinthong Dev. Block	Hamren
	Rongkhang Dev. Block	Donka
	Socheng Dev. Block	Jirikinding

Table No.05: Sub-Division-wise Revenue Circle and it's Headquarters of Karbi Anglong

SUB-DIVISION	NAME OF REVENUE CIRCLE	HEADQUARTERS
Hamren Sub-Division	Donka Revenue Circle	Donka

Table No.06: Sub-Division-wise Mouza of Karbi Anglong

	MOUZA
Hamren Sub-Division	East Rongkhang West Rongkhang
	Duaramla
	Amri
	Chinthong
	Langpampi
	Hamren
	Charchim
	Hawaipur

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

Table No.07: 3-Autonomous District (ST) Parliamentary and Legislative Assembly Constituency

Sl. No.	Parliamentary Constituency
1.	17-Bokajan (ST)
2.	18-Howraghat(ST)
3.	19-Diphu(ST)

(Source: /karbianglong.gov.in)

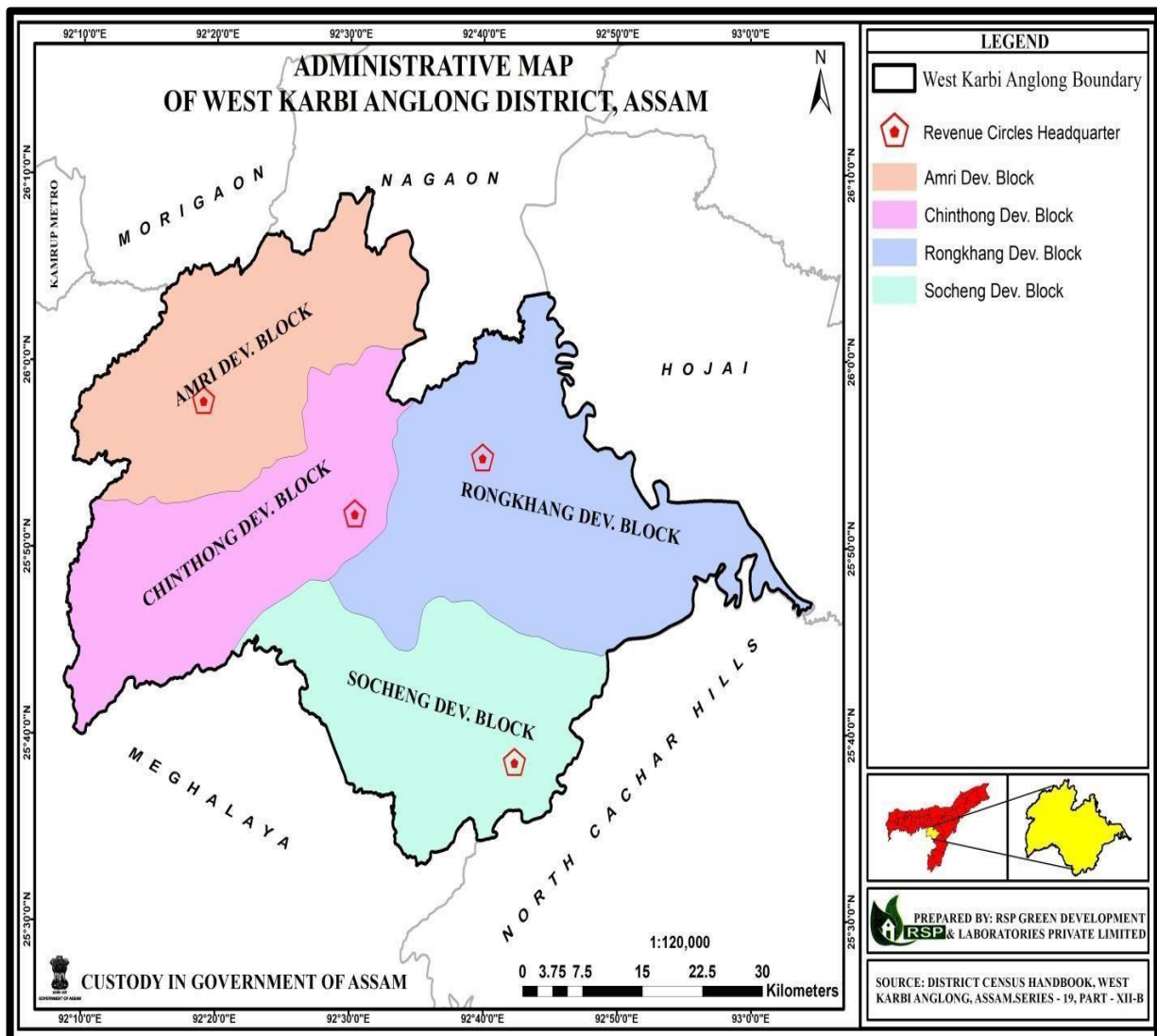


Figure No.06: Administrative Map of West Karbi Anglong, Hamren

b) Climatic Condition

The climate of the area is humid subtropical in nature. The mean annual precipitation (based on 10 years record from 1980-89) is 1950 mm. The mean annual air temperature is 23.5° C. The rainfall is well distributed throughout the year, though major portion is received during March to September (Vadivelu et al., 2003). The rainfall is high in the summer but received occasionally in the winter, the soil moisture control section seldom becomes dry in some parts for more than 90 cumulative days and therefore the area qualifies for ladle soil moisture regime. However, in 2018 maximum and minimum temperature were ranged between 9.9° C - 31.4° C and rainfall between 15 mm – 412 mm.

Summer

Karbi Anglong west experiences humid and hot summer with maximum temperatures often rises above 30° C in day time whereas minimum temperature falls below 20° C at night. As for the direction of the wind, it is blowing from all of the possible directions but majorly from south and south-east. The summers in Karbi Anglong West usually start from middle of March and last till the onset of monsoon in June. The maximum temperature was recorded as 33.8°C in 2005 (Goswami, 2010).

Monsoon

The arrival of the month of June marks the onset of monsoon in Karbi Anglong West, Assam. The district boasts of a high average rainfall. The region receives an average annual rainfall of 2324 mm and a major portion of this is contributed by the north-west monsoons. Monsoon lasts till the middle of the month of October.

Winter

The winter starts from the month of November and extends up to the end of February. The average temperature during this time ranges from 9° C to a maximum of about 18° C. During this time minimum temperature recorded was 9.8°C in the month of January 2005 (Goswami, 2010). The typical characteristics of this season are scanty rainfall and foggy or misty mornings and evenings. While the day time is pleasingly cool, with the fall of evening temperature lowers further, making the nights chilly and cold. During winters, wind usually blows from the north-west direction

Table No 08: Maximum & Minimum Temperature and Rainfall

Parameters	Maximum	Minimum
Temperature (°C)	33.8	9.9
Rainfall (mm)	412	15

Due to variation in the topography, the hills of Karbi Anglong district experience different climates in different parts. The climate of the area is sub-tropical in nature with hot and humid summer followed by dry autumn and cold winter. The average relative humidity varies from 73% to 85% while the average rainfall is about 2418mm. Heavy downpour from May to September under the influence of south west monsoon is a common feature of the climate of the region. The area records the maximum temperature of 23°C - 32°C during the summer months, while the months of December and January record the lowest temperature of 6°C - 12°C.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Avg. Temperature (°C)	16.5	18.4	22.5	25.5	26.9	28.2	28.6	28.4	27.9	25.6	21.4	17.6
Min. Temperature (°C)	9.1	11.1	15	19.1	22	24.2	24.8	24.6	24	21.2	15.6	10.8
Max. Temperature (°C)	23.9	25.8	30.1	32	31.8	32.2	32.4	32.3	31.8	30.1	27.2	24.4
Avg. Temperature (°F)	61.7	65.1	72.5	77.9	80.4	82.8	83.5	83.1	82.2	78.1	70.5	63.7
Min. Temperature (°F)	48.4	52.0	59.0	66.4	71.6	75.6	76.6	76.3	75.2	70.2	60.1	51.4
Max. Temperature (°F)	75.0	78.4	86.2	89.6	89.2	90.0	90.3	90.1	89.2	86.2	81.0	75.9

(CLIMATE GRAPH // WEATHER BY MONTH (<https://en.climate-data.org>))

Figure 07: Maximum & Minimum Temperature

C) Rainfall: Month wise

The average annual rainfall of West Karbi Anglong is about 1350 mm. The rainy season ranges from middle of June to September due to southwest monsoon and the highest rainfall occurs in July and August.

Table No. 09: Average rainfall by month in the district of West Karbi Anglong (Year: 2017)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Avg. rainfall (mm)	17	25	56	126	190	210	247	216	182	133	32	19	1350

Source: Weather base: Historical Weather for West Karbi Anglong, India

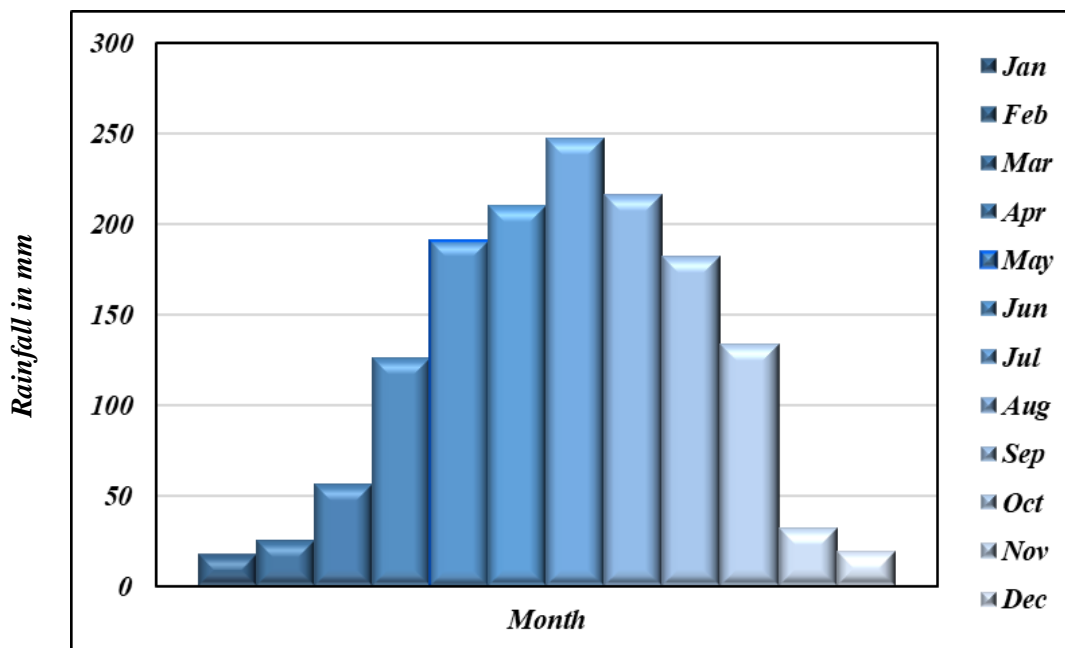


Figure 08: Maximum & Minimum Rainfall

d) Topography & Terrain:

Most part of the district is covered by hills except the narrow strips of flat lands along the banks of Myntriang River, KarbiLangpi River, Kopiliriver and Amreng River. Among these rivers, Hydro Electric Project have been set up on the Myntriang and KarbiLangpi rivers. The eastern part of the undivided KarbiAnglong is mostly covered with hills which end on the North at the plains of the Brahmaputra, and on the East and West on the plains of the Dhansiri and Jamuna valleys respectively. They rise sharply from the narrow valleys with which they are intersected and are covered with dense forests, except in places where they have been cleared for Shifting Cultivation locally referred as Jhum, by the tribal populace. The district consists of a mass of serrated ridges, whose steeply sloping sides are green with creepers smothered trees and bamboo forests that spring up on the sides of the following Jhum. The western Karbi Anglong, except the narrow strips of flat lands along major rivers, is covered by hills which are part of shilling plateau whose elevation varies between 150m to near about 1219.20 m above the sea level (Phangcho, 2001; Teron, 2011).

Even though, the district is dotted with hills, a few of which can be categorized into Mountain. Among them, the highest is the Laru Peak which is at about 1290 metre above the sea level.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

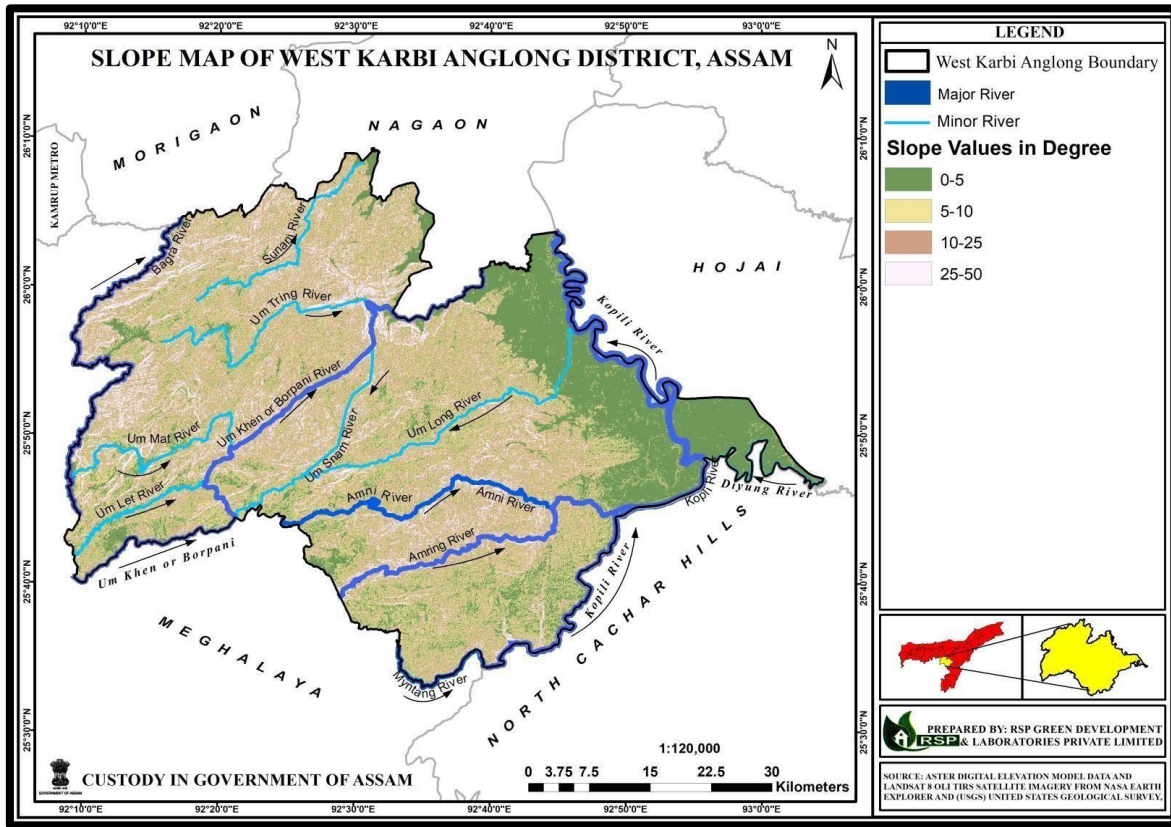
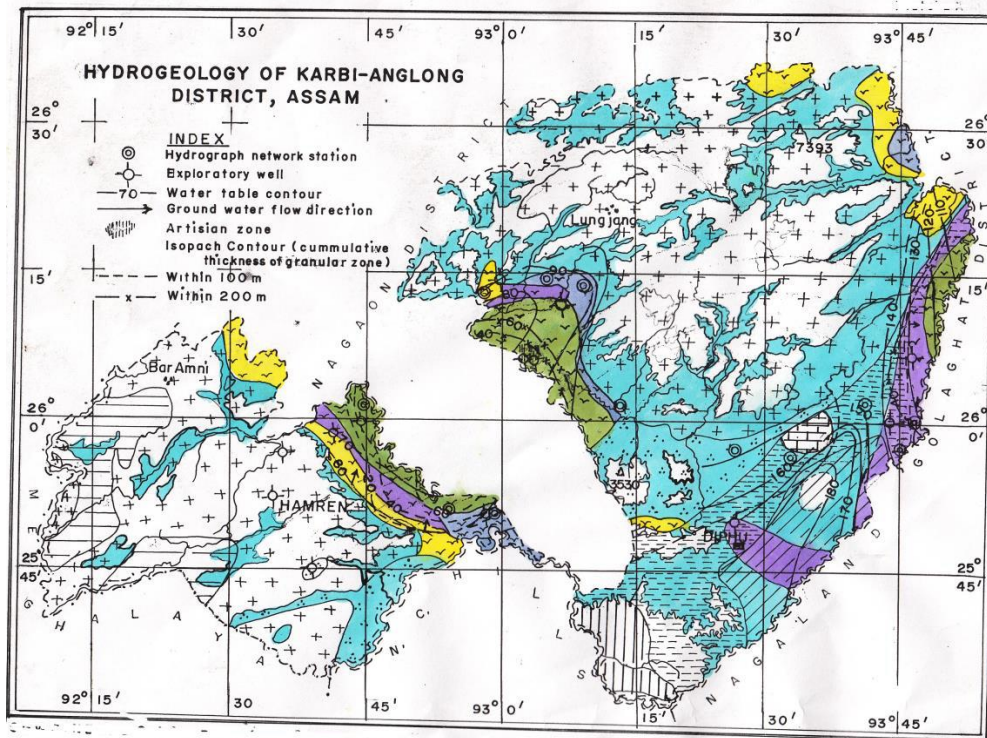


Figure No.09 Slope Map of the District

e) Water Course & Hydrology:

The drainage system within West KarbiAnglong, which also encompasses interdistrict areas, is based on the Kopili system. The Kopili with its vast catchment and basin areas is one of the longest tributary systems of the Brahmaputra. Its main drainage originates from the eastern part of the Jaintia Hills and passes through, forming the boundary between west Karbi Anglong and N. C. Hills and West Karbi Anglong and Nagaon districts. The drainage pattern is dendritic to sub-parallel and is controlled by structural features and underlying lithology. The important tributaries originating from the high plateau of the Khasi Hills are the Umkhen and Umiam. The rivers flow from south-west to north-east and almost parallel in accordance with the general slope of the relief. The Umkhen and Umiam meet the Kopili in Nagaon district. The term Umkhem is used only in Khasi and Jaintia Hills while within KarbiAnglong it is known as Langpi or Barapani. The Kopili and the Langpi pass through gentle slopes except in limited number of places where they have formed narrow and deep valleys and rapids, cascades and low water falls.

DISTRICT SURVEY REPORT OF WEST KARBIANGLONG, HAMREN



KARBI-ANGLONG DISTRICT, ASSAM

GROUP	AGE	FORMATION	LITHOLOGY	GROUND WATER CONDITIONS	GROUND WATER PROSPECTS
QUATERNARY	Recent	Alluvium	Sand, Gravel & Clay	Discontinuous lensoidal type of aquifers having limited thickness, ground water under unconfined/ confined condition.	A Suitable for dug wells down to depth of 10m with yield potential of 10m ³ /day.
					B Suitable for shallow tubewells down to 30-50m with yield potential of 12-18m ³ /hr. for normal drawdown.
TERTIARY	Miocene	Tipam	Sandstone, Siltstone, Shale, mottled clay	Discontinuous clayey type moderately thick semiconfined to confined aquifers.	C Suitable for deep tube wells down to 90-100m with yield potential of 80-90 m ³ /hr for drawdown upto 6m.
		Surma	Sandstone, Shale	Thin lensoid clayey sand aquifers of limited extension with semi-confined confined ground water.	D Suitable for deep tube wells down to 170-200m with yield potential of 60-80m ³ /hr upto 6m drawdown.
	Oligocene	Barail	Shale, Siltstone	Hilly tract.	E Suitable for shallow & deep tubewells of above category.
					F Suitable for dug wells down to 20m. Topographic lows weathered zone with 9-10m ³ /day yield potential.
	Eocene	Jaintia	Shale, Sandstone	Hilly tract	G Suitable for deep tube wells down to 200m low yield capacity to 5-10m ³ /hr.
					Ground water exploration considered suitable for low yield dug well limited to small intermontane valley, areas of limited yield potential of 5m ³ /day.
Pre-cambrian	Shillong Group	Quartzite, phyllite & Schist	Compact limestone with superficial weathering	Hilly tract	- do -
		Gneisses/Granite	Ground water occurs in water table conditions in weathered/fractured zone of shallow depth of 20-30m.	H Suitable for dug wells with 8-10m ³ /day in selected weathered portion.	
					Not considered suitable for ground water development.

Source: Central Ground Water Board

Figure No.10 Hydrogeology Map of the District

f) Ground Water Development:

Ground water occurs under unconfined to confined conditions. Hydrogeological these rock units occur – i) Consolidated formation ii.) Semi – consolidated formation and iii.) Unconsolidated formation. The consolidated formation comprises Archaen rocks of Shillong Series and to some

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

extent the lower part of Tertiary rocks, the semi-consolidated group comprising Sandstone, siltstone and clay restricted to tertiary rocks and the unconsolidated group to recent sub-recent alluvial sediments. From the view point of quality, the ground water is suitable for drinking purpose except high iron and fluoride content. The shallow zones are free from both iron and fluoride, while the deeper zones beyond 10 m depth contains high iron beyond permissible limit and the pediment zone on northern foot hill zone in Diphu-subdivision and eastern fringe area of Hamren sub-division contains up to 16 ppm in deeper aquifers. The estimated gross annual dynamic ground water resource is 340.46 mcm while net ground water resource is 20.63 mcm for undivided Karbi anglong district. At present the utilisation of ground water is mostly for drinking purpose. However, for irrigation ground water from tube wells is also used. The total area irrigated from ground water source is 2395 hectares.

In the consolidated formation, ground water is confined to the top weathered zone and the fractures and fissures of the fresh hard rock. The thickness of the weathered zone depends on compactness and topography of rock types and other climatic effects. The depth to water level varies from 4 to 6 m in low terraced zone and 8 to 10 m in high terraced zones. In small valleys within denudational hills, the static water level is 5 to 7 m bgl with water level fluctuation ranging from 2 to 3 m. The depth of the weathered materials generally is from 10 – 20 m. About 13 nos. bore wells were drilled in hard rock and yield of the boreholes are limited. The depth to water level varies from 1 m to as much as 14 m or more up to 28 m bgl.

The annual replenishable ground water resource of the district is 381.99 mcm and net annual drafts 28.03 mcm. The projected demand for domestic and industrial uses up to 2025 is 31.94 mcm. The stage of ground water development is 8%.

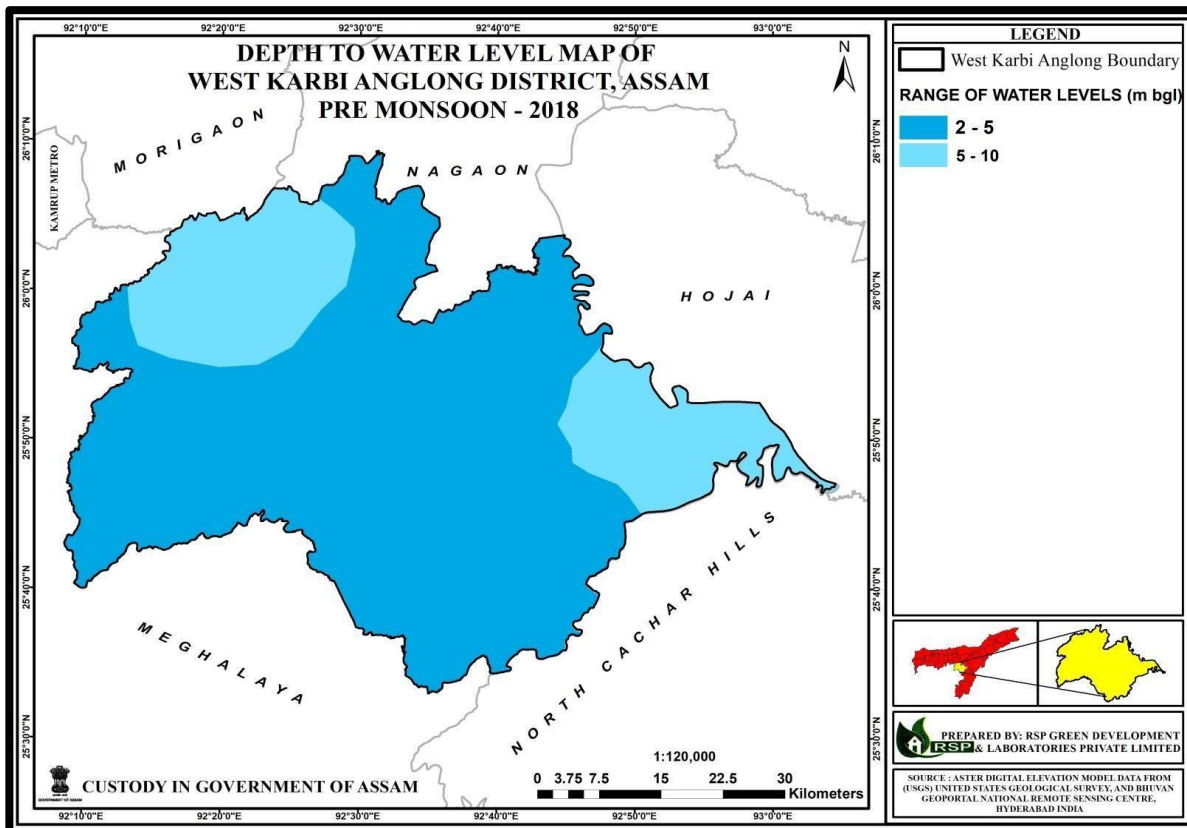


Figure No. 11 Water Level Depth Map of the District (Pre-Monsoon)

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

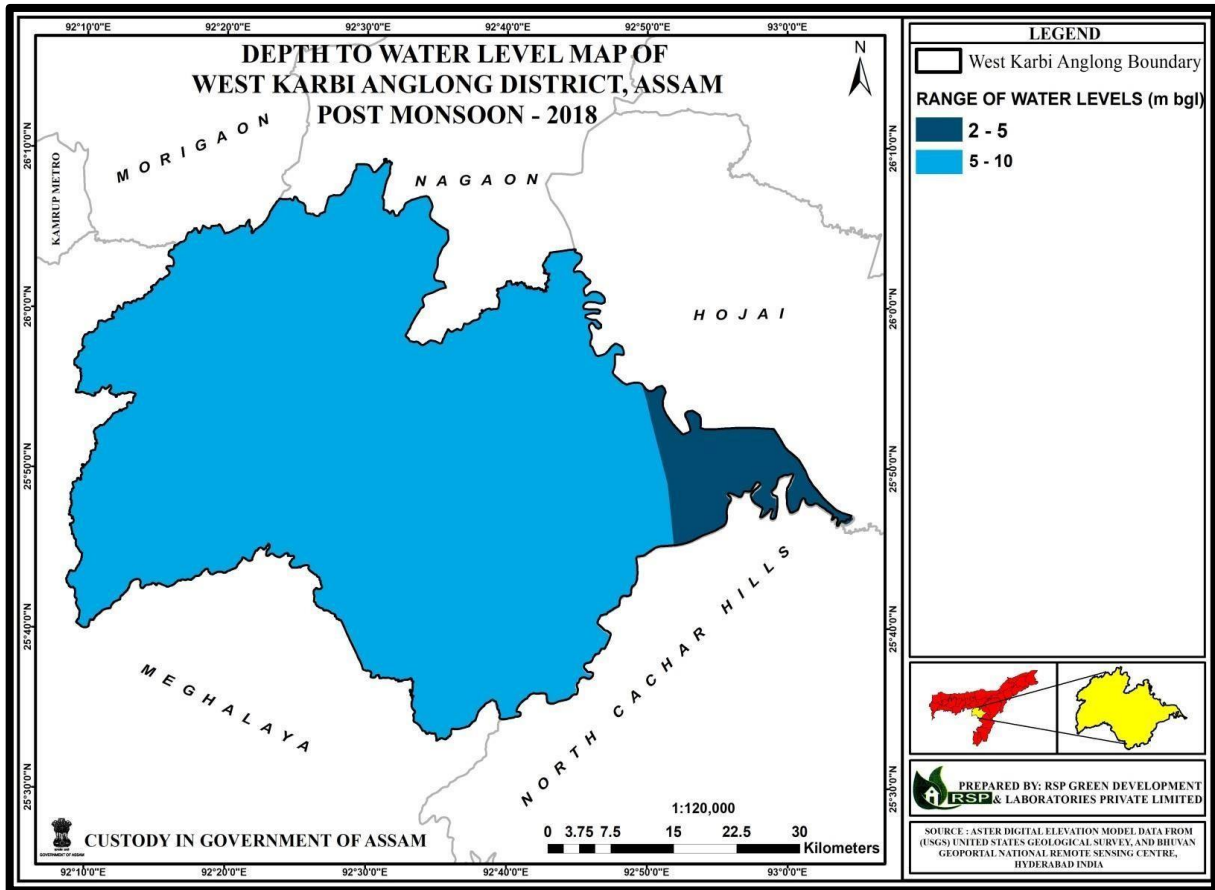


Figure No.12 Water Level Depth Map of the District (Post-Monsoon)

g) Drainage System (general):

The important rivers of this district are: The Myntriang River, Karbi Langpi River, Kopili River and Amreng River. Among these rivers, Hydro Electric Project have been set up on the Myntriang and Karbi Langpi rivers.

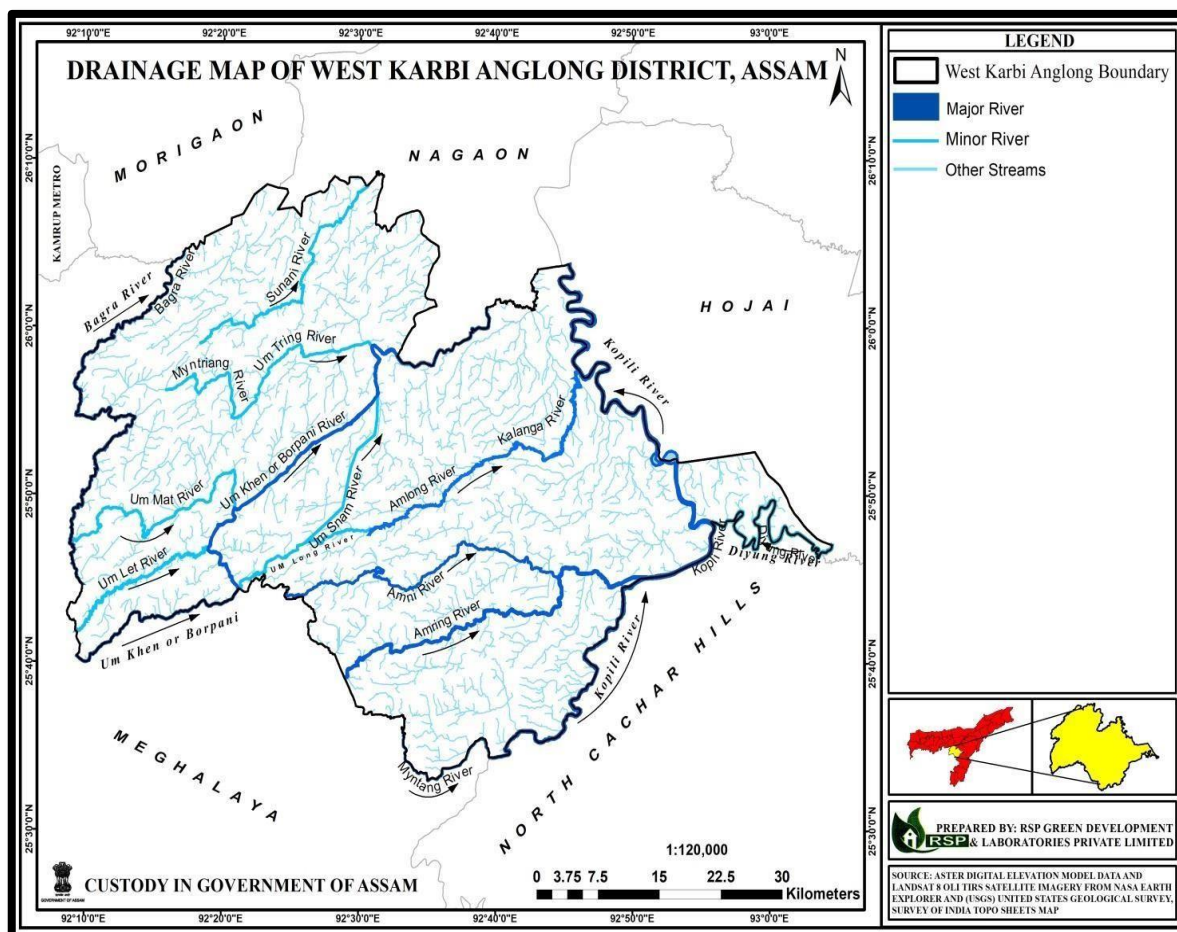


Figure No.13 Drainage Network Map of District

h) Demography:

Due to significant geographical aspect of Assam, it has usually pleasant tropical monsoon climate with moderate rainfall and temperature the growth of population of the state has increased since the middle decades of the 20th century. Karbi Anglong (West), the district lies at central part of Assam is predominantly popular as an area of indigenous ethnic tribal community “Karbis” of Assam is not an exception. Besides the Karbis, the population of the district also comprises of the other tribes, as Bodos, Kukis, Dimasas, Hmars, Garos, Rengma Nagas, Tiwas etc. Also, a large number of non-tribal communities are living together in this hilly province. The current demographic statistics of Karbi Anglong (West), depicts the births, deaths, literacy rate etc., which clearly illustrate the changing pattern of populations of the district (<http://assam.gov.in/>). According to the last census that is of 2011, portrays the below mentioned dataset of demography of the district Karbi Anglong (West).

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

Table No. 10: Demographic pattern of the district

Description	:	
Total population	:	300,320
Male	:	153,763
Female	:	146,557
Area in sq. km.	:	3035 sq. km
No. Of Villages	:	317(Revenue Village), 855(Census Village)
Nos. of Blocks	:	4
Density/sq km	:	98.952
Sex ratio(per 1000 male)	:	973
Child Sex Ratio(per 1010 male)	:	889
Average Literacy	:	85.19%
Male Literacy	:	90.19%
Female literacy	:	80.19 %.
<i>Source: https://had.assam.gov.in/frontimpotentdata/west-karbi-anglong-district</i>		

Table No.11: Town-wise population, sex ratio, literacy rate of West Karbi Anglong as per Census 2011

Town	Class	Population			Sex Ratio	Literacy Rate		
		Person	Male	Female		Person	Male	Female
Hamren	Class- V	8,694	4,406	4,288	973	86	90	82
Dongkamukam	Class - V	9,116	4,604	4,512	980	72	77.1	66.5
Total		17,810	9,010	8,800	976			
<i>(Source: http://assam.gov.in/)</i>								

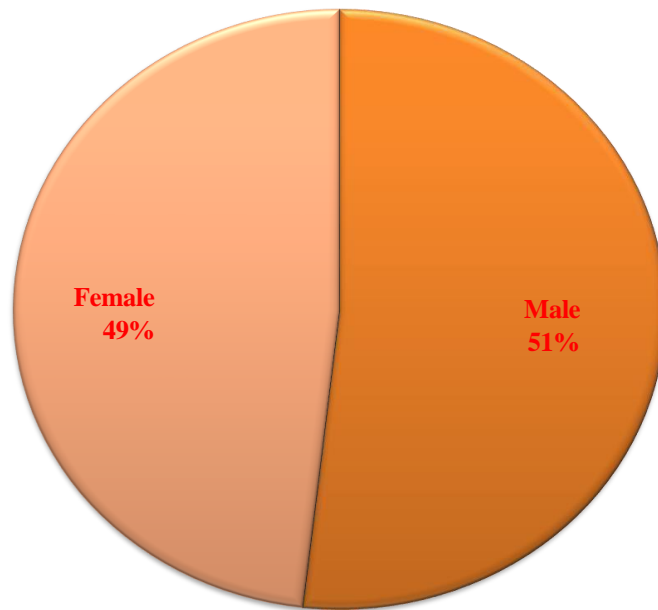


Figure 14: Gender-wise population of the district as per census 2011

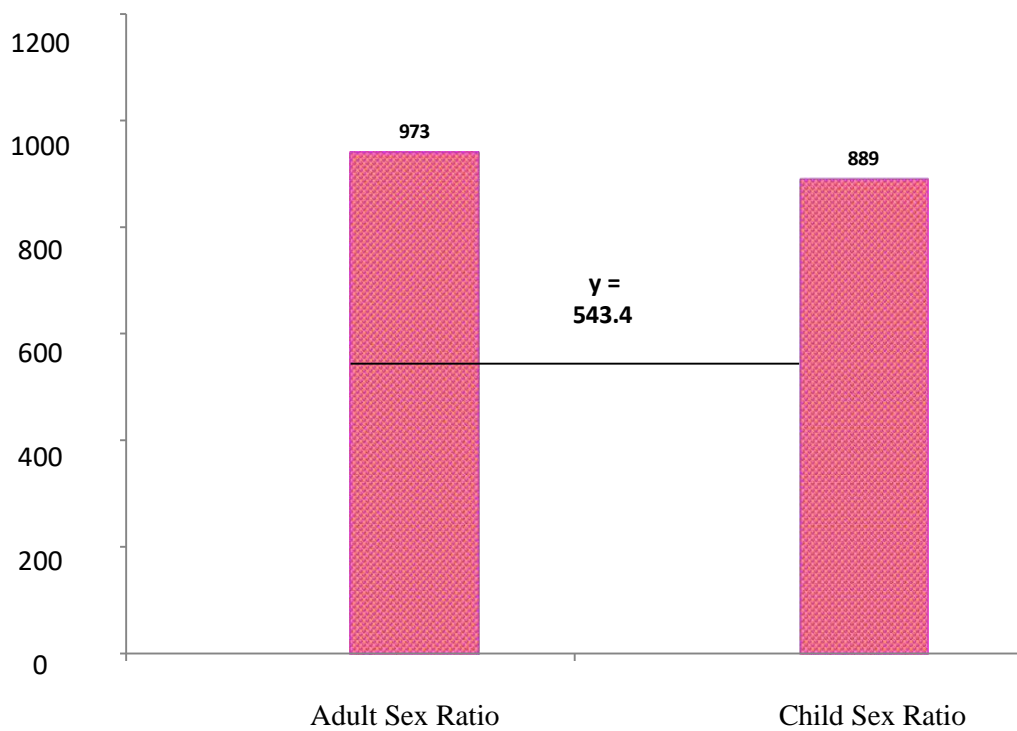


Figure 15: Sex ratio population of the district as per census 2011

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

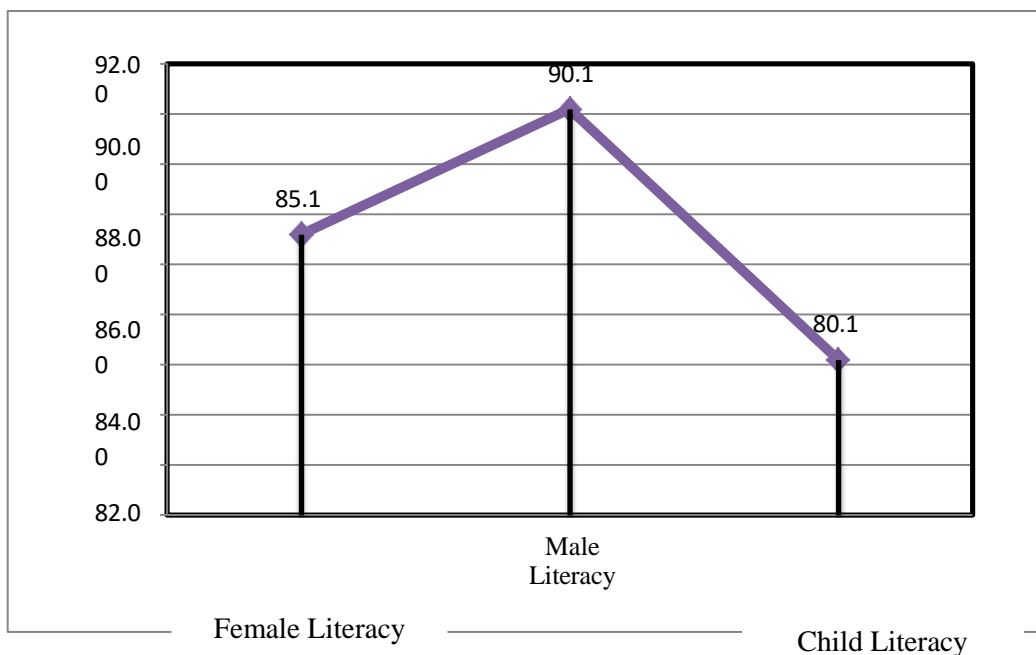


Figure 16: Graphical Representation of distribution of male & female literates of the district

Table No.: 12 Town-wise population, of SC & ST of the District

SL. NO.	TOWN	POPULATION	
		SC	ST
1	Hamren	178	6836
2	Dongkamukam	509	7007

Source: <http://karbianglong.nic.in/main-web/ata glance.html>

Table No. 13 Religious data of Hamren, West Karbi Anglong

Town	Population	Hindu	Muslim	Christian	Sikh	Buddhist	Jain	Others	Not Stated
Hamren	8,694	11.63%	6.61%	80.08%	0.25%	0.28%	0.32%	0.61%	0.22%

i) Cropping Pattern:

Agriculture is the main source of income of this region. The economic development of the district is highly dependent on agriculture and allied activities. Due to rich geographical and agro-climatic diversity, various types of crops are grown in the district of West Karbi Anglong. This hill district has topography of hills, plains and valleys and tropical climate in general. The

predominant soil types of the district are clay loam, sandy loam, and sandy. Red loamy soil mixed with clay covers about 70% of the area of Donka sub-division. Old alluvium is found in western part and also in the extreme northern most part of sub-division. Therefore the district portrays its own peculiarities in the system of cultivation with unique district attributes. The type of cultivation of crops varies from place to place according to the variation of relief, rainfall, soils etc.

According to the Indian Council of Agricultural Research (ICAR), the agro ecological sub-region of West Karbi Anglong district lies under warm to hot humid eco-sub-region of Eastern Himalayan province. Agriculture is the key stay of the tribal community of these hilly districts. Cropping pattern of the district illustrates that, the age old traditional, terrace cultivation/“Jhum” and shifting cultivation are prominent agricultural practises in Karbi Anglong. Agriculture in this district has its own peculiarities due to its geographical attribute which is encompassed of both hilly and plain tracts. Bulk of the tribes solely depend upon Jhum cultivation, on the other hand, people living in the plain areas generally engaged in wet paddy cultivation and generally the people of this district rarely follow the double/multiple cropping systems and mostly cultivate single crops in their cultivable lands (*DISTRICT IRRIGATION PLAN 2015- 20 KARBI ANGLONG, ASSAM, 2015-2020*). The favourable agro-climatic condition of KarbiAnglong supports plentiful growth and production of number of fruits as orange, lemon, pine-apple, banana, pomegranate, papaya. Large quantities of spice producing plants like ginger, chillies, cardamom, turmeric etc., are cultivated in interior hill regions.

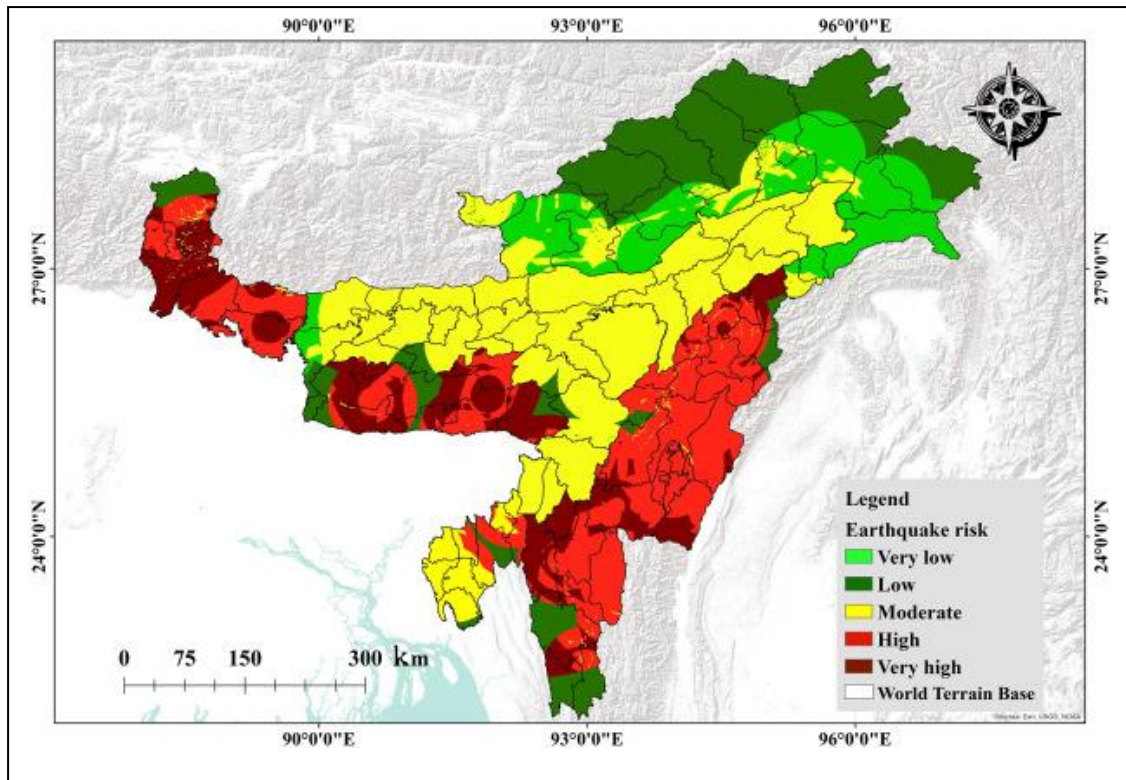
Horticultural crops are extensively grown in different development blocks of the district.

j) Land Form and Seismicity:

West Karbi Anglong has not experiences any major earthquake yet, except few mild tremors occasionally. But the entire District is vulnerable due to its weak and fragile relief being the most dangerous zone i.e. Zone (V). The district located at the eastern part of the Meghalaya Plateau. The whole district is sitting on the bed of limestone and hence very fragile. The whole district is sitting on the bed of limestone and hence very fragile. The soil is very much unstable and hence, need special attention to structures and constructions.

Table No.: 14 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: <https://www.sciencedirect.com/>)

Figure No 17: Seismic map of Assam and North East Part

k) Major Flora:

Vegetation of a particular area of region depends on the interaction of many factors besides the effects of the plants on the place in which they grow and live, as well as the influence of plants themselves on each other. For example-trees, shrubs and herbs arrest some light and decrease the force of wind. Evaporation of soil moisture from floor is checked by the fallen leaves. Again the plants inhabiting in a particular area have various types of growth forms.

These growth forms and associations among different types of vegetation can be described as follows:

Heterotrophic: It includes all the parasitic plants where chlorophylls are completely absent or ill developed, as for example – *Cuscuta reflexa*, *Balanophora dioica*, *Orobanche aegyptica*, *Salmonia aphylla*etc (Table 7).

Lianoidtype: It includes all climbers and twiners. As for example- *Calamus spp.*, *Uncaria spp.*, *Entada sp.*, *Viris spp.*, *Pothos spp.*, *Randia sp.*, *Delima sp.*, *Mikania spp.*, *Cardiospermum sp.*, *Naravelia sp.*, *Ipomoea spp.*, *Dioscorea spp.*, *Tylophora spp.*, *Stephanie sp.*, *Cissampelos sp.*, *Piper sp.*, *Rhaphidophora spp.*, *Mucuna sp.*, *Roydsia sp.*, *Smilax spp.*, *asparagus sp.*, *Stenoehloena sp.*, *vanilla sp.*, etc.

Prostrate type: This type includes all plants having decumbent creeping stems e.g., *Evolvulussp.*, *Oxalis sp.*, *Hydrocotyle sp.*, *Centellasp.*, *Eragaria sp.*, *Pistia sp.*, *Marsilea sp.*,

Oenanthe sp., Baccopasp., Tridax sp., Borreria sp., etc .

Renasant growth forms: These include plants which have flowers and leaf formation at different time of the year. As for example – Butea monosperma, Spondia spinnata, Didymoplexi spallens etc.

Cactus type: This is characterised by juicy lignified stem without foliage leaves. As for example - Opuntiasp. Euphorbia neriifolia, Phyllocactus sp., Epiphyllum sp., Asparagus sp., etc

Succulents type: In this type; the stem is very soft e.g., Hydrilla sp., Ceratophyllum sp., Ottelia sp., Utricularia sp., Potamogeton sp., Najas sp., Limnophila sp., Sagittaria sp., Monochoria sp., Lemna sp., etc.

Rosette type: This type has erect dwarf shoot with very short inter nodes and leaves are closely set e.g. - Plantagosp. Droserasp. Eichhornia sp., Roroppasp. Nasturtium sp., Elephantopus sp., Aponogetonsp ., Sagittaria sp., etc .

Musa type: It is characterised by large herbs comprised of pseudo stem formed of leaf sheath - bases. As for example - Musa sp., Alocasia sp., Colocasia sp., Kamferia sp., Curcuma sp., Acanthephippium sp., Alpinia sp., Coelogyne sp., Coix sp., etc.

Arboreal woody and shrubby forms: These are very frequent in the forests. As for example – Bombax ceiba, Sizygium ceumini, Mesua ferrea, Schima wallichii, Aguilaria agalocha, Artocarpus heterophylla, Ficus spp., Melastoma malabathricum, Lantana camara, Clerodendrum spp., Cassia alata, Vitex negundo, Eupatorium odoratum, Dalhousie abracteata, Callicarpa spp., etc.

Typical herbaceous type: This type is characterised by soft stem and usual low forms. As for example - Ageratum conyzoides, Amaranthus spp., Leucas spp., Cleome viscosa, Polygala arvensis, Polygonum spp., Justicia simplex, Salmonia spp., Pesmodium spp., Cyperus brevifolius, Eleusine indica, etc.

The vegetation is of somewhat 'Savannah' type where species of Phragmites karka are dominant and Butea monosperma, Lagerstroemia speciosa, Zizyphus mauritiana form the canopy of the vegetation (Sarmah, 1989).

The bamboo vegetation (though it is at present cultivated) is very common along with the other evergreen and semi-evergreen plants. From the western bank of the rivulet Kakodonga the vegetation of the western side starts. It does not include any dense forest. In this area scrub jungles and grass land vegetation is common along with the other evergreen and semi-evergreen plants. Besides which many epiphytic, parasitic and aquatic plants are also found in the area. The vegetation of western part is of mixed type comprising both evergreen and semi evergreen plants. The area includes forests patches, scrub jungles, and grass land vegetation. On most of the trees of forests many epiphytic plants including orchids are also found.

Tea gardens:

There are altogether 88 Tea gardens within the district (GoA, Directorate of Welfare). Though tea bushes are cultivated within certain boundaries yet, they add to the beauty of the vegetation of the district due to pruned habit of the tea bushes. Within the tea gardens some tall trees and shrubs are also found along with the herbaceous weeds. Generally, the trees and shrubs belong to the family Fabaceae (Leguminosae) and perhaps they are planted in the tea gardens for partial shade

and green manures (Sarmah, 1989).

I) Major Fauna:

KarbiAnglong West district is very rich in biodiversity, comprises of 35 species of mammals, 17 species of snakes, 10 species of lizards and 218 species of birds (Devi &Saikia, 2010).

Table No.: 15 Checklist of faunal species

Sl. No.	Common Name	Scientific Name
1	Western hoolock gibbon	<i>Hoolock hoolock</i>
2	Stump-tailed macaque	<i>Macaca arctoides</i>
3	Northern pig-tailed macaque	<i>Macaca leonina</i>
4	Eastern Assamese macaque	<i>Macaca assamensisassamensis</i>
5	Bengal slow loris	<i>Nycticebus bengalensis</i>
6	Indian rhesus macaque	<i>Macaca mulattamulatta</i>
7	Capped langur	<i>Trachypithecus pileatusdurga</i>
8	Indian hog deer	<i>Hyelaphu sporcinus</i>
9	Sambar	<i>Cervus unicolor</i>
10	Indian crested porcupine	<i>Hystrix indica</i>
11	Tiger	<i>Panthera tigris</i>
12	Leopard	<i>Panthera pardus</i>
13	Jungle cat	<i>Felis chaus</i>
14	Large Indian civet	<i>Viverra zibetha</i>
15	Small Indian civet	<i>Viverricula indica</i>
16	Common palm civet	<i>Paradoxurus hermaphroditus</i>
17	Malayan giant squirrel	<i>Ratufa bicolor</i>
18	Irrawaddy squirrel	<i>Callosciurus pygerythrus</i>
19	Indian elephant	<i>Elephas maximusindicus</i>
20	Marbled cat	<i>Pardofelis marmorata</i>
21	Leopard cat	<i>Prionailurus bengalensis</i>
22	Common mongoose	<i>Herpestes edwardsi</i>
23	Small Asian mongoose	<i>Herpestes auropunctatus</i>
24	Indian fox	<i>Vulpes bengalensis</i>
25	Jackal	<i>Canis aureus</i>
26	Wild boar	<i>Sus scrofa</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

27	Indian flying fox	<i>Pteropus giganteus</i>
28	Kelaart's pipistrelle	<i>Pipistrellus ceylonicus</i>
Domestic Animal		
Sl. No.	Common Name	Scientific Name
1	Cow	<i>Bos taurus indicus</i>
2	Buffalo	<i>Bubalus bubalis</i>
3	Horse	<i>Equus caballus</i>
4	Goat	<i>Capra hircus</i>
5	Pig	<i>Sus scrofa domesticus</i>
6	Dog	<i>Canis lupus familiaris</i>
7	Domestic Cat	<i>Felis catus</i>
Common Snakes		
Sl. No.	Common Name	Scientific Name
1	Indian python	<i>Python molurus</i>
2	Rat snake	<i>Boigatri gonata</i>
3	Indian cobra	<i>Najanaja</i>
4	Common rat snake	<i>Ptyas mucosa</i>
5	Black Krait	<i>Bungarus niger</i>
6	Bengal Cobra	<i>Najakaouthia</i>
7	Common Kukri Snake	<i>Oligodon arnensis</i>
8	Striped Keelback	<i>Amphies mastolata</i>
9	Common or Long-Nosed Vine Snake	<i>Ahaetulla nasuta</i>
10	Reticulated Python	<i>Python reticulatus</i>
11	Copperhead Trinket Snake	<i>Elapher adiata</i>
12	Common Krait	<i>Bungarus caeruleus</i>
13	Banded Krait	<i>Bungarus fasciatus</i>
14	King Cobra	<i>Ophiophagus hannah</i>
15	Russel's Viper	<i>Vipera russellii</i>
16	Pit Vipers	<i>Trimeresurus spp.</i>
17	Philippine cobra	<i>Naja philippinensis</i>
Common Lizards		
Sl. No.	Common Name	Scientific Name
1	Common Indian Skink	<i>Mabuya carinata</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

2	Assam Olive-Brown Skink	<i>Mabuya multifasciata</i>
3	Tuckto Gecko	<i>Gecko gecko</i>
4	Tickticky House Gecko	<i>Hemidactylus frenatus</i>
5	Common Bengal Monitor	<i>Varanus bengalensis</i>
6	Indian Water Monitor	<i>Varanus salvator</i>
7	Assam Greyish-Brown Gecko	<i>Hemidactylus garnotii</i>
8	Light-Olive Assam Garden Lizard	<i>Calotes emma</i>
9	Assam Garden Lizard	<i>Calotes maria</i>
10	Dotted Garden Skink	<i>Lygosoma punctata</i>

Table No.:16 Checklist of avian species

Sl. No.	Common Name	Scientific Name
1	Red junglefowl	<i>Gallus gallus</i>
2	Kalij pheasant	<i>Lophura leucomelanos</i>
3	Ruddy shelduck	<i>Tadorna furruginea</i>
4	Common teal	<i>Anas crecca</i>
5	Common pochard	<i>Aythya ferina</i>
6	Speckled piculet	<i>Picumnusinnominatus</i>
7	White-browed piculet	<i>Sasiaochracea</i>
8	Rufous woodpecker	<i>Celeusbrachyurus</i>
9	Grey-capped pygmy woodpecker	<i>Dendrocoposcanicapillus</i>
10	Fulvous-breasted woodpecker	<i>Dendrocoposmacei</i>
11	Lesser yellownape	<i>Picuschlorolophus</i>
12	Greater yellownape	<i>Picusflavinucha</i>
13	Streak-throated woodpecker	<i>Picusxanthopygaeus</i>
14	Grey-headed woodpecker	<i>Picuscanus</i>
15	Himalayan flameback	<i>Dinopiumshorii</i>
16	Common flameback	<i>Dinopiumjavanense</i>
17	Greater flameback	<i>Chrysocolapteslucidus</i>
18	Lineated barbet	<i>Megalaimalineata</i>
19	Golden-throated barbet	<i>Megalaimafranklinii</i>
20	Blue-throated barbet	<i>Megalaimaasiatica</i>
21	Blue-eared barbet	<i>Megalaimaaustralis</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

22	Coppersmith barbet	<i>Megalaimahaemacephala</i>
23	Oriental pied hornbill	<i>Anthracocerosalbirostris</i>
24	Great hornbill	<i>Bucerosbicornis</i>
25	Common hoopoe	<i>Upupaepops</i>
26	Red-headed trogon	<i>Harpacteserythrocephalus</i>
27	Indian roller	<i>Coraciasbenghalensis</i>
28	Dollarbird	<i>Eurystomusorientalis</i>
29	Common kingfisher	<i>Alcedoatthis</i>
30	Stork-billed kingfisher	<i>Halcyon capensis</i>
31	White-throated kingfisher	<i>Halcyon smyrnensis</i>
32	Pied kingfisher	<i>Cerylerudis</i>
33	Blue-bearded bee-eater	<i>Nyctyornisathertoni</i>
34	Green bee-eater	<i>Meropsorientalis</i>
35	Blue-tailed bee-eater	<i>Meropsphilippinus</i>
36	Chestnut-headed bee-eater	<i>Meropsleschenaulti</i>
37	Pied cuckoo	<i>Clamatorjacobinus</i>
38	Chestnut-winged cuckoo	<i>Clamatorcoromandus</i>
39	Common hawk-cuckoo	<i>Hierococcyxvarius</i>
40	Indian cuckoo	<i>Cuculusmicropterus</i>
41	Plaintive cuckoo	<i>Cacomantismerulinus</i>
42	Asian emerald cuckoo	<i>Chrysococcyx maculates</i>
43	Square-tailed drongo-cuckoo	<i>Surniculustlugubris</i>
44	Asian koel	<i>Eudynamysscolopacea</i>
45	Greater coucal	<i>Centropussinensis</i>
46	Lesser coucal	<i>Centropusbengalensis</i>
47	Alexandrine parakeet	<i>Psittaculaeupatria</i>
48	Rose-ringed parakeet	<i>Psittaculakrameri</i>
49	Red-breasted parakeet	<i>Psittaculaalexandri</i>
50	Blossom-headed parakeet	<i>Psittacula roseate</i>
51	Himalayan swiftlet	<i>Collocaliabrevirostris</i>
52	Asian palm swift	<i>Cypsiurusbalasiensis</i>
53	House swift	<i>Apusaffinis</i>
54	Mountain scops owl	<i>Otusspilocephalus</i>
55	Oriental scops owl	<i>Otussunia</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

56	Collared scops owl	<i>Otusbakkamoena</i>
57	Brown fish owl	<i>Ketupazeylonensis</i>
58	Collared owlet	<i>Glaucidiumbrodiei</i>
59	Asian barred owlet	<i>Glaucidiumcuculoides</i>
60	Spotted owlet	<i>Athenebrama</i>
61	Brown hawk-owl	<i>Ninoxscutulata</i>
62	Grey nightjar	<i>Caprimulgusindicus</i>
63	Large-tailed nightjar	<i>Caprimulgusmacrurus</i>
64	Ashy wood pigeon	<i>Columba pulchricollis</i>
65	Green imperial pigeon	<i>Duculaaenea</i>
66	Oriental turtle dove	<i>Streptopeliaorientalis</i>
67	Spotted dove	<i>Streptopeliachinensis</i>
68	Emerald dove	<i>Chalcophapsindica</i>
69	Ashy-headed green pigeon	<i>Treronphayrei</i>
70	Yellow-footed green pigeon	<i>Treronphoenicoptera</i>
71	White-breasted waterhen	<i>Amaurornisphoenicurus</i>
72	Western swamphen	<i>Porphyrioporphyrio</i>
73	Common moorhen	<i>Gallinulachloropus</i>
74	Common snipe	<i>Gallinagogallinago</i>
75	Common greenshank	<i>Tringanebularia</i>
76	Wood sandpiper	<i>Tringaglareola</i>
77	Common sandpiper	<i>Actitishypoleucos</i>
78	Little ringed plover	<i>Charadriusdubius</i>
79	Red-wattled lapwing	<i>Vanellusindicus</i>
80	Pheasant-tailed jacana	<i>Hydrophasianuschirugus</i>
81	Bronze-winged jacana	<i>Metopidiusindicus</i>
82	River tern	<i>Sterna aurantia</i>
83	Black baza	<i>Avicedaleuphotes</i>
84	Black kite	<i>Milvusmigrans</i>
85	Grey-headed fish eagle	<i>Ichthyophagaichthyaetus</i>
86	Crested serpent eagle	<i>Spilornischeela</i>
87	Pied harrier	<i>Circus melanoleucos</i>
88	Shikra	<i>Accipiter badius</i>
89	Black-winged kite	<i>Elanuscaeruleus</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

90	Oriental darter	<i>Anhinga melanogaster</i>
91	Little cormorant	<i>Phalacrocoraxniger</i>
92	Indian cormorant	<i>Phalacrocoraxfuscicollis</i>
93	Great cormorant	<i>Phalacrocoraxcarbo</i>
94	Little egret	<i>Egrettazarzetta</i>
95	Great egret	<i>Ardea alba</i>
96	Intermediate egret	<i>Mesophoyxintermedia</i>
97	Cattle egret	<i>Bubulcus ibis</i>
98	Indian pond heron	<i>Ardeolagrayerii</i>
99	Little heron	<i>Butorides stratus</i>
100	Black-crowned night heron	<i>Nyctioraxnycticorax</i>
101	Asian openbill	<i>Anastomusoscitans</i>
102	Lesser adjutant	<i>Leptoptilosjavanicus</i>
103	Oriental white-eye	<i>Zosterospalpebrosus</i>
104	Asian fairy bluebird	<i>Irena puella</i>
105	Golden-fronted leafbird	<i>Chloropsisaurifrons</i>
106	Orange-bellied leafbird	<i>Chloropsisishardwickii</i>
107	Common iora	<i>Aegithinetiphia</i>
108	Brown shrike	<i>Laniuscristatus</i>
109	Long-tailed shrike	<i>Laniusschach</i>
110	Grey-backed shrike	<i>Laniustephronotus</i>
111	Rufoustreepie	<i>Dendrocittavagabunda</i>
112	Grey treepie	<i>Dendrocittaformosae</i>
113	Collared treepie	<i>Dendrocittafrontails</i>
114	House crow	<i>Corvussplendens</i>
115	Large-billed crow	<i>Corvusmacrorhynchos</i>
116	Black-hooded oriole	<i>Oriolusxanthornus</i>
117	Maroon oriole	<i>Oriolustrailii</i>
118	Large cuckoo-shrike	<i>Coracinamacei</i>
119	Black-winged cuckoo-shrike	<i>Coracinamelaschistos</i>
120	Rosy minivet	<i>Pericrocotusroseus</i>
121	Small minivet	<i>Pericrocotuscinnamomeus</i>
122	Long-tailed minivet	<i>Pericrocotusethologus</i>
123	Short-billed minivet	<i>Pericrocotusbrevirostris</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

124	Scarlet minivet	<i>Pericrocotus flammeus</i>
125	Black-naped monarch	<i>Hypothymis azurea</i>
126	Black drongo	<i>Dicrurus macrocercus</i>
127	Ashy drongo	<i>Dicrurus leucophaeus</i>
128	Bronzed drongo	<i>Dicrurus aeneus</i>
129	Lesser racket-tailed drongo	<i>Dicrurus remifer</i>
130	Spangled drongo	<i>Dicrurus hottentottus</i>
131	Greater racket-tailed drongo	<i>Dicrurus paradiseus</i>
132	Ferruginous flycatcher	<i>Muscicapaferruginea</i>
133	Red-throated flycatcher	<i>Ficedula parva</i>
134	Little pied flycatcher	<i>Ficedula westermanni</i>
135	Slaty-blue flycatcher	<i>Ficedula tricolor</i>
136	Verditer flycatcher	<i>Eumyias thalassina</i>
137	Asian brown flycatcher	<i>Muscicapadaurica</i>
138	White-throated fantail	<i>Rhipidura albicollis</i>
139	Large niltava	<i>Niltavagrandis</i>
140	Small niltava	<i>Niltavamacgrigoriae</i>
141	Rufous-bellied niltava	<i>Niltavasundara</i>
142	Pale-chinned blue flycatcher	<i>Cyornis poliogenys</i>
143	Blue-throated blue flycatcher	<i>Cyornis rubeculoides</i>
144	Grey-headed canary flycatcher	<i>Culicicapaceylonensis</i>
145	Asian paradise-flycatcher	<i>Terpsiphone paradise</i>
146	White-tailed rubythroat	<i>Luscinia pectoralis</i>
147	Oriental magpie robin	<i>Copsychus saularis</i>
148	White-rumped shama	<i>Copsychus malabaricus</i>
149	Daurian redstart	<i>Phoenicurus aureus</i>
150	White-tailed robin	<i>Myiomela leucura</i>
151	Common stonechat	<i>Saxicola torquata</i>
152	Grey bushchat	<i>Saxicola ferrea</i>
153	Blue rock thrush	<i>Monticola solitarius</i>
154	Scaly thrush	<i>Zosterodaema</i>
155	Black-breasted thrush	<i>Turdus dissimilis</i>
156	Dark-throated thrush	<i>Turdus ruficollis</i>
157	Spot-winged starling	<i>Saroglossa spiloptera</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

158	Chestnut-tailed starling	<i>Sturnusmalabaricus</i>
159	Asian pied starling	<i>Sturnus contra</i>
160	Brahminy starling	<i>Sturnuspagodarum</i>
161	Common myna	<i>Acridotherestrictis</i>
162	Bank myna	<i>Acridotheresginginianus</i>
163	Jungle myna	<i>Acridotheresfuscus</i>
164	White-vented myna	<i>Acridotherescinereus</i>
165	Hill myna	<i>Graculareligiosa</i>
166	Chestnut-bellied nuthatch	<i>Sittacastanea</i>
167	Velvet-fronted nuthatch	<i>Sittafrontalis</i>
168	Great tit	<i>Parus major</i>
169	Sultan tit	<i>Melanochloisultanea</i>
170	Plain martin	<i>Ripariapaludicola</i>
171	Barn swallow	<i>Hirundorustica</i>
172	Red-whiskered bulbul	<i>Pynonotusjocosus</i>
173	Red-vented bulbul	<i>Pynonotuscafer</i>
174	White-throated bulbul	<i>Alophoixuxflaveolus</i>
175	Ashy bulbul	<i>Hemixoxflavala</i>
176	Black bulbul	<i>Hypsipetesleucocephalus</i>
177	Grey-breasted prinia	<i>Priniahodgsonii</i>
178	Yellow-bellied prinia	<i>Priniaflaviventris</i>
179	Slaty-bellied tesia	<i>Tesiaolivea</i>
180	Pale-footed bush warbler	<i>Cettiapallidipes</i>
181	Grey-sided bush warbler	<i>Cettiabrummifrons</i>
182	Paddyfield warbler	<i>Acrocephalusagricola</i>
183	Common tailorbird	<i>Orthotomussutorius</i>
184	Dusky warbler	<i>Phylloscopusfuscatus</i>
185	Smoky warbler	<i>Phylloscopusfulgiventor</i>
186	Tickell's leaf warbler	<i>Phylloscopusaffinis</i>
187	Greenish warbler	<i>Phylloscopustrochiloides</i>
188	Yellow-vented warbler	<i>Phylloscopuscantator</i>
189	White-spectacled warbler	<i>Zosterospalperbrosus</i>
190	Lesser necklacedlaughingthrush	<i>Garrulaxmonileger</i>
191	Greater necklacedlaughingthrush	<i>Garrulaxpectoralis</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

192	Rufous-necked laughingthrush	<i>Garrulaxruficollis</i>
193	Abbott's babbler	<i>Malacocinclaabbotti</i>
194	Buff-breasted babbler	<i>Pellorneuntickelli</i>
195	Puff-throated babbler	<i>Pellorneunruficeps</i>
196	White-browed scimitar babbler	<i>Pomatorhinusschisticeps</i>
197	Grey-throated babbler	<i>Stachyrisnigriceps</i>
198	Striped tit babbler	<i>Macronousgularis</i>
199	Yellow-eyed babbler	<i>Chrysommasinense</i>
200	Chestnut-capped babbler	<i>Timaliapileata</i>
201	Rufous-winged bushlark	<i>Mirafraassamica</i>
202	Pale-billed flowerpecker	<i>Dicaeumerythrorhynchos</i>
203	Plain flowerpecker	<i>Dicaeumminullum</i>
204	Scarlet-backed flowerpecker	<i>Dicaeumcruentatum</i>
205	Thick-billed flowerpecker	<i>Dicaeum agile</i>
206	Ruby-cheeked sunbird	<i>Anthreptessingalensis</i>
207	Purple sunbird	<i>Nectariniaasiatica</i>
208	Crimson sunbird	<i>Ethiopia sparaja</i>
209	House sparrow	<i>Passer domesticus</i>
210	Eurasian tree sparrow	<i>Passer montanus</i>
211	White wagtail (Motacilla alba)	<i>Passer montanus</i>
212	Grey wagtail	<i>Motacillacinerea</i>
213	Paddyfield pipit	<i>Anthusrufulus</i>
214	Olive-backed pipit	<i>Anthushodgsoni</i>
215	Rosy pipit	<i>Anthusroseatus</i>
216	White-rumpedmunia	<i>Lonchurastrata</i>
217	Scaly-breasted munia	<i>Lonchurapunctulata</i>
218	Black-headed munia	<i>Lonchuramalacca</i>

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

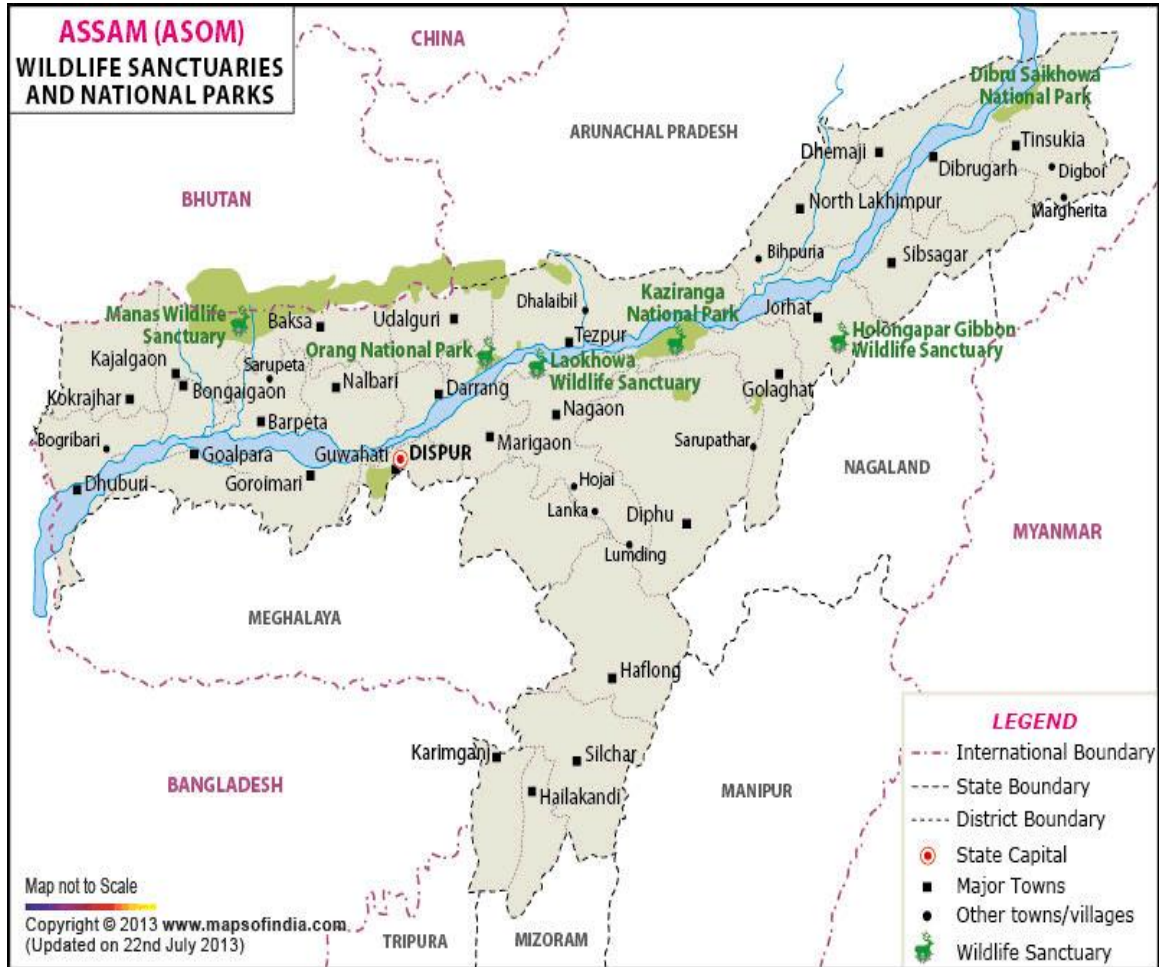


Figure No. 18 Wildlife Sanctuaries and National Parks of Assam

CHAPTER 4. PHYSIOGRAPHY OF THE DISTRICT:

4.1 General Land form:

The state of Assam is situated in the extreme north eastern region of India. Physiographically Assam is divided into three natural divisions or physiographic units, viz., (i) Brahmaputra Valley in the north, (ii) Barak Valley in the south and (iii) Central Assam Plateau. The third physiographic unit i.e., Assam Plateau encompasses two hill tracts which lie between the other two physiographic units e.g., Brahmaputra Valley and Barak Valley. Therefore, the district Karbi Anglong lies upon the Assam Plateau. The hill areas of the district are basically the extension of Karbi Anglong hills and the Karbi plateau is essentially the north-eastern extension of the Shillong plateau having an elevation of 300 to 400 meters above mean sea level with moderate slope. (<https://mines.assam.gov.in/>). The Karbi Hills part of Shillong plateau is a pop up structure, bounded in all sides by faults (Evans, 1964; Desikachar, 1974); sandwiched between two young orogenic belts viz., the east-west trending Himalayas to the north and north east and north-south trending Indo-Burma Range to the south. Studies revealed occurrence of five major episodes of magmatism in the area.

Hamren Plateau mostly covers the West Karbi Anglong district. Hamren Plateau has no prominent feature to be called peak. Most areas are flattish with smooth crests in wider sense. Parallel drainage greatly controlled by underlying rocks. This physiographic division is distinct in the sense that it has slope only one side i.e. towards the Rongkhang and the Nowgong plains into which it smoothly merges. The plateau is nothing but the continuation of the plateau of Khasi and Jaintia Hills.

4.2 Soil & rock pattern:

The soil of the district contains high quantity of organic matter and nitrogen. It is due to withering process of the hills which being washed away by rain. As the soil is acidic and contains organic matter and nitrogen these help in producing many crops like paddy, sugar cane, mustard, cotton, maize including fruits like citrus, orange, pineapple, cashew nut, banana, etc.

Soil in Karbi Anglong has originated from Pre-Cambrian gneissic rock. The hill soils of the district are well drained, brownish to yellowish red in colour.

The soils of the district, in general, are sandy loam with good depth except on eroded hill slopes. On the whole, the soils of the district can be divided into three (3) types:

1. **Red loamy soil mixed with clay:** It covers about 40% of West Karbi Anglong and this soil is appropriate for plentiful cultivation of various types of potatoes, grams and hill paddy etc.
2. **Old alluvium:** It is found in western portion of the Hamren plateau and covers 50-60% of the area. This soil is suitable mainly for tea plantation, production of several fruits and vegetables. Old alluviums, also called Bhangar in North India.
3. **The sandy and new alluvial soils:** It is found in eastern most part of West Karbi Anglong and has acidic character, suitable for rice and jute cultivation. Such soils in North India are popularly known as Khadar.

The salient feature of district soils:

New alluviums are somewhat sandy, medium in porosity due to fine texture and presence of some amount of clay, grey in colour. They are often acidic and well support evergreen vegetation.

Old alluviums are composed of coarse gravel usually found above the flood level. Its texture varies from coarse to clayey loam with a varying degree of nitrogen. There is low percentage of phosphate but considerable amount of potash. These soils are used for the cultivation of rice, fruits, and vegetables.

Red loam and lateritic soils derived from granites, gneiss, charnokites etc., relatively richer in clay forming minerals and poorer in silica.

The soil cover is shallow over the hill slopes with a thin surface layer of humus, nitrogenous compounds and is liable to erosion. Usually these soils are red loam.

The surface soils are generally pale red to reddish brown or bright red in colour and have low water holding capacity (fairly well-drained) as well as poorer fertility.

The soils are in general moderately to strongly acidic with pH, varying from 4.9 to 6.2 and have high humus content and low cation exchange capacity (CEC).

The soil texture and thickness varies from place to place according to slope, elevation in addition to vegetation cover.

The topsoil texture is generally sandy to loam soil and prone towards erosion whereas the soils found in depressions and/or water logged areas have fine texture. The soils on uncovered hill slopes are coarser and gritty in nature. (<http://shodhganga.inflibnet.ac.in>; *DISTRICT CENSUS HANDBOOK KARBI ANGLONG, SERIES-19 PART XII-A, 2011*)

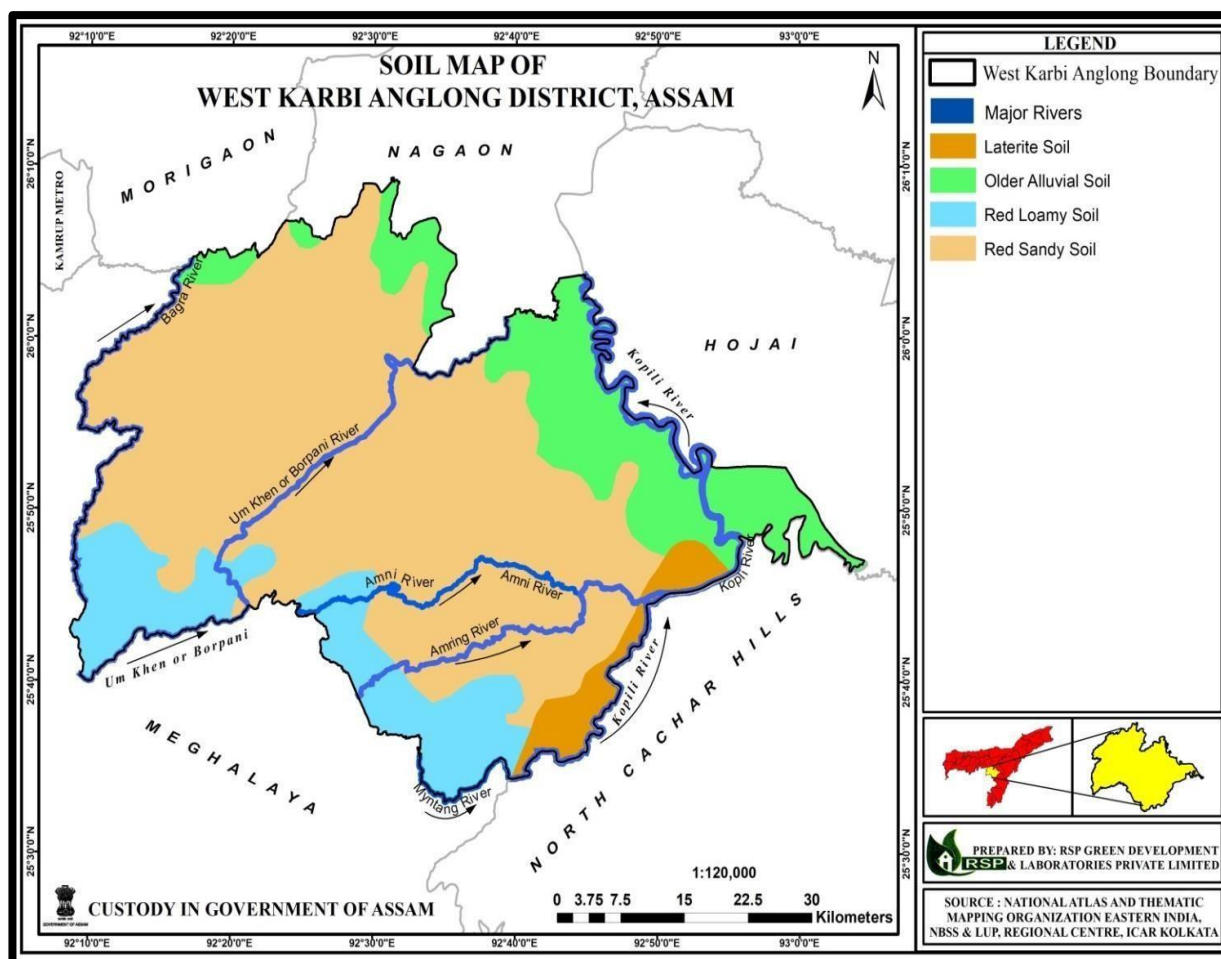


Figure. No. 19 Soil Map of the District

4.3 Different geomorphological Units:

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

Physiographic Features

Part of Hamren Sub-division (West Karbi Anglong) is located north of Mynriang, Amring Rivers. Granite, gneiss and the Shillong Group of rocks pre-dominate in this unit.

The Western Karbi Anglong district, in contrast to the East Karbi Anglong District, more or less uniformly runs down towards north-east maintaining a moderate slope. The flattish surface undoubtedly exhibits the characteristics of a plateau. At many places rivers have cut it into narrow and steep sided valleys.

The oldest Archaean land mass is highly weathered representing a rugged topography with extensive pediment zone surrounding it. The area which possesses hard rocks as granite and gneiss etc., is at higher elevation and forms plateau over wide-ranging areas and high mountains are originated from Tertiary rocks but deeply dissected by water courses giving a complicated relief pattern into low plateau of rippling surface.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

The bordering plains of Karbi Anglong, at many places, are mere marshy lands usually inundated by monsoon floods. The plains eventually merge with that of the Brahmaputra. Geomorphologically, the district can be roughly divided into four units e.g.

- Denudation hills
- Pediment zone
- Even alluvial lands/ Alluvial area with flood plains
- Dissected Plateau interspersed with Valleys

Moderate to strongly sloping land having residual isolated hills, hillocks and piediments occur in the central and western part of the district. The surface has been denuded leaving exposed areas of bare hard rocks. Archaean rocks composed of gneiss, schists and granites occupy most of the areas. Mostly central part of the district is moderately dissected, whereas north-western portion and area along southern portion of Kopili River is highly dissected.

Denudation hills

These are the resistant isolated, steep sided, usually smoothed and rounded hill of circumdenudation rising abruptly above the surroundings over the level plains in tropical regions. Very shallow, coarse loamy soil on moderately steep to very steep hill slopes and escarpments having different degrees of hardness are characteristic features. Open to dense forest and plantation, not suitable for agriculture/pasture/orchard.

Pediment zone

A pediment is a gently sloping erosion surface or plain of low relief formed by running water in arid or semiarid region at the base of a receding mountain front. A pediment is underlain by bedrock that is typically covered by a thin, discontinuous veneer of soil and alluvium derived from upland areas.

Even alluvial lands/ alluvial area with flood plains

Soils are mostly derived from decomposed rocks deposited by the streams. The older alluvium of middle Pliocene age occupying comparatively larger land mass and that is coarse in texture. Flood Plains are developed where there is deposition of alluvial material over the valley floor. Active flood plain is notable along Kopili River. The Kopili River originates from the eastern part of the Jaintia Hills (outside the regional boundary) and passes through, forming boundary between West Karbi Anglong and North Cachar Hills.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

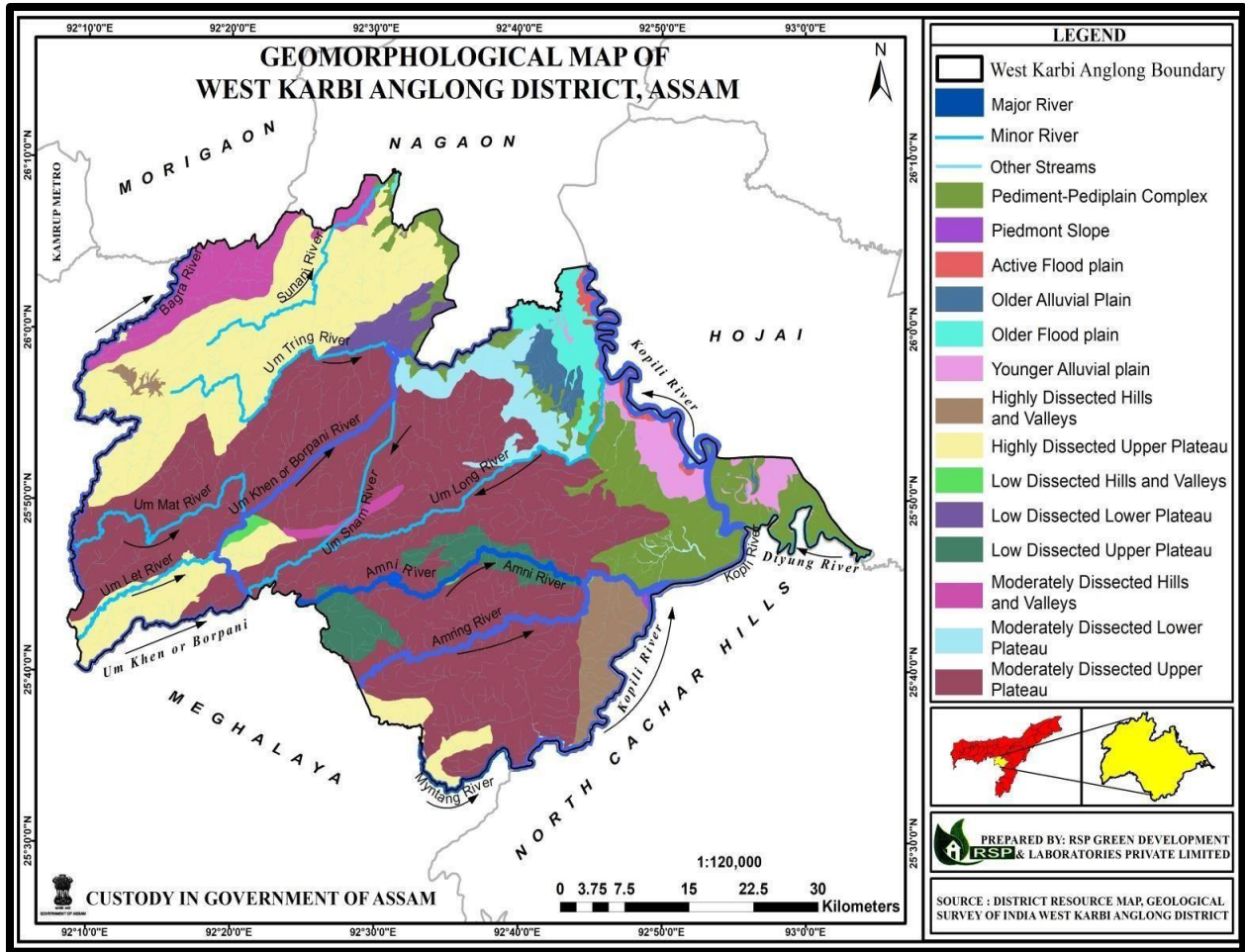


Figure. No. 20 Geomorphological Map of the District

CHAPTER 5. LAND USE PATTERN OF THE DISTRICT

- **Land cover:** It is the physical material at the surface of the earth. Land covers include grass, asphalt, trees, bare ground, water, etc. Land cover data documents how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types. Water types include wetlands or open water.
- **Land use** not only shows how people use the landscape but also utilization of land resources naturally. Therefore, the land of a particular region can be used for the purpose of infrastructural development, settlements, amusement & recreation, conservation of wildlife and wildlife habitat, agriculture & farming or mixed uses and can be defined as „land use“. Land use applications involve both baseline mapping and subsequent monitoring, since timely information is required to know what current quantity of land is in what type of use and to identify the land use changes from year to year.
- **Evergreen forest :** An evergreen forest is a forest made up of evergreen trees with a percent cover >60% and height exceeding 2 m. Consists of broadleaf tree communities with an annual cycle of leaf-on and leaf-off periods, dominated by trees that lose their leaves each year.
- **Cropland:** Temporarily cropped area followed by harvest and a bare soil period (*e.g.*, single and multiple cropping systems). Different types of crop cultivation and cropping arrangement are specified according to the seasons (*e.g.*, kharif, rabi, zaid). Cropland includes areas used for the common crop production and are also used for the adapted crops for harvest.
- **Settlement:** A developed area, i.e. any land on which buildings and/or nonbinding structures are present, normally as part of a larger developed environment such as: developed land lot, rural area, urban area. Land covered by buildings and other man-made structures.
- **Mixed forest:** In mixed forests the vegetation composition principally displays the presence of tree sand also includes shrub and bushes. Mixed type of forest is neither predominated by broad-leaved tree nor by the coniferous floral species.
- **Fallow land:** Fallow land is farmland without crops and usually needs a year to recover its fertility to grow crops. Such kinds of land are acquired for cultivation temporarily and are kept uncultivated for one or more seasons for its reclamation.
- **Waste land:** Sparsely vegetated land with signs of erosion and land deformation that could be attributed to lack of appropriate water and soil management, or natural causes. These are land identified as currently underutilized and could be reclaimed to productive uses with reasonable effort. Degraded forest (<10% tree cover) with signs of erosion is classified under wasteland. An empty area of land, especially in or near a city, which is not used to grow crops or built on, or used in any way and/or a place, time or situation containing nothing positive or productive, or completely without a particular quality or activity.
- **Water body:** Areas with surface water, either impounded in the form of ponds, lakes, reservoirs or flowing as streams, rivers, etc. can be either fresh or salt-water bodies.
- **Plantations:** A *plantation* is the large-scale estate meant for farming that specializes in cash crops. The crops that are grown include cotton, coffee, tea, cocoa, sugar cane, sisal, oil seeds, oil palms, rubber trees, fruits, commercial horticulture plantations, orchards and tree cash

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

crops.

- **Wetland:** A wetland is a distinct ecosystem that is inundated by water, either permanently or seasonally. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants adapted to the unique hydric soil. Land with permanent mixture of water and herbaceous or woody vegetation. The vegetation can be present either in salt, brackish, or fresh water.

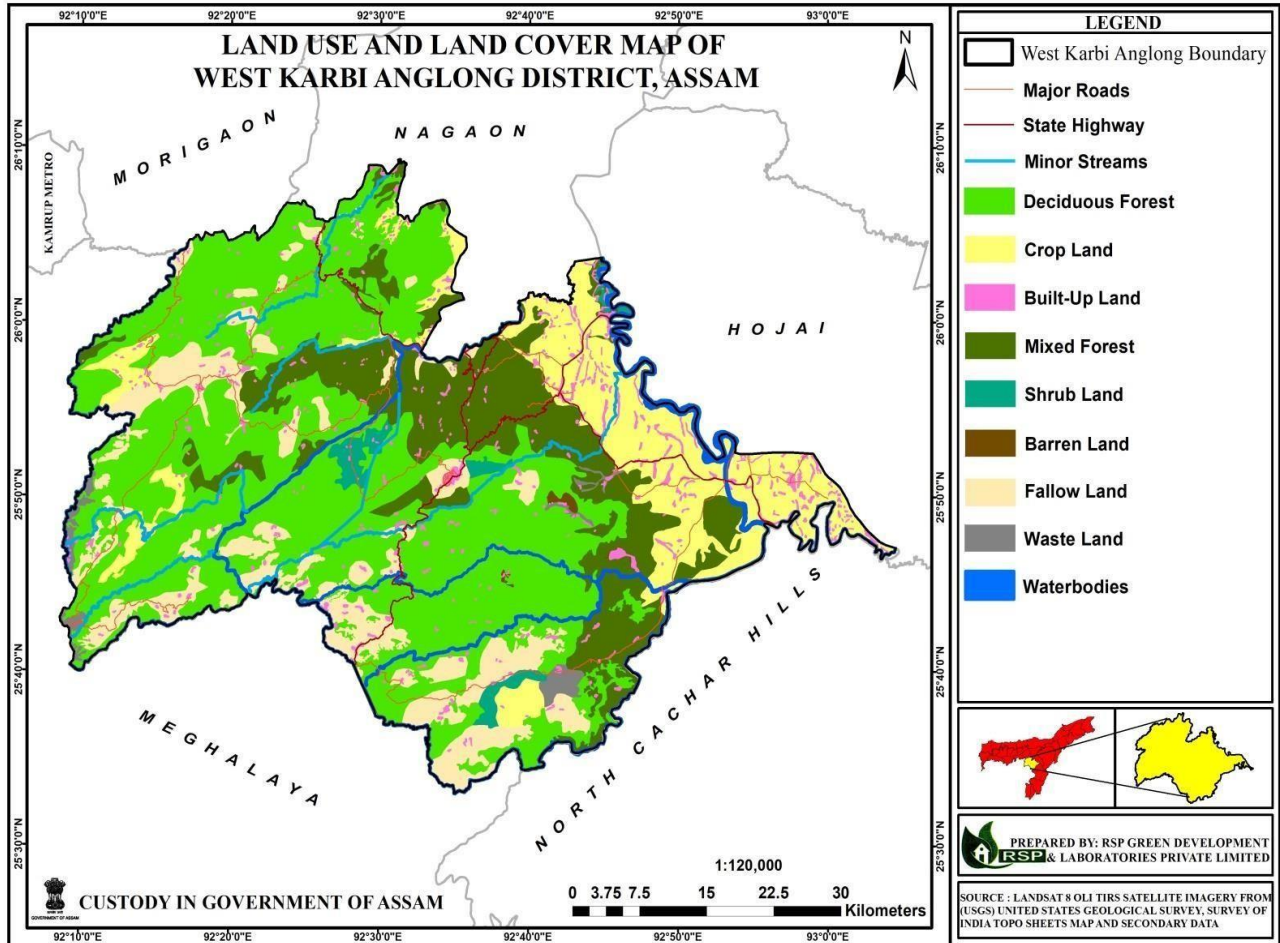


Figure No. 21 Land Use & Land Cover Map of the District

Table No. 17: Land Use Pattern of the district

Class Name		Area in sq.km
Deciduos Forest	:	1595.25
Cropland	:	487.00
Built-up land	:	92.99
Mixed Forest	:	559.74
Shrub land	:	96.05
Barren land	:	5.18
Fallow land	:	384.01
Waste land	:	34.00
Water bodies	:	66.64
TOTAL	:	3320.86

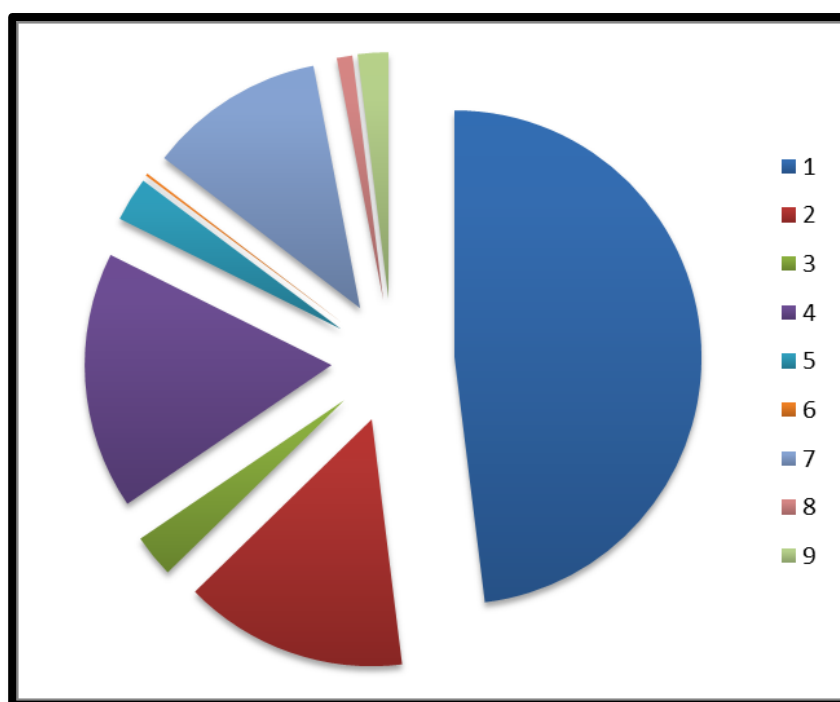


Figure 22: Land use pattern of West Karbi Anglong of the district (represented in sq.km)

5.1 Forest:

The forest areas are managed by three territorial divisions namely Karbi Anglong East Division, Karbi Anglong West Division and Hamren Division. All these divisions are under the supervisory control of Council head of department, Karbi Anglong, Diphu.

The important forest types found in Karbi Anglong District are:

- Moist semi-evergreen forests
- Moist Mixed Deciduous forests
- Riverine Type
- Miscellaneous type with scattered pure or mixed patches of bamboos

Though a large part of Karbi Anglong District is covered with thick forest cover but the legal status of notified forest area is as under:

STATE RESERVED FORESTS	732.04 sq.km
DISTRICT COUNCIL RESERVED FOREST	441.8 sq.km
PROPOSED RESERVE FOREST	1000.95 sq.km.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

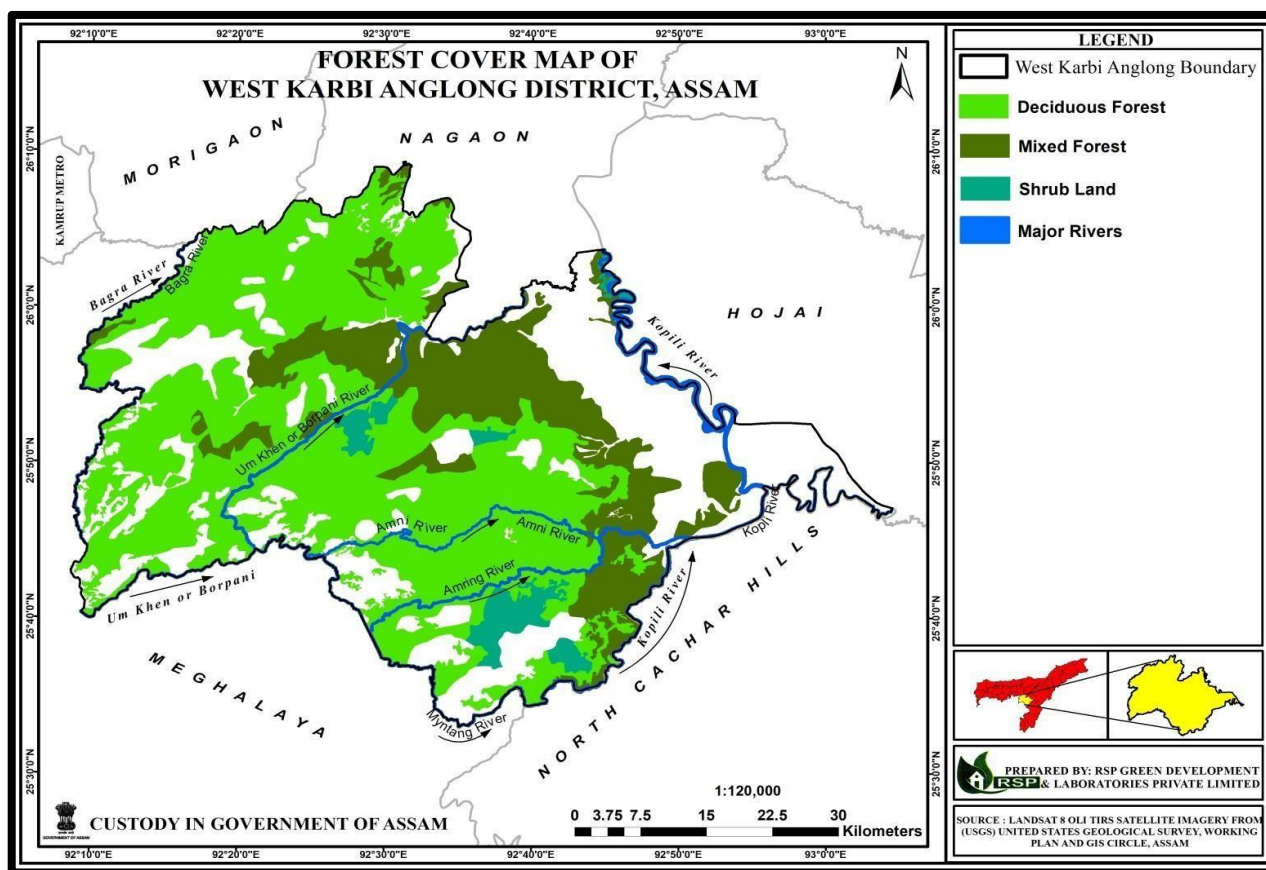


Figure. No. 23 Forest Cover Map of the District

Table No. 18: Area under State Reserve Forests under West Karbi Anglong

Sl. No.	RESERVE FOREST	AREA (in sq.km)
1	Amreng R.F. (Addition)	56.94
2	Jokota R.F.	12.35
3	Rongkhang R.F.	33.39

Table No.19: District Council Reserve Forests under West Karbi Anglong

Sl. No.	DISTRICT COUNCIL RESERVE FOREST	AREA (in sq.km)
1	Kolonga D.C.R.F.	17.35
2	Amreng 1st Addition D.C.R.F.	5.80
3	Amreng 2nd Addition D.C.R.F.	56.30
4	Sarchim D.C.R.F.	146.00

Table No. 20: Proposed Reserve Forests under West Karbi Anglong

Sl. No.	PROPOSED RESERVE FOREST	AREA (in sq.km)	NOTIFICATION NO. & DATE
1	Amsolong P.R.F.	74.73	No. Nil dated 16-01-1976
2	Umjakini P.R.F.	36.80	
3	Punja P.R.F.	4.00	
4	Chainanadi P.R.F.	19.87	
5	Balazor P.R.F.	82.79	
6	Rekhalong P.R.F.	18.25	

5.2 Agriculture and Irrigation:

Agriculture is the backbone of the West Karbi Anglong district's economy. The progression of the district therefore, directly is linked with the advancement of agriculture. The number of cultivators along with the number of agricultural laborers has been increasing over the decades. Comprehending the opportunity and significance of agriculture, the State Government has rightly made a policy decision to invest a major share of its plan allocation for agricultural development. The people of this district generally cultivate single crops. They rarely follow the double/multiple cropping systems. The principal crops grown in this district are maize, paddy, rape, cotton, mustard, sugarcane, jute, ginger etc. Paddy is the principal agricultural crops produced in the district. Apart from it many other different crops are grown in the district such as wheat, potato, sugarcane, pulses, oilseeds, etc. Fruits such as Mango, banana, guava etc are also found to be grown in the district. The hilly areas are suitably used for tea plantation food crop and/or other food resources every year during the time of good rainfall and rice is the main crop of the district. Besides rice, the major crop are potato, wheat, vegetables, mustard, summer til etc. The cultivators of the district produce potato & other vegetables as surplus. Pulse & oilseed production are still impoverished in this district and that is why government is try to focus on production of same by introducing new varieties of pulse crops as arhar, lentil, gram, khesari, kalai, moong etc., and groundnut and sunflower as oilseeds. To meet up the gap between demand and production, the oilseed crops have been introduced in Rabi season. Broccoli and Capsicum are also cultivated by farmers of this district to meet up the demand of the local people.

The sources of irrigation in the district are canals, tanks, open wells, bore wells, etc. The area also shows lift irrigation schemes as micro-irrigation, pump sets, tractors etc.

Table No.21: Net irrigated area for the blocks of West Karbi Anglong

BLOCK	NET IRRIGATED AREA (HA)
AMRI DEV. BLOCK	1443
RONGKHANG DEV. BLOCK	15842
CHINTHONG DEV. BLOCK	7561
SOCHENG DEV. BLOCK	3548

Table No.22: Status of sources of irrigation in Karbi Anglong

Block	Source of irrigation	Canal Based Irrigation	Electricity Pump
Rongkhang	FIS	84	12
	Command Area (Ha)	15842	890

State Government of Assam designed the groundwater management plan with an emphasis in providing irrigation facilities through ground water development as agriculture is the main means of livelihood of the people.

5.3 Horticulture:

Assam is traditionally rich in horticulture due to its diverse and unique agro-climatic situation conducive for growing wide range of fruits, vegetables, spices, nut crops, flowers, medicinal and aromatic plants, mushroom etc. The agro-climatic condition of Karbi Anglong and its altitude favours growth and production of fruit crops like orange, lemon, pine-apple, banana, pomegranate, papaya etc. Species such as ginger, chillies, cardamom, turmeric etc., are also produced in large quantities in the interior hills.

5.4 Mining:

The common practices of mining activities in this district are manual. Exposures of rocks or so called „minor minerals“ are naturally exploited by blasting (Short holes). Type, obtainability and distribution of mineral resources are basically the reflection of antiquated paragenetic or-geological sequence. The land of Assam is blessed with the immense mineral potential and other natural resources. The available major mineral resources found in the state are mainly of petroleum & natural gas, coal, iron-ore etc., and the minor minerals like sand, china- clay, silica, granite, limestone, quartzite, fuller’s earth etc., (<http://assam.gov.in/>). The district, West Karbi Anglong is blessed with useful minor minerals. The district of Karbi Anglong is crisscrossed with several down-stream Rivers and rivulets and sand mining here has been an old practice. But now a day’s unscientific extraction uncontrolled mining of sand and gravel from river beds and agricultural lands has assumed an alarming proportion in the hill district of west Karbi Anglong. Urbanization and the construction boom have played a huge role in upping the demand for sand.

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 states 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 rocks 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, Borpong 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.

Geologically, the area can be divided into three distinct geological units.

- i. Part of Hamren Sub-division (West Karbi Anglong) - lying north of Mynriang, Amring rivers. Granite, gneiss and the Shillong Group of rocks pre-dominate in this unit.
- ii. *ii.* Part of Diphu Sub-division (East Karbi Anglong) lying north of the Jamuna river forms a distinct unit (separated from the previous by the Nowgong plain) with pre dominantly gneissic rocks of Archaean group and with isolated patches of gneiss and Shillong Group of rocks along the western margin,
- iii. The whole of the North Cachar area covering parts of Hamren and Diphu sub - divisions of

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

Karbi Anglong forms a separate unit with upper Tertiary rocks comprising Barail, Surma and Tipam series etc. with number of folds, faults, thrusts and un-conformities. The unit, practically, does not have any alluvial deposits except for a limited area flanking the Nowgong plain.

Table No. 23: Stratigraphic succession of West Karbi Anglong

AGE	GROUP NAME	FORMATION (Thickness)	LITHOLOGY
Holocene	Unclassified	Newer Alluvium	Sand, silt, clay
Middle to upper Pleistocene	Unclassified	Older Alluvium	Sand, clay, pebble, gravel and boulder deposit
Unconformity/ Tectonic			
Pliocene-Pleistocene	Siwalik Group	Kimin Formation	Sandstone with clay stone
		Subansiri	Micaceous sandstone
Pliocene	Dihing Group	Dihing Formation (900 m)	Pebbles beds, soft sandy clay, clay, conglomerates grit and sandstone
Unconformity			
Mio-Pliocene	Dupitila Group	Dupitila Formation (3300 m)	Sandstone, mottled clay, grit and conglomerates; locally with beds of coals, conglomerates and poorly consolidated sandstone with layers and pockets of pebbles
		Namsang Formation (800 m)	Coarse gritty, poorly consolidated sandstone and conglomerate of coal pebbles
Unconformity			
Mio-Pliocene	Tipam Group	Girujan Clay Formation (1800 m)	Mottled clays, sandy shale and subordinate mottled, coarse to gritty sandstone
		Tipam sandstone Formation (2300 m)	Bluish grey to greenish, coarse to gritty, false bedded, ferruginous sandstone, clays, shale and conglomerate
Unconformity			

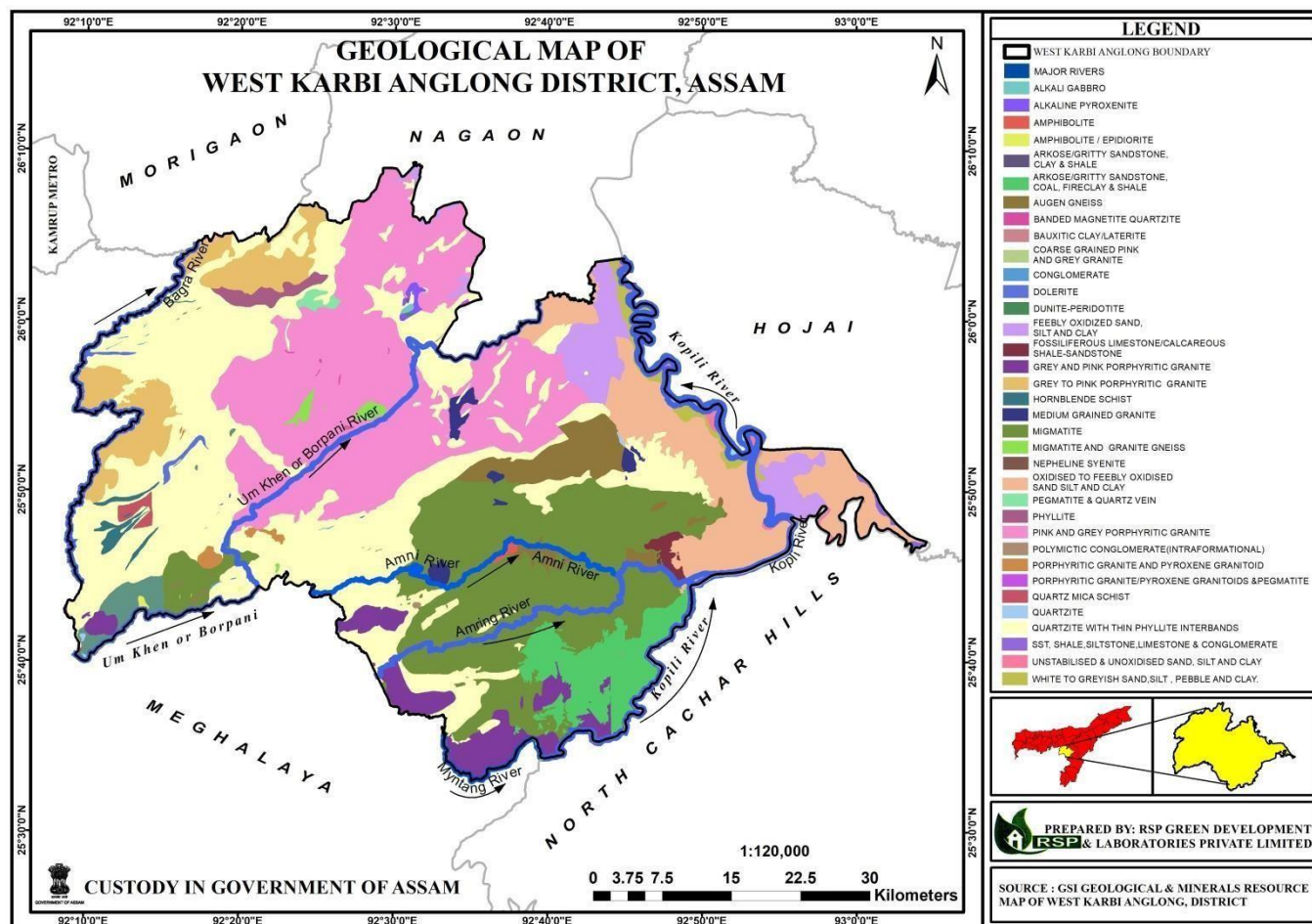
DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMBREN

Miocene	Surma Group	Bokabil Formation (1800 m)	Shale, sandy shale, siltstone, mudstone and lenticular, coarse ferruginous sandstone
		Bhuban Formation (2400 m)	Alteration of shale and sandy shale and thin conglomerate, argillaceous in middle part
	Unconformity		
Eocene-Oligocene	Barail Group	Renji Formation (900 – 1800 m)	Massive bedded sandstone; its equivalent – the Tikak Parbat Formation in the Upper Assam is marked by thick coal seam in basal part
		Jenam Formation (1000 - 3300 m)	Shale, sandy shale and carbonaceous shale with interbedded hard sandstone; its equivalent the Bargolai Formation in Upper Assam is marked by thin coal seam
		Laisong Formation (2000 - 2500 m)	Well bedded compact flaggy sandstone and subordinate shale; its equivalent- the Nagaon Formation in upper Assam is marked by thin bedded, hard sandstone and interbedded shale.
	Disang group		Splintery dark grey shale and thin sandstone
Paleocene-Eocene	Jaintia group	Kopili Formation	Shale, sandstone, marl
		Shella Formation	Sylhet Limestone (Fossiliferous Limestone Sylhet sandstone, Sandstone, clay and thin coal seam
		Langpar Formation (exposed in Meghalaya)	Calcareous shale, Sandstone, Limestone
	Unconformity		
Cretaceous	Alkali Complex of Samchampi	Pyroxenite - Serpentinite with abundant development of melilite pyroxene rock, ijolite, syenite, carbonatite
	Unconformity		

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMBREN

Cretaceous		Sylhet Trap (exposed in Meghalaya) 600m)	Basalt, alkali basalt, rhyolite, acid tuff
	Unconformity		
Permo- Carboniferous	Lower Gondwana	Kaharbari Formation	Very coarse to coarse grained sandstone with conglomerate lense, shale, carbonaceous shale, coal
		Talchir Formation	Basal tillite, conglomerate with sandstone bands, siltstone and shale
	Unconformity		
Neo- Proterozoic- Early proterozoic	Granite Plutons	Porphyritic coarse granite, pegmatite, aplite, quartz vein traversed by epidiorite, dolerite
	Intrusive Contact		
Paleo-Meso Proterozoic	Shillong group	Quartzite, phyllite, quartz- sericite schist, conglomerate
	Unconformity		
Archean	Gneissic Complex	Complex metamorphic group comprising ortho and para gneisses and schists, migmatites granulites <i>etc.</i> Later intruded by acidic and basic intrusive.
<i>Source: GSI Miscellaneous Publication No. 30 Part IV Vol 2 (i) Assam. (2009)</i>			

FIGURE No. 24: GEOLOGICAL MAP OF THE DISTRICT



Local Geology (Based on Field Investigation):

The geology of West Karbi Anglong encompasses the history of disposition of different types of litho- units in foreland facies condition of dispositional history. Geologically, the district comprises the oldest Archaean gneissic rocks followed by Precambrian Shillong Series with rock types of phyllite, schists, and ferruginous quartzite, pink granite and limestone. The Archean Gneissic Rocks are the oldest group of rocks. These Gneissic and the central part are intruded by younger acidic granitoid intrusive bodies. These rocks are scattered here and there like inselberg. These pre-cambrian rocks are overlain by Younger Tertiary shelf sediments and again overlain by the Quaternary and Recent deposits. This district is basically, from the point of view of geology, can be divided into three units:

- Denudation hills
- Pediment zones
- Valley areas

The relics of oldest Archaean landmass are representative of highly weathered condition having a

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMBREN

rugged topography with vast pediment zones. Different structural features like foliation, gneissosity, cleavage, schistosity are also observed in these rocks. The foliation plane, dipping 60°-70° towards southeast with strike along NE-SW direction (GSI, NER report 1986-87). There are some granites present which are dark in colour, hard, compact, equigranular occurs at many places although the granites are generally whitish in colour with pink tone as the orthoclase are present in this rock. Due to weathering, the rocks become dark grey to blackish in nature with sub-rounded spheroidally weathered surface. The drainage pattern of the studied area is the manifestation of the upper catchment of Kopili River, Amring and Borpani rivers. In the entire area, drainage pattern is dendritic to sub-parallel and totally is controlled by several of structural features and concealed lithology below the surface.

Following litho-units have been encountered from West Karbi Anglong:

- Silt, Clay, Sand (Bimodal)
- Boulder, Cobble & Pebble intermingled with Silt & Clay
- Carbonaceous clays (of Barail), Limestone & Sandstone
- Granite & Gneissic granite.

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 West Karbi Anglong of Assam must give perspective and confidence. It is pertinent to say that the preparation of DSR of West Karbi Anglong 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

- ❖ **Limestone:** Limestone usually found in Voteranlangsho area with an area of about 25 sq. km of Sylhet Limestone and also occurred in the eastern part of the district.

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 West Karbi Anglong district is amongst the last few in sand production. Sand production of Kopili, Borpani, and Amring rivers play a vital role.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

- ❖ Riverbed sand and River bank sand deposits
- ❖ Ordinary earth and Brick earth material: Generally found in Hamren sub-division particularly in Baithalangso and Donkamukam areas for manufacturing of the bricks.
- ❖ Granite & Quartzite: Pink granite, greyish white medium to coarse grained granite, ferruginous quartzite are also found in West Karbi Anglong. Muscovite, Mica flakes are also observed in this district. Quartzite is also observed in this district of smoky quartz and mica-infused quartz are also observed in this district.

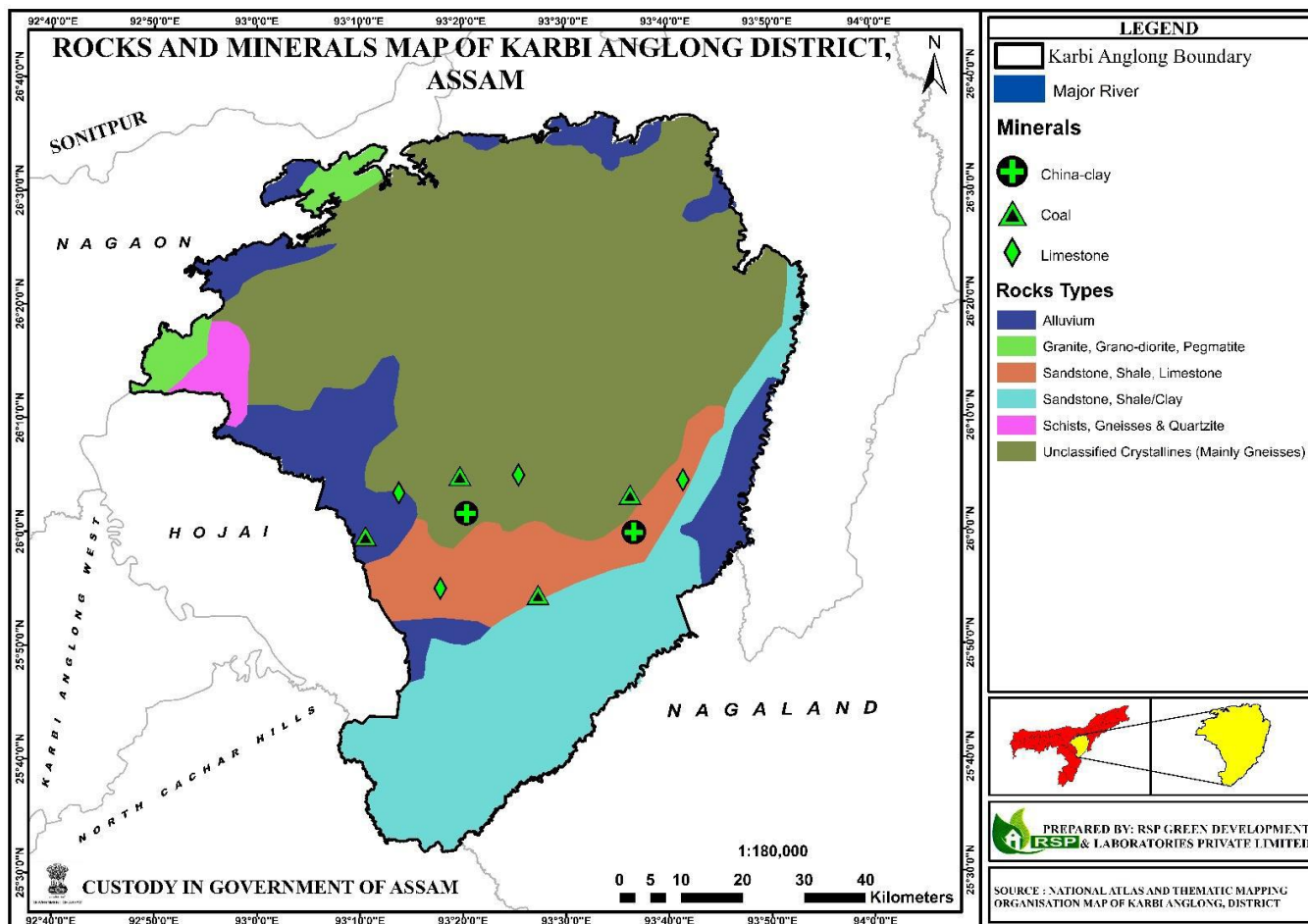


FIGURE NO. 25: ROCKS AND MINERALS MAP OF THE DISTRICT

7.2.1 SAND AND OTHER RIVERBED MINERALS:

I. Drainage System

The drainage pattern of the studied area is the manifestation of the upper catchment of Kopili River, Borpani River, Amlong River, Amsorli River, Amreng, Amni and Bagra drainage pattern is dendritic to sub-parallel and totally is controlled by several of structural features and concealed lithology below the surface.

During the survey of the investigated area of West Karbi Anglong 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. Generalised streams and river courses are in directions from SW – NE and also from W – E as in case of Amni River. Amni and Amring River are together joined with each other in the south-eastern site of the district and forming the tributary of Koili River. Kopili River flows through the southern boundary and also the eastern boundary 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.

Kopili River

Kopili is a south bank tributary of Brahmaputra which originates in the Borail Range Mountains in Meghalaya at an altitude of about 1600 m and has a total length of 290 km up to its confluence with Brahmaputra. Its basin is bound by the Jaintia Hills in the west and the South Cachar and Mikir Hills in the east. Kharkor, Myntriang, Dinar, Longsom, Amring, Umrong, Longku and Langkri are its major tributaries in its upper reaches. After entering Assam, the Kopili separates the Karbi Anglong district from the Dima Hasao North Cachar Hills district up to its confluence with Diyung River on its right at 135 km. After the confluence with Diyung, Kopili flows into the Nagaon district in a north-westerly direction. The Jamuna River with a catchment of 3960 km² flows to the Kopili at Jamunamukh. The river then flows in western direction, and further downstream, the Umkhen-Borapani River which rises in the Shillong plateau and drains an area of 2038 km² joins Kopili at a distance of 254 km from the left. The Killing River, known as Umiam in its upper reaches draining an area of about 1445 km², flows into Kopili from the left at about 280 km. The Kopili River finally flows to Kalang, a spill channel of Brahmaputra, near Hatimukh after traversing a distance of 290 km. The total catchment of Kopili River is about 16,421 km².

Borpani River

Borpani Basin Lies between 25°33'N to 26°35'N latitude and 92°10'E to 93°50'E longitude. It originates from Shillong hills of Meghalaya about 1300m in altitude and it enters into Karbi Anglong. It enters in West Karbi Anglong District from SE direction and flows straight towards NE direction and drained about 1064.37sq.km. It covers the total length in this district is about 176.68km. Two power projects was situated on Borpani River in Assam i.e., 1. Karbi Langpi Hydro Electric Project (KLHEP) which is situated in Karbi Anglong District of Assam and 2. Karbi Langpi Middle-II Hydro-Power Project. It is situated in West Karbi Anglong District of 24MWw run-of

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

river scheme. A Gravity and Masonary Dam is situated upon the Borpani River named Karbi Longpi Dam in Assam of about 197m in length and 35m in height.

Amreng River

It is originated from Longlwit village, Meghalaya with an altitude of 1190m. This river drained about 524.17 sq.km. Total length of this river in West Karbi Anglong district is about 99.60km. It flows from SW direction to NE direction and joined with Amni River.

Killing River

This river is generally known as Umiam in Meghalaya, one of the primary tributaries of the Kopili River. Meghalaya and Assam are the states where the Kiling/Umiam flows. This river debouches into Kopili River near Dharamtul (NoaBil) in Morigaon district (Assam) which in turn joins the Kalang River which is the tributary of Brahmaputra River. From southwest to northeast, it has the following significant feeders: Phud Umshing, Um Shiprah, Um Lator, Um Let, Um Sader, Um Swat, Um Bi, Um Thalong, Amshai Nadi, Um Siang, and Wah Umphanmiet, Wah Lyngkut, Um Rangsaw, Um Ban, Wah Ro Ro, Um Ew. Um Siang, a tributary on the left bank, joins Umiam around Amjonggaon in the East Khasi Hills area, heading towards the basin's terminal portion. Umiam now reaches the Assam Plains and leaves the mountainous terrain behind. This section of the Assamese plains' Umiam is referred to as the "killing river."

Amlong River

This river is a perennial river, flowing to SW-NE direction in this district, branching from Um Snam River and finally forming the Tributary of Kopili River.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

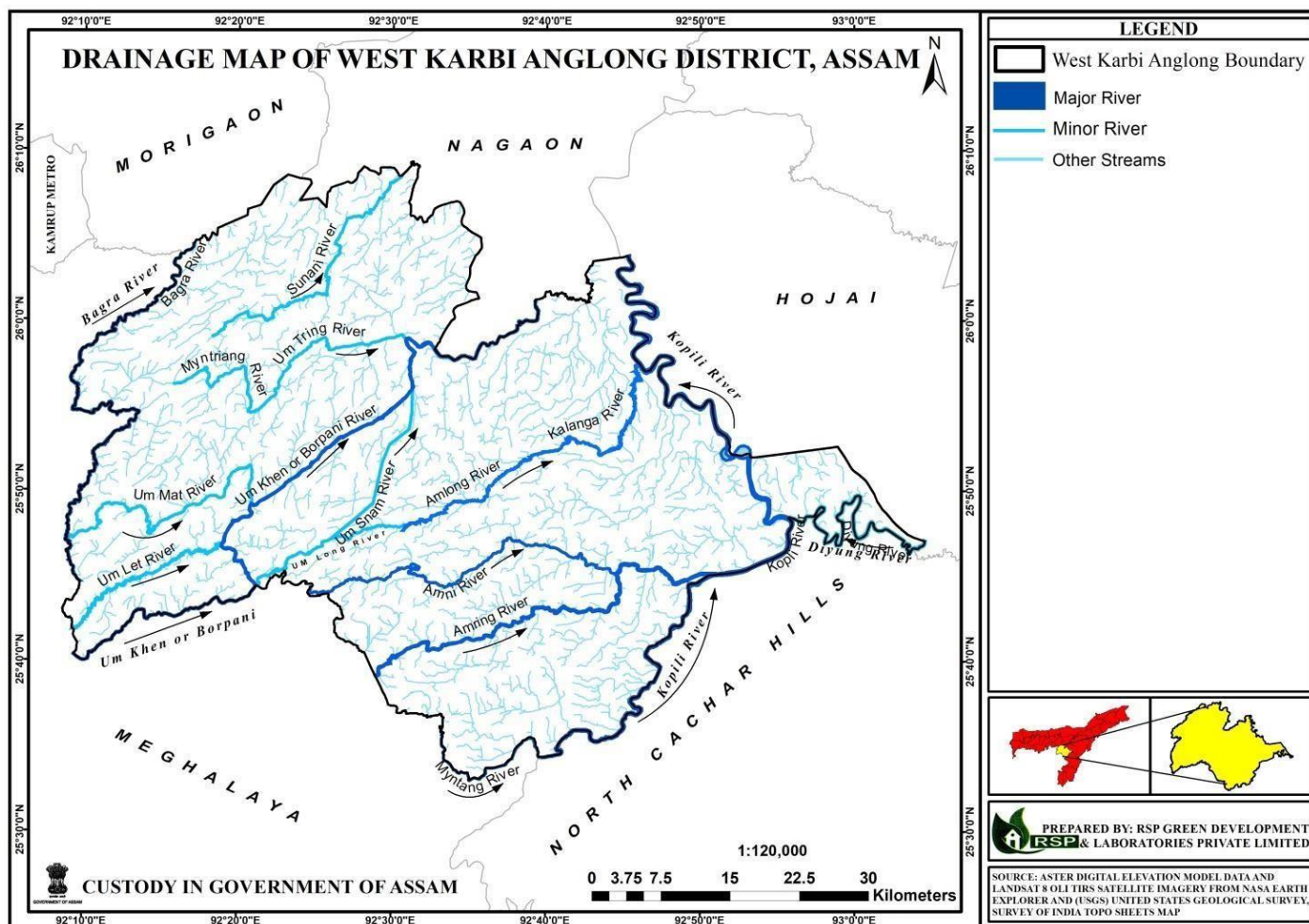


Figure No. 26: Drainage Map of West Karbi Anglong District

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 24: Drainage system with description of main rivers

Sl. No.	Name of the River	Area drained (sq.km.)	% area drained in the district
1.	Kopili	805.30	25.79%
2.	Borpani	1064.37	34.08%
3.	Amring	524.17	16.78%
4.	Amni	230.08	7.36%
5.	Bagra	321.65	10.30%

b) Salient Features of important rivers and streams

Table No. 25: 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.	Kopili	227.51	Borail Range Mountains in Meghalaya	1600m
2.	Borpani	176.68	Shillong plateau	1300m
3.	Amreng	99.60	Ionglwit village, Meghalaya	1190 m

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 West Karbi Anglong District are furnished in Table.

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

Table No. 26: Place of Origin of important rivers and streams

Sl. No.	Name of the River or Stream	Place of Origin
1	Kopili	Borail Range Mountains in Meghalaya
2	Borpani	Shillong plateau
3	Amreng	Ionglwit village, Meghalaya

ii) Catchment Area

The West Karbi Anglong district of Assam is mainly drained by the Kopili River, Borpani River, Amreng River which are forming the main catchment area.

Table No. 27: Catchment areas of main rivers of West Karbi Anglong district, Assam

Sl. No.	Name of the River or Stream	Catchment Area (sq. km.)
1	Kopili	805.30
2	Borpani	1064.37
3	Amreng	524.17

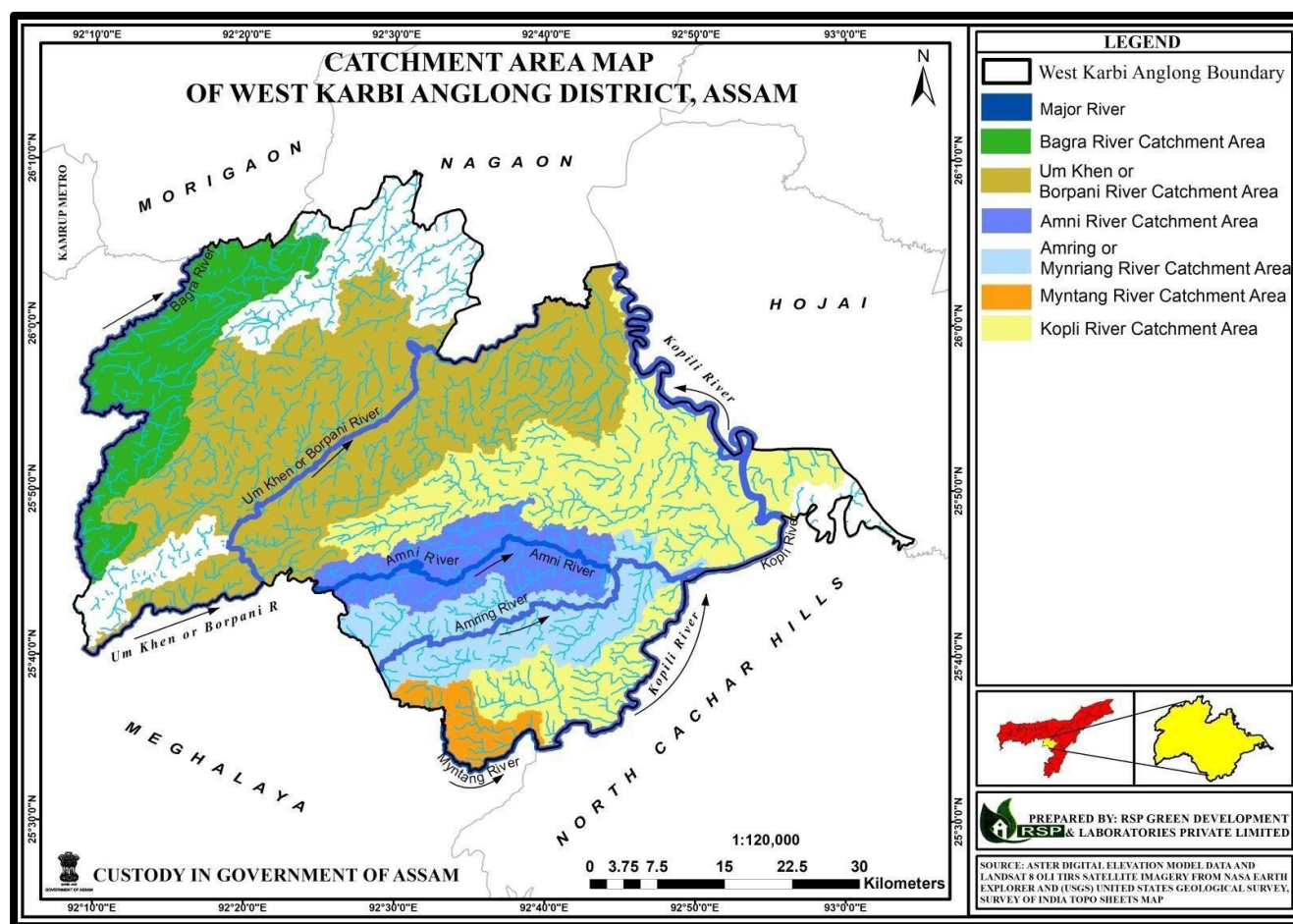


Figure No. 27: Catchment area Map of the main rivers Kopili, Borpani, Amreng, Amlong of West Karbi Anglong district, Assam

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

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

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**.

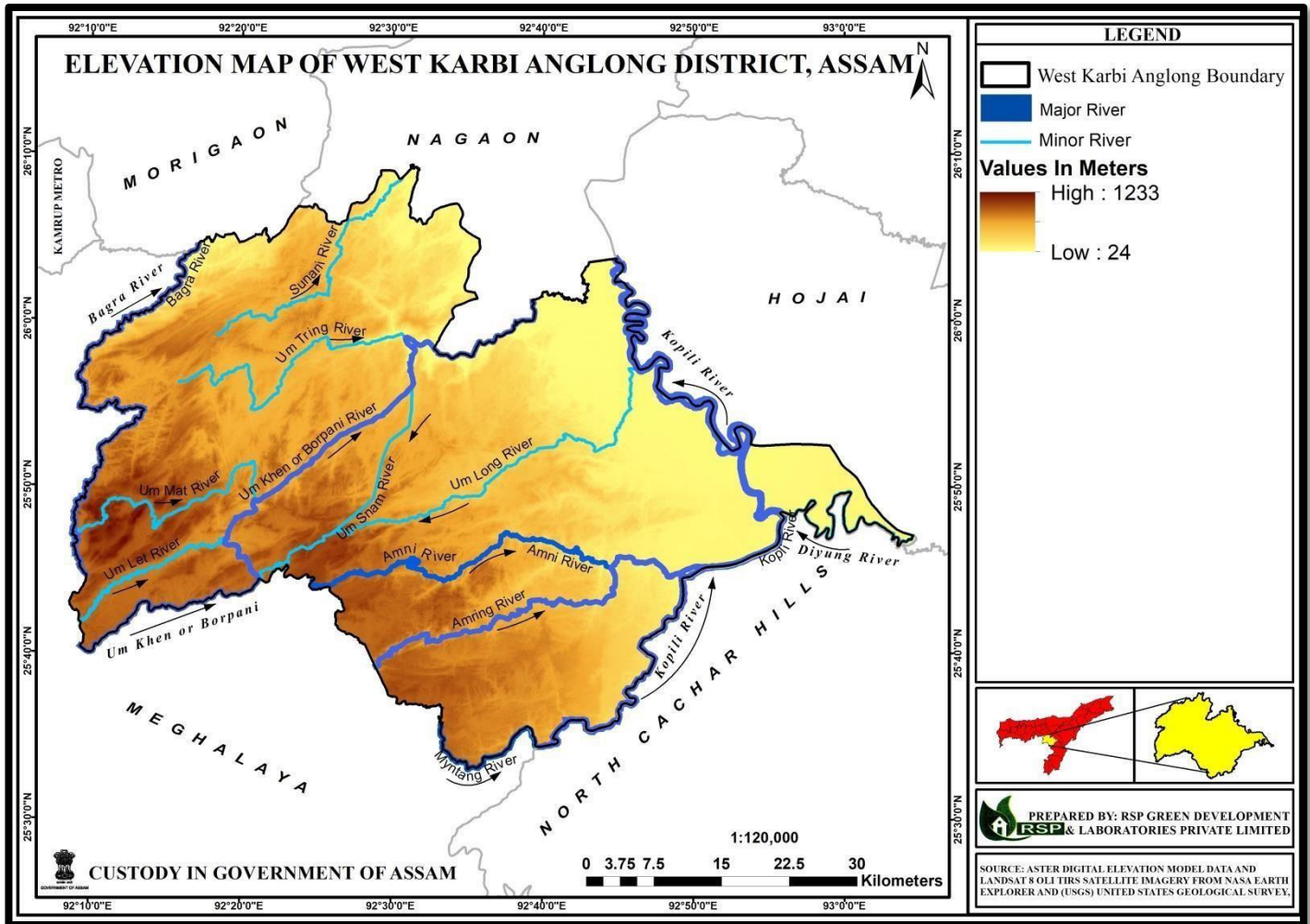


Figure No.28: Elevation of river Map of the West Karbi Anglong district, Assam

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.

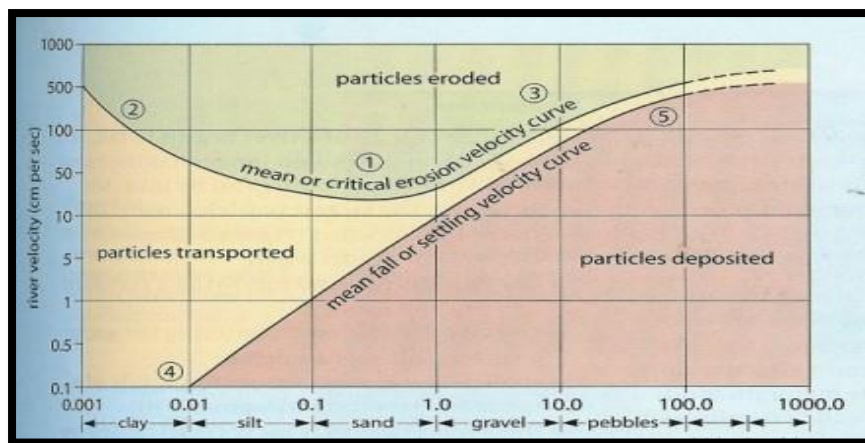


Figure No. 29: HJULSTRÖM CURVE

(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 $20\text{-}30 \text{ cm. s}^{-1}$, medium sand grains at $2\text{-}3 \text{ cm.s}^{-1}$, 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:

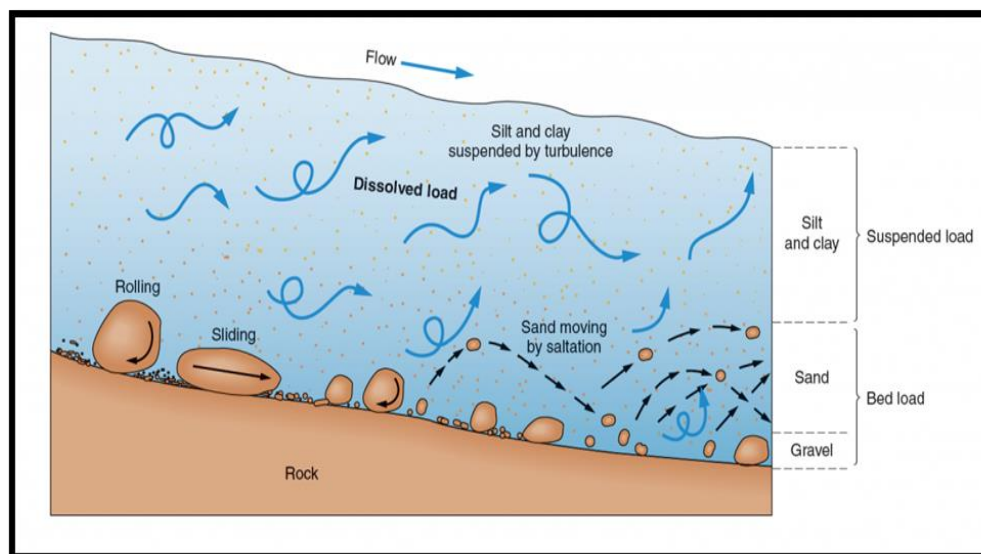
- i. Dissolved load
- ii. Suspended load
- iii. Saltation load
- iv. Wash load
- v. Bed load

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

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 Q_s .

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

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

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

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

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:

$$\text{Catchment Yield (m3)} = \text{Catchment area (m2)} * \text{Runoff coefficient (\%)} * \text{Rainfall (mts/annum)}$$

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, $Q = CA^{3/4}$

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.

$$C_t = C_s G_s (d_{50}/h) (V/U^*)^{n'} [(F_{gr}/A_1) - 1]^m$$

The dimensionless particle d_{gr} is calculated by:

$$D_{gr} = d_{50} (g(G_s-1)/v^2)^{1/3}$$

The particle mobility factor F_{gr} is calculated by:

$$F_{gr} = (U^* n' / (G_s - 1) g d_{50})^{1/2} * (V / (5.66 \log (10h / d_{50}))^{1-n'}$$

Where,

A_1 = Critical particle mobility factor

C_s = Concentration coefficient in the sediment transport function

C_t = Total sediment concentration

d_{50} = Median grain size

d_{gr} = Dimensionless particle diameter

F_{gr} = Particle mobility parameter

g = Acceleration of gravity

D_s, S_g = Specific gravity

h = Water depth

m = Exponent in the sediment transport function

n' = Manning roughness coefficient

U = Shear velocity

V = Mean flow velocity

v = 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:

$$g_b = 0.417[\tau_0 (\eta' / \eta)^{1.5} - \tau_c]^{1.5}$$

Where,

g_b = 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., $\eta' = (1/24) \times d^{1/6}$ where d is the median size (d_{50}) 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 11 cumecs, and 0.0225 for lower discharges.

τ_c = Critical shear stress required to move the grain in N/m² and given by equation $\tau_c = 0.687 d_a$, where d_a is mean or average size of the sediment in mm. This arithmetic average size is usually found to vary between d_{50} and d_{60} .

τ_0 = Unit tractive force produced by flowing water i.e., $\gamma_w R S$. Truly speaking, its value should be taken as the unit tractive force produced by the flowing water on bed = $0.97 \gamma_w R S$. R is the hydraulic mean depth of the channel (depth of flow for wider channel) and S is the bed slope.

➤ **SEDIMENT YIELD 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

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

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:

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

For run off more than 2 inches:

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

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:

$$Y = 11.8 * (Q * qP)^{0.56} * K * Ls * C * P$$

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 West Karbi Anglong 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:

- 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.
- 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).
- 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:

DISTRICT SURVEY REPORT OF WEST KARBIANGLONG, HAMBREN

Table No.28: 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'
PREMOONSOON					POSTMONSOON					
1	KRBH_PRO_SAND_01	62000	2.2	136400	1	KRBH_PRO_SAND_01	62000	2.5	155000	18600
SUB TOTAL		62000		136400	SUB TOTAL		62000		155000	18600
2	KRBH_PRO_SAND_02	252000	2.45	617400	2	KRBH_PRO_SAND_02	252000	3	756000	138600
3	KRBH_PRO_SAND_02a	35200	2.45	86240	3	KRBH_PRO_SAND_02a	35200	3	105600	19360
4	KRBH_PRO_SAND_02b	123000	2.45	301350	4	KRBH_PRO_SAND_02b	123000	3	369000	67650
5	KRBH_PRO_SAND_02c	106000	2.45	259700	5	KRBH_PRO_SAND_02c	106000	3	318000	58300
6	KRBH_PRO_SAND_02d	79000	2.45	193550	6	KRBH_PRO_SAND_02d	79000	3	237000	43450
7	KRBH_PRO_SAND_03	104000	2.45	254800	7	KRBH_PRO_SAND_03	104000	3	312000	57200
8	KRBH_PRO_SAND_04	83100	2.45	203595	8	KRBH_PRO_SAND_04	83100	3	249300	45705
9	KRBH_PRO_SAND_22	189000	2.45	463050	9	KRBH_PRO_SAND_22	189000	3	567000	103950
10	KRBH_PRO_SAND_23	159000	2.45	389550	10	KRBH_PRO_SAND_23	159000	3	477000	87450
11	KRBH_PRO_SAND_24	139000	2.45	340550	11	KRBH_PRO_SAND_24	139000	3	417000	76450
12	KRBH_PRO_SAND_26	223000	2.45	546350	12	KRBH_PRO_SAND_26	223000	3	669000	122650
13	KRBH_PRO_SAND_27	33200	2.45	81340	13	KRBH_PRO_SAND_27	33200	3	99600	18260
14	KRBH_PRO_SAND_28	367000	2.45	899150	14	KRBH_PRO_SAND_28	367000	3	1101000	201850
15	KRBH_PRO_SAND_29a	374000	2.45	916300	15	KRBH_PRO_SAND_29a	374000	3	1122000	205700
16	KRBH_PRO_SAND_29	179000	2.45	438550	16	KRBH_PRO_SAND_29	179000	3	537000	98450
SUB TOTAL		2445500		5991475	SUB TOTAL		2445500		7336500	1345025

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMBREN

17	KRBH_PRO_SAND_25	66900	2.5	167250	17	KRBH_PRO_SAND_25	66900	3	200700	33450
SUB TOTAL		66900		167250	SUB TOTAL		66900		200700	33450
18	KRBH_PRO_SAND_20	30000	2.15	64500	18	KRBH_PRO_SAND_20	30000	2.5	75000	10500
19	KRBH_PRO_SAND_21	98600	2.15	211990	19	KRBH_PRO_SAND_21	98600	2.5	246500	34510
SUB TOTAL		128600		276490	SUB TOTAL		128600		321500	45010
20	KRBH_PRO_SAND_05	77900	2	155800	20	KRBH_PRO_SAND_05	77900	2.5	194750	38950
21	KRBH_PRO_SAND_06	25400	2	50800	21	KRBH_PRO_SAND_06	25400	2.5	63500	12700
22	KRBH_PRO_SAND_07	86700	2	173400	22	KRBH_PRO_SAND_07	86700	2.5	216750	43350
23	KRBH_PRO_SAND_08	55400	2	110800	23	KRBH_PRO_SAND_08	55400	2.5	138500	27700
24	KRBH_PRO_SAND_09	37000	2	74000	24	KRBH_PRO_SAND_09	37000	2.5	92500	18500
25	KRBH_PRO_SAND_10	24800	2	49600	25	KRBH_PRO_SAND_10	24800	2.5	62000	12400
26	KRBH_PRO_SAND_11	22900	2	45800	26	KRBH_PRO_SAND_11	22900	2.5	57250	11450
27	KRBH_PRO_SAND_12	98600	2	197200	27	KRBH_PRO_SAND_12	98600	2.5	246500	49300
28	KRBH_PRO_SAND_13	52800	2	105600	28	KRBH_PRO_SAND_13	52800	2.5	132000	26400
29	KRBH_PRO_SAND_14	41600	2	83200	29	KRBH_PRO_SAND_14	41600	2.5	104000	20800
30	KRBH_PRO_SAND_15	81000	2	162000	30	KRBH_PRO_SAND_15	81000	2.5	202500	40500
31	KRBH_PRO_SAND_16	39500	2	79000	31	KRBH_PRO_SAND_16	39500	2.5	98750	19750
32	KRBH_PRO_SAND_17	157000	2	314000	32	KRBH_PRO_SAND_17	157000	2.5	392500	78500
33	KRBH_PRO_SAND_18	57300	2	114600	33	KRBH_PRO_SAND_18	57300	2.5	143250	28650
34	KRBH_PRO_SAND_19	104000	2	208000	34	KRBH_PRO_SAND_19	104000	2.5	260000	52000
SUB TOTAL		961900		1923800	SUB TOTAL		961900		2404750	480950
ALL TOTAL		3664900		8495415	ALL TOTAL		3664900		10418450	1923035

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

Table No.29: Sediment Load Comparison Pre & Post monsoon period for different rivers of West Karbi Anglong District

Sediment Load Comparison Pre & Post monsoon period							
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)	Replenishment Percentage (%) (Premonsoon / Postmonsoon *100)
AMLONG RIVER	1	1	136400	155000	18600	12	88
KOPIL RIVER	15	15	5991475	7336500	1345025	18	82
AMRENG RIVER	1	1	167250	200700	33450	17	83
AMSORLI RIVER	2	2	276490	321500	45010	14	86
BORPANI RIVER	15	15	1923800	2404750	480950	20	80
TOTAL	34	34	8495415	10418450	1923035		

B. Geological studies

i) Lithology of the catchment area

- **Kopili:** lithological units are Crystalline Limestone, Metamorphosed Basic volcanic, and Granite & Quartzite.
- **Borpani:** Granite, Phyllite.

ii) Tectonics and structural behavior of rocks

The Jurassic rocks lie over the Archaeans which are overlain by Tertiary rocks. The Quaternary deposits comprising alluvium and laterites are found overlying these formations along the river valley on the eastern fringe. Rocks which comprise the Meghalaya Plateau as well as the Mikir Hills region represent the eastern shield of the peninsular Indian plateau. The occurrence of Upper Cretaceous carbonatite – ultramafic complex along a NE fracture zone in the east-central part of the plateau and in the Kaliani river basin, Mikir hills is noted. N –S to NW – SE trending active faults/fractures are found in this region. To the west of the Mikir Hills the NW – SE Kopili lineament (Nandy, 1980) is very prominent and was later identified as the Kopili fault (Dasgupta; Nandy, 1982) is an important tectonic feature. The NW trending Bomdilla fault marks the northeastern limit of the Mikir hills. Lineaments chiefly are surficial evidences of past neotectonic movements which do have a record of reactivation (Nandy, 2001).

Tectonically the area has experienced three phases of upliftment

- i. During the end of Jurassic to early Cretaceous times a dominant E – W, vertical to sub vertical fracture / fault system started along the southern margin of the Meghalaya plateau when block faulting took place simultaneously to its north.
- ii. During the second phase in Oligocene time, uplift and erosion occurred north of the Dauki fault and many basement faults were reactivated. (Wandrey, 2004. 7 p.).
- iii. Upliftment along the Dauki fault system became very pronounced during the Mio – Pleistocene time with the deposition of huge sediments in the southernmost down faulted block of the Sylhet Trap (NANDY 2001).
- iv. The present height of the Meghalaya Plateau has been achieved mostly by repeated upliftment along the Dauki fault system over a long span of time (Nandy, 2000. 126 p.)

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 West Karbi Anglong district. The area enjoys a sub-tropical climate with abundance of monsoonal rain. The rainfall is not uniform

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

throughout the district. The average rainfall is about 2416 mm. Almost 60% of precipitation is received during July to September.

ii) Climate zone

The West Karbi Anglong district has sub-tropical tropical/ Equatorial climate as Assam lies in the regime of monsoon climate of the sub-tropical belt. So, people of West Karbi Anglong 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 34 °C (Max) and minimum of 6 °C. In summer weather becomes hot and humid with temperature range 25 °C to 32 °C. The temperature ranges from 6 °C - 12°C degree in winter which begins from October and continues till February.

➤ 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.30: Annual deposition

River Name	Zone	Type of Material	Quantity in CUM(as per YY)	60% of quantity in CUM
AMLONG RIVER	1	RBM	18600	11160
KOPIL RIVER	15	SAND	1345025	807015
AMRENG RIVER	1	SAND	33450	20070
AMSORLI RIVER	2	SAND	45010	27006
BORPANI RIVER	15	SAND	480950	288570
TOTAL	34		1923035	1153821

- i. 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.
- ii. As per guidelines, mining depth has been restricted to 3 meters depth and distance from the

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

bank is ¼th of river width and not be less than 7.5 meters.

- iii. 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.
- iv. 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. 31 : Resources of Potential Riverbed Mineral

Boulder / Bajri (cum)	Sand (cum)	Total Mineral Potential (cum)
2083690	8334760	10418450
Annual Deposition		
384607	1538428	1923035

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 in 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 in 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

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMBREN

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

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMBREN

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 West Karbi Anglong 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 Kopili River, Borpani Amreng River, Amlong River, Amsorli River etc. 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 and stone quarries of the respective ranges in West Karbi Anglong District are attached in **ANNEXURE II**.

8.3 DETAILS OF PRODUCTION OF SAND AND OTHER MINERALS OF 2017-2020:

➤ **Total Mineral production of Sand in the district of 2017-2020:**

Table No.32: Production of the District for the year 2017-18

Sl. No.	Name of the Mineral	Production (In CuM)
1	Sand	10886

Table No.33: Production of the District for the year 2018-19

Sl. No.	Name of the Mineral	Production (In CuM)
1	Sand	34,877

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMBREN

Table No.34: Production of the District for the year 2019-20

Sl. No.	Name of the Mineral	Production (In CuM)
1	Sand	28998

- **Total Mineral production of In-situ Minerals (Minerals other than sand) in the district of 2017-2020:**

Table No.35: Production of the District for the year 2017-18

Sl. No.	Name of the Mineral	Production (In CuM)
1	Stone	20717
2	Gravel	52472
3	Earth Clay	700

Table No.36: Production of the District for the year 2018-19

Sl. No.	Name of the Mineral	Production (In CuM)
1	Stone	31,787
2	Sand Gravel	36,178
3	Silt/Clay	8000

Table No.37: Production of the District for the year 2019-20

Sl. No.	Name of the Mineral	Production (In CuM)
1	Stone	34961.12
2	Sand Gravel	44554.13
3	Silt/Clay	24733

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

For Sand:

Table No.38: Production and Revenue and District for the year 2020-21

Sl. No	Name of the Mineral	Production (in Mts)	Rate	Royalty (in Rs)
1.	Sand	11286 m ³	Rs. 140/-	Rs. 15,80,040/-

Table No. 39: Production and Revenue of district for the year 2021-22

Sl. No	Name of the Mineral	Production (in Mts)	Rate	Royalty (in Rs)
1.	Sand	31550 m ³	Rs. 140/-	Rs. 44,17,000/-

Table No. 40: Production and Revenue of district for the year 2022-23

Sl. No	Name of the Mineral	Production (in Mts)	Rate	Royalty (in Rs)
1.	Sand	19571 m ³	Rs. 140/-	Rs. 27,39,940/-

YEAR	ROYALTY/ DEED RENT	CESS	Production (in MTs)	TOTAL REVENUE
2020-2021	Rs. 15,80,040/-	Rs. 4,74,012/-	11286 m ³	Rs. 15,80,040/-
2021-2022	Rs. 44,17,000/-	Rs. 13,25,100/-	31550 m ³	Rs. 44,17,000/-
2022-2023	Rs. 27,39,940/-	Rs. 8,21,982/-	19571 m ³	Rs. 27,39,940/-
2023-2024	Rs. 34,65,000/-	Rs. 10,39,500	24750 m ³	Rs. 34,65,000/-

For Stone & Sand Gravel

Table No. 41: Production and Revenue and District for the year 2020-21

Sl. No	Name of the Mineral	Production (in Mts)	Rate	Royalty (in Rs)
1.	Stone	27550 m ³	Rs. 200/-	Rs. 55,10,000/-
2.	Sand Gravel	18607 m ³	Rs. 200/-	Rs. 37,21,400

Table No. 42: Production and Revenue of district for the year 2021-22

Sl. No	Name of the Mineral	Production (in Mts)	Rate	Royalty (in Rs)
1.	Stone	11529 m ³	Rs. 200/-	Rs. 23,05,800/-
2.	Sand Gravel	13509 m ³	Rs. 200/-	Rs. 27,01,800/-

Table No. 43: Production and Revenue of district for the year 2022-23

Sl. No	Name of the Mineral	Production (in Mts)	Rate	Royalty (in Rs)
1.	Stone	41595 m ³	Rs. 200/-	Rs. 83,19,000/-
2.	Sand Gravel	20580 m ³	Rs. 200/-	Rs. 41,16,000/-

YEAR	ROYALTY/ DEED RENT	CESS	Production (in MTs)	TOTAL REVENUE
2020-2021	Rs. 55,10,000/-	Rs. 16,53,000/-	27550 m ³	Rs. 55,10,000/-
2021-2022	Rs. 23,05,800/-	Rs. 6,91,740/-	11529 m ³	Rs. 23,05,800/-
2022-2023	Rs. 83,19,000/-	Rs. 24,95,700/-	41595 m ³	Rs. 83,19,000/-
2023-2024	Rs. 58,85,000/-	Rs. 17,65,500/-	29425 m ³	Rs. 58,85,000/-

CHAPTER 10: Transport (Railway, Road)

Emphasize on local transport infrastructure from mineral transport point of view Karbi anglong West district is well connected with other cities and towns of Assam and neighborhood states by road and rail transport.

The district is connected with other district through various routes. The P.W.D routes covered the entire district. The North Eastern Council routes covered only two routes in the whole entire District via thru Baithalangso to khanduli and the other hand is via through Baithalangso to kampur.

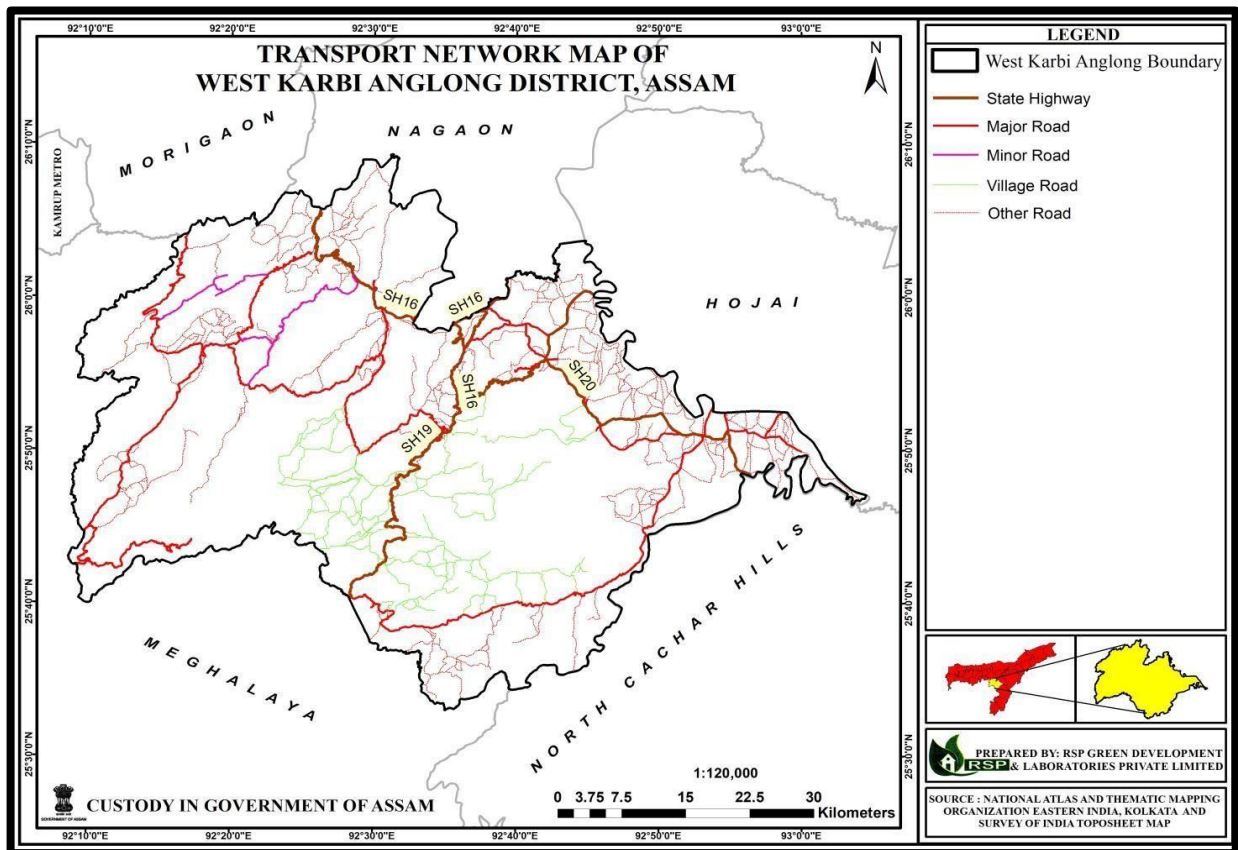


Figure No: 31 Transport Map of the District

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. West Karbi Anglong District is no exception of these. Limestone is a sedimentary rock with economic values generally found in Voteranlangsho, Chirimthipi area of the district. This limestone is generally cementing grade, favorable for Cement industry. Granites is also present in this district. Granites is generally pinkish in colour as orthoclase is present in this rock in significant amount, medium to coarse grained in nature, showing porphyritic texture. These granites are usually used for building material. Clay is present in this district for producing the bricks. (*Source: Miscellaneous Publication of GSI, Census report of Karbi Anglong*)

Mineral resources of the district are explained below.

Limestone: The deposits of limestone is generally occurred in Voteranlangsho, Chirimthipi area of the district. The limestone of this area is generally cement grade in nature with significant amount of CaO% and less amount of MgO% is present in this area, favourable for the cement plant. This limestone are belongs to Sylhet Limestone.

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 Quartzite, feldspar, granite, etc.

Quartzite is a white to greyish in colour, hard, compact, medium -coarse grained, almost mono-minerallic metamorphic rock showing non-foliated texture. It is generally formed from quartz arenite sandstone by experiencing extreme heating and pressure related to orogenic belts. Quartzite is present umjakini range, Ouguri range, central range in this district. This rock type is usually used in roofing, tiles and flooring for decorating purposed in building.

Porphyritic granites and pink granites of granitic pluton are also found in this district. Granites are generally found in central range of this district, generally used in decorative stone in the building. Mica Schist is also present in this district.

Mica-infused quartz is also present in this district where natural mica is exposed.

CHAPTER 12: REMEDIAL MEASURE TO MITIGATE THE IMPACT OF MINING

12.1 Environment Sensitivity

Hamren (West Karbi Anglong) District represent a unique geo-environmental setup. As human population increases, forests are being depleted for the extension of agricultural lands, introduction of new settlements, roadways etc.

According to NTCA (National Tiger Conservation Authority) has blamed the “stone mining/quarrying and stone crushers established in the intervening area” between Kaziranga and Karbi Anglong hills for “destruction of wildlife corridors and vital wildlife habitat which is essential for long ranging species like Indian elephant and tigers.” some animals, like elephants, use both flood plains of Kaziranga and hills of Karbi Anglong for seasonal needs and the free movement of wild elephants is essential. Further, if mining continues in Kaziranga-facing hills of Karbi Anglong, silts and stone dust can damage the wetland ecosystems of Kaziranga and that in turn could create more problem for wetland and grassland dependant species in Kaziranga.

The land use practices play the most important role in determining the stability factors in respect of landslide hazards. Stone quarrying from the slope is another way of human intervention that causes occasional slope failure.

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.

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.

Sand Mining in beaches disturbs the ecosystem of different fauna of the beaches. The sand mining from natural barriers, made up of sand, causes flooding of the natural habitat. The sand mining activity destroys the aesthetic beauty of beaches and river bank and makes the ecosystem unstable. If there are popular tourist destination, tourism potential of such areas will decline.

It can be concluded that there has been little in-depth research on the environmental, social and political effects of land use practices and calls for urgent attention by the competent authority.

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.

DISTRICT SURVEY REPORT OF WEST KARBIANGLONG, HAMREN

- ❖ 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.

DISTRICT SURVEY REPORT OF WEST KARBIANGLONG, HAMREN

- ❖ 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 meter 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:

- a) 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;
- b) The proposed mining cross-section data should be plotted over the baseline data to illustrate the vertical extent of the proposed excavation;
- c) 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;
- d) A planimetric map showing the aerial extent of the excavation and extent of the riparian buffers;
- e) 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;
- f) 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.
- g) 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

The District Survey Report has been prepared in conformity with the S O 141 (E), S O 3611 (E) and other sand mining guidelines published by MoEF&CC.

Potential areas of economic mineralization and mineral deposition have been identified and list is furnished in the report. Estimation of annual sand deposition by replenishment study has been incorporated in the report.

The district survey report has been prepared by utilizing both primary and secondary data. The primary data generation involved the satellite imagery study, site inspection, survey, ground truthing etc. while secondary data has been acquired through various authenticated sources and satellite imagery studies.

The District Survey report (DSR) will contain mainly data published and endorsed by various departments and websites about Geology of the area, Mineral wealth details of rivers, details of Lease and Mining activity in the district along with Sand mining and revenue of minerals. This report also contains details of Forest, Rivers, Soil, Agriculture, Road, Transportation and climate etc.

The main minor mineral of the district i.e., sand will be replenished annually and available for excavation in the next post- monsoon season. Additional areas may be further assessed on the basis of various ecological, environmental, social considerations. It can be further studied as potential area for mining and revenue generation.

15.1 Conclusion

- I. The river beds of the district are enriched with sand which is highly potential for mining.
- II. The replenishment study has been carried out during the preparation of this DSR. Both field- based surveys coupled with satellite imagery study and empirical study were carried out to determine the rate of replenishment in each river of the district.
- III. The determined values of various methods as adopted for replenishment study gives a comparable value and in all cases the values are found to be much more as compared to the capping limit (60%) as suggested in the Enforcement & Monitoring Guidelines for Sand Mining (EMGSM) January 2020, Issued by Ministry of Environment, Forest and Climate Change (MoEF&CC) 2020.
- IV. The total potential riverbed deposit for the district comes to about 9443250 Mcum.
- V. In the district a total 49 in-situ minor mineral potential block have been identified.

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 Agencies 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.

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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**

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

a) Rivers:

Sl. No.	River Name / M-Sand plant	Total stretch of River (in Km)	Type Of River
1	AMLONG RIVER	50.7	Perennial
2	KOPIL RIVER	227.51	Perennial
3	BORPANI RIVER	176.68	Perennial
4	AMSORLI RIVER	12.3	Perennial
5	AMRENG RIVER	99.60	Perennial

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

Name	Maintain/Controlled by State Govt./ PSU etc.	Location	District	Tehsil	Village	Size (Ha)
NA						

c) List of Patta Lands / Khatadari land

Sl. No.	Owner	Division	Range	Area	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)

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

➤ **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	Range	Village	Lease Details	Area (Ha)	Geo-Coordinates		Distance in (km) from PA/BR/WC	Distance from Forest Area (in km)	Mining Leases within 500 meters (if yes cluster area)	Total excavation in tonnes/Annun considering digging depth max as 3 meters	Mineral to be mined (Sand/Bajri/RBM etc)	Existing /Proposed
							Latitude	Longitude						
1	Borpani	Dan Abi Sand Contract Permit Area At Rongagorah Borpani Upstream Baithalangs o	Central Range, Hamren	Hamren	Dan Abi Sand Contract Permit Area At Rongagorah Borpani Upstream Baithalangs o	4.8	25° 57' 52.22" 25° 57' 45.45" 25° 57' 41.90" 25° 57' 49.10"	92° 33' 45.04" 92° 33' 56.37" 92° 33' 53.46" 92° 33' 42.44"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	5,000	Sand	Existing
2	Borpani	Amdubi Ghat (Tharve Abi)	Central Range, Hamren	Amdubi	Amdubi Ghat (Tharve Abi)	2	25° 59' 54.10" 25° 59' 50.24" 25° 59' 53.67" 25° 59' 57.16"	92° 38' 14.56" 92° 38' 24.40" 92° 38' 24.30" 92° 38' 16.66"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	5,000	Sand	Existing
3	Borpani	Hongkram	Central Range, Hamren	Hongkram	Hongkram	1.5	25° 59' 4.97" 25° 59' 8.34" 25° 59' 9.97" 25° 59' 6.63"	92° 37' 23.56" 92° 37' 28.51" 92° 37' 26.34" 92° 37' 21.21"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	5,000	Sand	Existing
4	Borpani	Dikisir-Longre Sand Contract	Central Range, Hamren At Lengri	Dikisir-Longre	Dikisir-Longre Sand Contract	5	25° 58' 30.60" 25° 58' 34.43" 25° 58' 34.74" 25° 58' 39.58"	92° 32' 00.21" 92° 32' 09.30" 92° 31' 56.57" 92° 32' 04.84"	No Pa/Br/Wc Available In 500m	No Forest Available In	No	10,000	Sand	Existing

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

		Permit Area Borpani Upstream Baithalangs o	(Baithala ngso)		Permit Area Borpani Upstream Baithalang so					500m				
5	Borpani	Phukup Abi Sand Contract Permit Area Borpani Upstream Baithalangs o	Central Range, Hamren At Lengri (Baithala ngso)	Phukup Abi	Phukup Abi Sand Contract Permit Area Borpani Upstream Baithalang so	3	25° 57' 43.21" 25° 57' 44.09" 25° 57' 47.58" 25° 57' 48.55"	92° 35' 16.17" 92° 35' 08.99" 92° 35' 17.31" 92° 35' 09.39"	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	10,000	Sand	Existing
6	Borpani	Kro Arong, Rongagora Sand Contract Permit Area Borpani Upstream Baithalangs o	Central Range, Hamren At Lengri (Baithala ngso)	Kro Arong	Kro Arong, Rongagora Sand Contract Permit Area Borpani Upstream Baithalang so	3	25°57'43.21"N 25°57'44.09"N 25°57'47.58"N 25°57'48.55"N	92°35'16.71"E 92°35'8.99"E 92°35'17.31"E 92°35'9.39"E	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	10,000	Sand	Existing
8	Borpani	Phung Abi Sand Contract Mining Area Borpani Downstrea m Baithalangs o	Central Range, Hamren At Phung Abi (Baithala ngso)	Phung Abi	Phung Abi Sand Contract Mining Area Borpani Downstrea m Baithalang so	3	25° 58' 40.16" 25° 58' 36.89" 25° 58' 34.39" 25° 58' 31.31"	92° 36' 0.51" 92° 35' 58.84" 92° 36' 10.06" 92° 36' 07.09"	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	8,000	Sand	Existing

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

9	Borpani	Sobailangso No. 1	Central Range, Hamren	Sobailangso	Sobailangso No. 1	2	25° 58' 53.55" 25° 59' 0.33" 25° 58' 54.51" 25° 59' 1.61"	92° 36' 54.06" 92° 36' 57.80" 92° 36' 50.70" 92° 36' 54.30"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	5,000	Sand	Existing
10	Borpani	Hongkram Sand Contract Permit Area Borpani Downstream	Central Range, Hamren At Hongkram	Hongkram	Hongkram Sand Contract Permit Area Borpani Downstream	1.5	26° 00' 0.43" 25° 59' 57.30" 25° 59' 59.31" 26° 00' 1.63"	92° 39' 14.53" 92° 39' 14.83" 92° 39' 21.08" 92° 39' 19.97"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	4,000	Sand	Existing
11	Borpani	Nusor Abi Sand Contract Permit Area Borpani Upstream	Central Range, Hamren At Nusor Abi, Rongcheck	Nusor Abi	Nusor Abi Sand Contract Permit Area Borpani Upstream	2	25° 53' 17.33" 25° 53' 18.88" 25° 53' 12.83" 25° 53' 14.36"	92° 27' 7.43" 92° 27' 5.84" 92° 26' 59.43" 92° 26' 58.45"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	4,000	Sand	Existing
12	Borpani	Sand Contract Permit Area, Maisam Village (Borpani River, Down Stream)	Central Range, Hamren	Maisam	Sand Contract Permit Area, Maisam Village (Borpani River, Down Stream)	1.65	25° 58' 35.8" 25° 58' 41.7" 25° 58' 37.9" 25° 58' 36.5"	92° 35' 44.0" 92° 35' 51.0" 92° 35' 51.8" 92° 35' 49.9"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	5,000	Sand	Existing
13	Borpani	Lengri Sand Contract Periiiit Area Borpani Upstream Baithalango	Central Range, Hamren At Lengri (Baithalango)	Lengri	Lengri Sand Contract Periiiit Area Borpani Upstream	4.48	25° 57' 55.13" 25° 58' 01.31" 25° 57' 51.56" 25° 58' 00.04"	92° 33' 10.70" 92° 33' 08.36" 92° 33' 08.36" 92° 32' 56.59"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	10,000	Sand	Existing

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

					Baithalango									
14	Borpani	Hongkram Sand Mining Lease Fermit Area Borpani Downstream Baithalango	Central Range, Hamren At Lengri (Baithalango)	Hongkram	Hongkram Sand Mining Lease Fermit Area Borpani Downstream Baithalango	4.2	26° 00' 28.30" 26° 00' 42.42" 26° 00' 27.25" 26° 00' 41.22"	92° 39' 29.41" 92° 39' 25.71" 92° 39' 25.39" 92° 39' 22.15"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	15,000	Sand	Existing
15	Borpani	Hongkram Baithalango Borpani Downstream	Central Range, Hamren	Hongkram	Hongkram Baithalango Borpani Downstream	0.95	25° 59' 16.95" 25° 59' 18.92" 25° 59' 20.04" 25° 59' 17.83"	92° 37' 44.89" 92° 37' 44.23" 92° 37' 49.15" 92° 37' 49.76"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	6,000	Sand	Existing
16	Borpani	Rongagorah Baitlialango Borpani Upstream	Central Range, Hamren	Rongagorah Baitlialango	Rongagorah Baitlialango Borpani Upstream	4.8	25°57' 55.17" 25°57' 54.28" 25°57' 49.47" 25°57' 50.37"	92° 33' 33.65" 92° 33' 19.97" 92° 33' 31.30" 92° 33' 20.69"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	12,000	Sand	Existing
17	Borpani	Hongkram Rongphar Arong Borpani Downstream	Central Range, Hamren	Hongkram Rongphar	Hongkram Rongphar Arong Borpani Downstream	11	25° 59' 9.26" 25° 59' 17.97" 25° 59' 34.59" 25° 59' 11.63" 25° 59' 17.49" 25° 59' 36.28"	92° 37' 30.32" 92° 37' 51.44" 92° 38' 09.17" 92° 37' 28.41" 92° 37' 38.36" 92° 38' 05.09"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	20,000	Sand	Existing
18	Borpani	Inghin Abi Sand Contract Permit Area	Central Range, Hamren	Inghin Abi	Inghin Abi Sand Contract Permit Area	2	25° 58' 36.81" 25° 58' 39.53" 25° 58' 39.29" 25° 58' 42.68"	92° 36' 38.38" 92° 36' 39.17" 92° 36' 29.63" 92° 36' 30.52"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	5,000	Sand	Existing
19	Borpani	Sand Contract Permit Area	Central Range, Hamren	Phung Abi	Sand Contract Permit	2.11	25° 58' 41.1" 25° 58' 40.02" 25° 58' 37.7"	92° 35' 55.6" 92° 35' 47.9" 92° 35' 55.6"	No Pa/Br/Wc Available	No Forest Available	No	--	Sand	Existing

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

					Area		25°58' 36.2"	92° 35' 50.8"	In 500m	e In 500m				
20	Borpani	Sand Contract Permit Area	Central Range, Hamren	Sobailangso	Sand Contract Permit Area	2.86	25° 59' 02.0" 25° 59' 04.3" 25° 59' 03.8" 25° 59' 06.4"	92° 37' 06.9" 92° 37' 22.1" 92° 37' 06.5" 92° 37' 21.5"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
21	Borpani	Khuropindha Sand Contract Permit Area	Central Range, Hamren	Khuropindha	Khuropindha Sand Contract Permit Area	1.33	25° 58' 42.12" 25° 58' 40.31" 25° 58' 37.88" 25° 58' 37.01"	92° 35' 54.91" 92° 36' 0.29" 92° 35' 54.46" 92° 35' 59.12"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	500	Sand	Existing
22	Borpani	Adorso Bazar, Hongkram	Central Range, Hamren	Adorso Bazar	Adorso Bazar, Hongkram	4.25	26° 00' 48.34" 26° 01' 03.13" 26° 01' 03.96" 26° 00' 46.30"	92° 39' 21.22" 92° 39' 18.88" 92° 39' 15.18" 92° 39' 18.48"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	10,000	Sand	Existing
23	Borpani	Lengri Sand Mining Permit Area Borpani Upstream Baithalangs	Central Range, Hamren At Lengri (Bathalangs)	Lengri	Lengri Sand Mining Permit Area Borpani Upstream Baithalangs	4.8	25° 58' 19.71" 25° 58' 11.53" 25° 58' 16.43" 25° 58' 08.74"	92° 32' 46.55" 92° 32' 53.45" 92° 32' 42.32" 92° 32' 48.90"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	15,000	Sand	Existing
27	Kopili	Kopili River (Taradubi)S and Contract Permit Area	Donkam Range, Under Hamren Division, Hamren	Taradubi	Kopili River (Taradubi) Sand Contract Permit Area	9.64	26° 04' 77.50" 26° 04' 80.28" 26° 05' 48.06" 26° 05' 49.72"	92° 74' 44.72" 92° 74' 28.06" 92° 75' 91.67" 92° 75' 98.33"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
28	Kopili	Deramukh Kopili River Sand Contract	Donkam Range, Under	Deramukh	Deramukh Kopili River Sand Contract	2.28	25° 55' 56.80" 25° 56' 02.46" 25° 56' 7.58" 25° 56' 19.25"	92° 47' 47.47" 92° 47' 46.64" 92° 47' 45.15" 92° 47' 39.96"	No Pa/Br/Wc Available In 500m	No Forest Available In	No	--	Sand	Existing

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

		Permit Area	Hamren Division, Hamren		Permit Area		25° 56' 10.08"	92° 47' 47.00"		500m				
30	Kopili	"Tumpreng-Kopili River" Proposed Site For Extraction Of Sand	Donkamukam Range, Under Hamren Division, Hamren		"Tumpreng-Kopili River" Proposed Site For Extraction Of Sand	7.36	26° 00' 31.2" 26° 00' 32.4" 26° 00' 24.6" 26° 00' 25.4"	92° 46' 03.8" 92° 46' 16.4" 92° 46' 16.4" 92° 46' 03.7"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
32	Kopili	Bania Ghat	Southern Range, Kheroni		Bania Ghat	10.5	25° 49' 9.10" 25° 49' 9.62" 25° 49' 18.13" 25° 49' 30.99" 25° 49' 29.80"	92° 54' 10.00" 92° 54' 27.67" 92° 54' 24.81" 92° 54' 20.68" 92° 54' 18.40"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
33	Kopili	Upper Kopili	Southern Range, Kheroni		Upper Kopili	2.26	25° 50' 16.65" 25° 50' 8.83" 25° 50' 2.30" 25° 50' 1.72" 25° 50' 9.12"	92° 53' 22.06" 92° 53' 24.24" 92° 53' 26.47" 92° 53' 25.03" 92° 53' 21.79"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
34	Kopili	Dayangmukh-Panimur	Southern Range, Kheroni		Dayangmukh-Panimur	1.4	25° 48' 26.33" 25° 48' 24.67" 25° 48' 23.52" 25° 48' 21.80"	92° 55' 32.96" 92° 55' 31.66" 92° 55' 40.58" 92° 55' 40.09"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
35	Kopili	Kalighat	Southern Range, Kheroni		Kalighat	0.62	25° 48' 32.30" 25° 48' 31.92" 25° 48' 29.91" 25° 48' 28.18"	92° 55' 24.01" 92° 55' 27.88" 92° 55' 36.43" 92° 55' 41.76"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
36	Amreng	Sansika	Southern Range, Kheroni		Sansika	2.29	25° 45' 11.01" 25° 45' 16.00" 25° 45' 18.90" 25° 45' 18.90"	92° 47' 46.68" 92° 47' 38.33" 92° 47' 32.96" 92° 47' 40.00"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
37	Kopili	Rajadubi	Southern		Rajadubi	4	25° 48' 46.26"	92° 54' 27.47"	No	No	No	--	Sand	Existing

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

		Ghat 2	Range, Kheroni		Ghat 2		25° 48' 45.16" 25° 48' 26.28" 25° 48' 27.14"	92° 54' 30.07" 92° 54' 24.21" 92° 54' 22.40"	Pa/Br/Wc Available In 500m	Forest Availabl e In 500m				
38	Kopili	Rajadubi- Kalighat	Southern Range, Kheroni		Rajadubi- Kalighat	0.63	25° 48' 14.55" 25° 48' 14.03" 25° 48' 11.26" 25° 48' 10.27" 25° 48' 11.32" 25° 48' 10.39"	92° 54' 21.57" 92° 54' 20.55" 92° 54' 24.40" 92° 54' 24.16" 92° 54' 26.66" 92° 54' 26.69"	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	--	Sand	Existing
39	Kopili	Prisek	Southern Range, Kheroni		Prisek	0.76	25° 42' 34.76" 25° 42' 34.86" 25° 42' 32.63" 25° 42' 32.53" 25° 42' 31.56" 25° 42' 30.50" 25° 42' 30.57"	92° 48' 52.18" 92° 48' 53.46" 92° 48' 50.99" 92° 48' 52.84" 92° 48' 51.86" 92° 48' 49.90" 92° 48' 52.78"	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	--	Sand	Existing
40	Kopili	Upper Kopili Ghat 2	Southern Range, Kheroni		Upper Kopili Ghat 2	2.5	25° 50' 1.60" 25° 50' 3.22" 25° 49' 55.96" 25° 49' 54.23"	92° 53' 22.19" 92° 53' 25.78" 92° 53' 29.30" 92° 53' 26.97"	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	--	Sand	Existing
41	Kopili	Bogorighat	Southern Range, Kheroni		Bogorighat	9.75	25° 52' 36.8" 25° 52' 37.2" 25° 52' 06.0" 25° 52' 05.4"	92° 51' 43.0" 92° 51' 44.7" 92° 51' 44.1" 92° 51' 41.8"	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	--	Sand	Existing
42	Kopili	Sinery Ghat	Southern Range, Kheroni		Sinery Ghat	2.77	25° 49' 59.10" 25° 49' 59.87" 25° 49' 44.31" 25° 49' 45.59"	92° 53' 27.85" 92° 53' 25.31" 92° 53' 38.80" 92° 53' 40.40"	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	--	Sand	Existing
43	Kopili	Lower Kopili	Southern Range, Kheroni		Lower Kopili	4.93	25° 52' 08.08" 25° 52' 07.70" 25° 51' 54.20" 25° 51' 53.70"	92° 53' 11.82" 92° 53' 15.80" 92° 53' 10.80" 92° 53' 15.03"	No Pa/Br/Wc Available In 500m	No Forest Availabl e In 500m	No	--	Sand	Existing

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

44	Kopili	Rajadubi Ghat 1	Southern Range, Kheroni		Rajadubi Ghat 1	0.28	25° 48' 12.13" 25° 48' 10.97" 25° 48' 12.96" 25° 48' 12.08"	92° 54' 27.83" 92° 54' 28.09" 92° 54' 31.15" 92° 54' 31.16"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
45	Amsorli	Amsorli River Sand Contract Permit Area	Ouguri Range, Ouguri		Amsorli River Sand Contract Permit Area	1.5	26° 03' 07.85" 26° 03' 08.55" 26° 02' 57.45" 26° 02' 57.06"	92° 16' 45.85" 92° 16' 45.82" 92° 16' 31.52" 92° 16' 31.00"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
46	Amsorli	Amsorli River Sand Contract Permit Area (Downstream)	Ouguri Range, Ouguri		Amsorli River Sand Contract Permit Area (Downstream)	1.62	26° 02' 51.04" 26° 02' 49.96" 26° 02' 56.02" 26° 02' 56.47"	92° 16' 12.62" 92° 16' 12.58" 92° 16' 30.95" 92° 16' 30.36"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing
47	Killing	River Sand Contract Permit Area At Killing River, Amguri	Ouguri Range, Ouguri		River Sand Contract Permit Area At Killing River, Amguri	5.24	26° 03' 34.19" 26° 03' 35.08" 26° 04' 6.62" 26° 04' 5.90"	92° 16' 0.08" 92° 16' 0.01" 92° 16' 50.01" 92° 16' 50.40"	No Pa/Br/Wc Available In 500m	No Forest Available In 500m	No	--	Sand	Existing

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

➤ **List of existing mining zones of the district with location, area, period for each minor mineral (In-Situ)**

Sl. No.	Name Of Mineral	Name Of Lease	Range	Area (Ha)	Geo-Cordinates		Quantity As Per Ec (Cum)	Lease Execution Date	Lease Expiry Date
					Latitude	Longitude			
1	Stone	Kunchi Mca Area	Amri	1.14	25° 57' 41.47" 25° 57' 43.18" 25° 57' 40.98" 25° 57' 39.72"	92° 20' 26.76" 92° 20' 28.82" 92° 20' 31.45" 92° 20' 28.54"	--	--	--
2	Stone	Umat Area	Amri	2.3	25° 48' 45.8" 25° 48' 47.4" 25° 48' 38.7" 25° 48' 38.1"	92° 13' 05.7" 92° 13' 03.9" 92° 12' 53.5" 92° 12' 55.5"	--	--	--
3	Stone	Sobailangso Stone Contract Permit Area	Central Range, Hamren	0.75	25° 58' 40.5" 25° 58' 41.1" 25° 58' 39.6" 25° 58' 38.0"	92° 37' 02.3" 92° 37' 03.5" 92° 37' 04.1" 92° 37' 02.8"	2000	--	--
4	Stone	Sobailangso Usf	Central Range, Hamren	1.27	25° 58' 36.84" 25° 58' 38.44" 25° 58' 41.35" 25° 58' 41.32"	92° 37' 03.19" 92° 37' 04.37" 92° 37' 05.05" 92° 37' 01.48"	--	--	--
5	Stone	Longpai Usf	Central Range, Hamren	0.91	25° 48' 59.19" 25° 49' 1.11" 25° 49' 5.07" 25° 49' 4.01"	92° 28' 46.93" 92° 28' 43.71" 92° 28' 45.01" 92° 28' 46.37"	--	--	--
6	Stone	Mopulangso	Central Range, Hamren	0.2	25° 51' 9.97" 25° 51' 10.58" 25° 51' 9.77"	92° 32' 38.41" 92° 32' 38.41" 92° 32' 36.96"	--	--	--

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

					25° 51' 10.62"	92° 32' 37.00"			
7	Stone	Umdap-I	Central Range, Hamren	0.72	25° 48' 57.8" 25° 48' 59.7" 25° 49' 01.7" 25° 49' 01.5"	92° 28' 45.9" 92° 28' 44.6" 92° 28' 43.7" 92° 28' 46.4"	--	--	--
8	Stone	Sobailangso, Rong Ali	Central Range, Hamren	1.1	25° 58' 10.18" 25° 58' 12.70" 25° 58' 09.21" 25° 58' 08.27"	92° 37' 05.66" 92° 37' 02.56" 92° 37' 02.38" 92° 37' 03.33"	--	--	--
9	Stone	Mala Alum, Hmaren	Central Range, Hamren	2.35	25° 52' 28.9" 25° 52' 14.9" 25° 52' 15.6" 25° 52' 18.1"	92° 34' 56.1" 92° 34' 04.0" 92° 34' 04.8" 92° 34' 04.1"	--	--	--
10	Stone	Umbaso	Central Range, Hamren	0.5	25° 44' 23.7" 25° 44' 23.46" 25° 44' 22.6" 25° 44' 21.6"	92° 29' 10.2" 92° 29' 08.83" 92° 29' 09.2" 92° 29' 07.8"	--	--	--
11	Stone	Somintho, Khanduli	Central Range, Hamren	0.9	25° 44' 11.95" 25° 44' 09.40" 25° 44' 09.58" 25° 44' 11.42"	92° 26' 15.31" 92° 26' 17.13" 92° 26' 15.31" 92° 26' 17.28"	--	--	--
12	Stone	Tharve Anglong, Tumprop	Central Range, Hamren	1.63	26° 04' 08.72" 26° 04' 04.52" 26° 04' 11.68" 26° 04' 07.70"	92° 34' 44.05" 92° 34' 45.66" 92° 34' 47.69" 92° 34' 49.08"	--	--	--
13	Stone	Umchera	Central Range, Hamren	2.86	25° 45' 14.06" 25° 45' 19.12" 25° 45' 15.24" 25° 45' 11.61" 25° 45' 15.13"	92° 30' 46.60" 92° 30' 54.13" 92° 30' 43.06" 92° 30' 43.62" 92° 30' 51.81"	--	--	--

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

14	Stone	Langherang, Hongkram	Central Range, Hamren	1.71	25° 58' 46.69" 25° 58' 49.93" 25° 58' 52.25" 25° 58' 49.12"	92° 37' 48.59" 92° 37' 51.75" 92° 37' 49.17" 92° 37' 44.49"	--	--	--
15	Stone	Firing Anglong Stone Contract Permit Area	Donkamukam Range,Under Hamren Division, Hamren	2.81	25° 56' 02.4" 25° 56' 03.0" 25° 55' 52.2" 25° 55' 51.9"	92° 41' 32.8" 92° 41' 30.2" 92° 41' 30.9" 92° 41' 27.4"	--	--	--
16	Stone	Donka Riso Stone Contract Permit Area	Donkamukam Range,Under Hamren Division, Hamren	1.23	25° 55' 28.6" 25° 55' 28.8" 25° 55' 28.8" 25° 55' 27.2"	92° 41' 10.7" 92° 41' 11.4" 92° 41' 17.6" 92° 41' 18.0"	--	--	--
17	Stone	Serlongchor Stone Contract Permit Area	Donkamukam Range,Under Hamren Division, Hamren	2.45	25° 50' 24.20" 25° 50' 19.60" 25° 50' 17.73" 25° 50' 22.15"	92° 42' 56.90" 92° 43' 11.00" 92° 43' 10.76" 92° 42' 56.72"	--	--	--
18	Stone	Phonghonthor Proposed Site For Extraction Of Stone	Donkamukam Range,Under Hamren Division, Hamren	46.5	25° 51' 50.00" 25° 51' 41.17" 25° 51' 38.9" 25° 51' 43.3"	92° 43' 13.9" 92° 43' 19.8" 92° 43' 43.6" 92° 42' 41.7"	--	--	--
19	Stone	Telehor Stone Permit Area	Donkamukam Range,Under Hamren Division, Hamren	0.67	25° 51' 31.95" 25° 51' 33.97" 25° 51' 34.81" 25° 51' 34.80"	92° 44' 29.31" 92° 44' 26.15" 92° 44' 26.51" 92° 44' 30.86"	--	--	--
20	Quartzite Stone	Gps Co-Ordinates Of Quartzite Stone Area At Rong-Alum	Donkamukam Range,Under Hamren Division, Hamren	9.83	25° 52' 01.56"	92° 40' 42.98"	--	--	--
21	Sand	Sand Gravel At	Donkamukam	11.6	25° 54' 50.83"	92° 43' 23.60"	--	--	--

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

	Gravel	Kuthepi No.1 By Abci	Range, Under Hamren Division, Hamren		25° 54' 43.15" 25° 54' 35.14" 25°54' 42.83"	92° 43' 30.92" 92° 43' 20.51" 92° 43' 12.16"			
22	Stone	Amsorli Stone Contract Permit Area (Ci-Em Hansse)	Oguri Range, Ouguri	6	26° 03' 13.5" 26° 03' 14.5" 26° 03' 18.1" 26° 03' 15.8"	92° 17' 38.7" 92° 17' 47.2" 92° 17' 46.1" 92° 17' 40.6"	--	--	--
23	Stone	Stone Quarry At Amsorli (L&T Construction)	Oguri Range, Ouguri	2.26	26° 03' 13.87" 26° 03' 22.15" 26° 03' 20.47" 26° 03' 14.28"	92° 17' 49.60" 92° 17' 46.97" 92° 17' 50.35" 92° 17' 55.57"	--	--	--
24	Stone	Stone Contract Permit Area At Baulagog (Jitu Amsi)	Oguri Range, Ouguri	1.11	26° 04' 38.3" 26° 04' 42.8" 26° 04' 43.20" 26° 04' 41.65"	92° 17' 38.9" 92° 17' 40.7" 92° 17' 37.45" 92° 17' 35.75"	--	--	--
25	Stone	Pumakuchi Gsb Quarry {M/S Smk Pddc (Jv)}	Oguri Range, Ouguri	1.5	26° 04' 20.22" 26° 04' 15.23" 26° 04' 14.26" 26° 04' 18.04"	92° 18' 30.67" 92° 18' 31.94" 92° 18' 29.65" 92° 18' 28.41"	--	--	--

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

b) List of Patta Lands / Khatedari land

Sl. No.	Owner	Division	Range	Area	Tehsil	Village	Agricultural Land (Yes/No)
NA							

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

Name	Maintain/Controlled by State Govt./PSU etc.	Location	District	Tehsil	Village	Size (Ha)	Quantity (MT/Year)	Existing / Proposed
NA								

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:**

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

• **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.	Cluster No.	Number of leases in the cluster	Location (Riverbed/Patta Land)	Distance between clusters	Village	Area of Cluster (Ha)	Total Mineral Excavation (Ton)
NA								

ANNEXURE – IV

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

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

➤ **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)

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

➤ **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	KRBH_PRO_SAND_01	AMLONG RIVER	6.2	25°52'52.71"N 25°52'52.87"N 25°52'22.83"N 25°52'22.18"N	92°44'46.47"E 92°44'47.06"E 92°44'2.03"E 92°44'3.22"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	155000	93000	RBM	PROPOSED
2	KRBH_PRO_SAND_02	KOPIL RIVER	25.2	26° 0'31.41"N 26° 0'25.37"N 26° 0'20.94"N 26° 0'29.21"N	92°46'3.82"E 92°46'3.74"E 92°46'37.19"E 92°46'41.07"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	756000	453600	SAND	PROPOSED
3	KRBH_PRO_SAND_02a	KOPIL RIVER	3.52	26° 1'3.55"N 26° 1'3.91"N 26° 1'2.12"N 26° 0'59.38"N	92°45'15.04"E 92°45'19.15"E 92°45'26.20"E 92°45'27.52"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	105600	63360	SAND	PROPOSED
4	KRBH_PRO_SAND_02b	KOPIL RIVER	12.3	26° 1'36.22"N 26° 1'34.41"N 26° 1'12.60"N 26° 1'8.96"N	92°45'50.91"E 92°45'47.61"E 92°45'13.06"E 92°45'16.18"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	369000	221400	SAND	PROPOSED
5	KRBH_PRO_SAND_02c	KOPIL RIVER	10.6	26° 2'22.47"N 26° 2'22.71"N 26° 2'4.33"N 26° 2'6.68"N	92°44'55.29"E 92°44'58.94"E 92°45'23.40"E 92°45'30.95"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	318000	190800	SAND	PROPOSED

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

6	KRBH_PRO_SAND_02d	KOPIL RIVER	7.9	26° 3'3.46"N 26° 2'59.46"N 26° 3'0.82"N 26° 2'57.16"N	92°45'13.49"E 92°45'10.63"E 92°44'46.01"E 92°44'41.82"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	237000	142200	SAND	PROPOSED
7	KRBH_PRO_SAND_03	KOPIL RIVER	10.4	25°56'16.26"N 25°56'25.16"N 25°56'4.52"N 25°55'55.14"N	92°47'37.32"E 92°47'38.19"E 92°47'47.86"E 92°47'46.77"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	312000	187200	SAND	PROPOSED
8	KRBH_PRO_SAND_04	KOPIL RIVER	8.31	25°55'3.48"N 25°55'6.44"N 25°54'59.31"N 25°54'54.68"N	92°49'28.14"E 92°49'31.47"E 92°49'50.92"E 92°49'50.05"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	249300	149580	SAND	PROPOSED
9	KRBH_PRO_SAND_05	BORPANI RIVER	7.79	25°57'49.07"N 25°57'51.80"N 25°57'42.58"N 25°57'40.10"N	92°33'42.53"E 92°33'44.68"E 92°34'5.13"E 92°34'5.56"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	194750	116850	SAND	PROPOSED
10	KRBH_PRO_SAND_06	BORPANI RIVER	2.54	25°59'53.91"N 25°59'52.51"N 25°59'54.61"N 25°59'57.40"N	92°38'27.79"E 92°38'28.76"E 92°38'14.38"E 92°38'15.75"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	63500	38100	SAND	PROPOSED
11	KRBH_PRO_SAND_07	BORPANI RIVER	8.67	25°58'43.02"N 25°58'39.71"N 25°58'30.94"N 25°58'34.38"N	92°32'16.85"E 92°32'18.23"E 92°31'59.90"E 92°31'56.52"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	216750	130050	SAND	PROPOSED
12	KRBH_PRO_SAND_08	BORPANI RIVER	5.54	25°57'48.30"N 25°57'44.75"N 25°57'51.03"N 25°57'51.53"N	92°35'9.63"E 92°35'8.70"E 92°35'24.83"E 92°35'22.49"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	138500	83100	SAND	PROPOSED
13	KRBH_PRO_SAND_09	BORPANI RIVER	3.7	25°59'4.58"N 25°59'2.82"N 25°58'52.99"N	92°37'2.47"E 92°37'2.73"E 92°36'53.33"E	2.5	No PA/BR/WC available in	No forest available	No	92500	55500	SAND	PROPOSED

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

				25°58'53.71"N	92°36'51.09"E		500m	in 500m					
14	KRBH_PRO_SAND_10	BORPANI RIVER	2.48	26° 0'4.06"N 26° 0'3.40"N 25°59'57.59"N 25°59'59.57"N	92°39'23.38"E 92°39'25.15"E 92°39'12.59"E 92°39'12.35"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	62000	37200	SAND	PROPOSED
15	KRBH_PRO_SAND_11	BORPANI RIVER	2.29	25°53'20.93"N 25°53'20.03"N 25°53'11.86"N 25°53'13.03"N	92°27'10.86"E 92°27'12.60"E 92°26'56.43"E 92°26'55.60"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	57250	34350	SAND	PROPOSED
16	KRBH_PRO_SAND_12	BORPANI RIVER	9.86	25°58'35.01"N 25°58'33.11"N 25°58'30.17"N 25°58'31.59"N	92°36'15.15"E 92°36'16.52"E 92°35'44.38"E 92°35'41.08"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	246500	147900	SAND	PROPOSED
17	KRBH_PRO_SAND_13	BORPANI RIVER	5.28	25°58'0.94"N 25°58'3.39"N 25°57'51.67"N 25°57'54.69"N	92°32'56.42"E 92°32'59.86"E 92°33'11.13"E 92°33'11.63"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	132000	79200	SAND	PROPOSED
18	KRBH_PRO_SAND_14	BORPANI RIVER	4.16	26° 0'41.09"N 26° 0'41.90"N 26° 0'24.43"N 26° 0'23.69"N	92°39'23.08"E 92°39'25.44"E 92°39'26.02"E 92°39'28.07"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	104000	62400	SAND	PROPOSED
19	KRBH_PRO_SAND_15	BORPANI RIVER	8.1	25°57'54.56"N 25°57'51.75"N 25°57'50.50"N 25°57'54.07"N	92°33'13.38"E 92°33'12.95"E 92°33'38.28"E 92°33'38.02"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	202500	121500	SAND	PROPOSED
20	KRBH_PRO_SAND_16	BORPANI RIVER	3.95	25°58'40.74"N 25°58'38.97"N 25°58'37.41"N 25°58'39.81"N	92°36'22.54"E 92°36'24.28"E 92°36'43.18"E 92°36'42.32"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	98750	59250	SAND	PROPOSED
21	KRBH_PRO_SAND_17	BORPANI RIVER	15.7	25°59'42.42"N 25°59'41.70"N	92°38'7.86"E 92°38'9.50"E	2.5	No PA/BR/WC	No forest	No	392500	235500	SAND	PROPOSED

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

				25°59'4.25"N 25°59'2.62"N	92°37'4.31"E 92°37'4.05"E		available in 500m	available in 500m					
22	KRBH_PRO_ SAND_18	BORPANI RIVER	5.73	26° 1'3.68"N 26° 1'3.12"N 26° 0'41.83"N 26° 0'42.82"N	92°39'15.52"E 92°39'18.90"E 92°39'22.57"E 92°39'24.84"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	143250	85950	SAND	PROPOSED
23	KRBH_PRO_ SAND_19	BORPANI RIVER	10.4	25°58'25.21"N 25°58'27.15"N 25°58'1.90"N	92°32'37.00"E 92°32'41.00"E 92°32'55.81"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	260000	156000	SAND	PROPOSED
24	KRBH_PRO_ SAND_20	AMSORLI RIVER	3	26° 3'8.97"N 26° 3'8.44"N 26° 2'50.94"N 26° 2'50.08"N	92°16'45.59"E 92°16'45.81"E 92°16'12.69"E 92°16'12.55"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	75000	45000	SAND	PROPOSED
25	KRBH_PRO_ SAND_21	AMSORLI RIVER	9.86	26° 4'9.44"N 26° 4'8.37"N 26° 3'34.60"N 26° 3'36.35"N	92°16'53.62"E 92°16'55.40"E 92°16'0.01"E 92°15'60.00"E	2.5	No PA/BR/WC available in 500m	No forest available in 500m	No	246500	147900	SAND	PROPOSED
26	KRBH_PRO_ SAND_22	KOPIL RIVER	18.9	25°49'30.90"N 25°49'35.35"N 25°49'4.00"N 25°49'3.59"N	92°54'9.07"E 92°54'9.72"E 92°54'24.21"E 92°54'29.68"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	567000	340200	SAND	PROPOSED
27	KRBH_PRO_ SAND_23	KOPIL RIVER	15.9	25°50'16.91"N 25°50'16.77"N 25°49'40.66"N 25°49'44.27"N	92°53'17.77"E 92°53'21.87"E 92°53'39.89"E 92°53'42.74"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	477000	286200	SAND	PROPOSED
28	KRBH_PRO_ SAND_24	KOPIL RIVER	13.9	25°48'33.02"N 25°48'27.08"N 25°48'20.82"N 25°48'28.36"N	92°55'20.84"E 92°55'18.94"E 92°55'41.88"E 92°55'42.43"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	417000	250200	SAND	PROPOSED

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

29	KRBH_PRO_SAND_25	AMRENG RIVER	6.69	25°45'19.07"N 25°45'21.37"N 25°45'4.36"N 25°45'6.74"N	92°47'31.73"E 92°47'33.93"E 92°47'51.20"E 92°47'53.27"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	200700	120420	SAND	PROPOSED
30	KRBH_PRO_SAND_26	KOPIL RIVER	22.3	25°48'56.74"N 25°48'51.29"N 25°48'14.33"N 25°48'15.37"N 25°48'6.25"N 25°48'14.51"N	92°54'29.84"E 92°54'30.94"E 92°54'23.25"E 92°54'36.57"E 92°54'20.16"E 92°54'14.16"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	669000	401400	SAND	PROPOSED
31	KRBH_PRO_SAND_27	KOPIL RIVER	3.32	25°42'36.48"N 25°42'33.98"N 25°42'27.98"N 25°42'21.32"N	92°48'53.75"E 92°48'49.71"E 92°48'49.57"E 92°48'51.51"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	99600	59760	SAND	PROPOSED
32	KRBH_PRO_SAND_28	KOPIL RIVER	36.7	25°53'28.53"N 25°53'30.22"N 25°52'36.86"N 25°52'35.75"N	92°51'12.96"E 92°51'13.57"E 92°51'43.02"E 92°51'45.76"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	1101000	660600	SAND	PROPOSED
33	KRBH_PRO_SAND_29a	KOPIL RIVER	37.4	25°52'24.83"N 25°52'4.94"N 25°52'6.00"N 25°51'59.52"N	92°51'40.97"E 92°51'37.38"E 92°52'6.93"E 92°51'26.98"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	1122000	673200	SAND	PROPOSED
34	KRBH_PRO_SAND_29	KOPIL RIVER	17.9	25°52'26.07"N 25°52'26.68"N 25°51'42.44"N 25°51'41.66"N	92°53'10.58"E 92°53'12.31"E 92°53'10.88"E 92°53'14.30"E	3	No PA/BR/WC available in 500m	No forest available in 500m	No	537000	322200	SAND	PROPOSED
TOTAL			366.49							10418450	6251070		

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

➤ **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)	Geo-coordinates	
							Latitude	Longitude
1	KRBH_IS_ST_PRO_01	STONE	16.7	15	2505000	1503000	26° 4'13.61"N 26° 4'2.72"N 26° 3'58.85"N 26° 4'4.88"N 26° 4'16.09"N	92°34'37.35"E 92°34'36.49"E 92°34'44.14"E 92°34'50.96"E 92°34'42.27"E
2	KRBH_IS_ST_PRO_02	STONE	28.6	15	4290000	2574000	25°58'54.02"N 25°59'0.30"N 25°58'46.39"N 25°58'40.98"N	92°37'36.40"E 92°37'55.98"E 92°37'58.80"E 92°37'45.58"E
3	KRBH_IS_ST_PRO_03	STONE	19.5	15	2925000	1755000	25°58'49.49"N 25°58'47.06"N 25°58'37.35"N 25°58'40.39"N	92°36'59.00"E 92°37'13.60"E 92°37'10.37"E 92°36'50.96"E
4	KRBH_IS_ST_PRO_04	STONE	25.4	15	3810000	2286000	25°58'4.52"N 25°57'57.29"N 25°58'0.68"N 25°58'13.43"N 25°58'16.94"N	92°36'53.17"E 92°37'1.21"E 92°37'9.79"E 92°37'12.68"E 92°36'59.40"E
5	KRBH_IS_ST_PRO_05	STONE	69.5	15	10425000	6255000	25°52'31.26"N 25°52'22.14"N 25°52'3.34"N 25°52'25.38"N	92°33'49.95"E 92°33'49.40"E 92°34'18.49"E 92°34'25.94"E
6	KRBH_IS_ST_PRO_06	STONE	16	15	2400000	1440000	25°51'12.82"N 25°51'7.28"N 25°51'5.45"N 25°51'12.88"N	92°32'28.23"E 92°32'28.48"E 92°32'43.35"E 92°32'47.32"E

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

							25°51'16.65"N	92°32'45.04"E
7	KRBH_IS_ST_PRO_07	STONE	33.4	15	5010000	3006000	25°49'7.04"N 25°49'10.51"N 25°48'55.34"N 25°48'52.30"N	92°28'34.78"E 92°28'53.07"E 92°28'56.40"E 92°28'39.28"E
8	KRBH_IS_ST_PRO_08	STONE	23.8	15	3570000	2142000	25°44'7.74"N 25°44'1.48"N 25°44'7.92"N 25°44'17.40"N 25°44'18.75"N	92°26'4.00"E 92°26'13.16"E 92°26'24.53"E 92°26'21.89"E 92°26'12.41"E
9	KRBH_IS_ST_PRO_09	STONE	15.4	15	2310000	1386000	25°44'26.00"N 25°44'16.25"N 25°44'20.45"N 25°44'29.51"N	92°29'2.25"E 92°29'5.73"E 92°29'17.47"E 92°29'16.42"E
10	KRBH_IS_ST_PRO_10	STONE	33.7	15	5055000	3033000	25°45'14.48"N 25°45'1.11"N 25°45'5.83"N 25°45'21.50"N	92°30'33.97"E 92°30'40.41"E 92°30'55.39"E 92°30'56.79"E
11	KRBH_IS_ST_PRO_11	STONE	32.5	15	4875000	2925000	25°57'44.62"N 25°57'36.03"N 25°57'36.46"N 25°57'46.15"N 25°57'51.05"N	92°20'11.04"E 92°20'22.42"E 92°20'42.06"E 92°20'40.16"E 92°20'21.36"E
12	KRBH_IS_ST_PRO_12	STONE	42.2	15	6330000	3798000	25°48'31.15"N 25°48'45.71"N 25°48'52.75"N 25°48'45.06"N 25°48'28.42"N	92°12'46.67"E 92°12'49.59"E 92°13'10.47"E 92°13'19.05"E 92°12'59.47"E
13	KRBH_IS_ST_PRO_13	STONE	19.9	15	2985000	1791000	25°55'56.29"N 25°55'47.52"N 25°55'50.06"N	92°41'19.14"E 92°41'23.86"E 92°41'35.50"E

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

							25°56'4.98"N	25°56'4.98"N
14	KRBH_IS_ST_PRO_14	STONE	20.2	15	3030000	1818000	25°55'32.44"N 25°55'22.05"N 25°55'27.09"N 25°55'39.97"N	92°41'5.05"E 92°41'14.70"E 92°41'23.25"E 92°41'16.54"E
15	KRBH_IS_SGVL_PRO_15	SAND GRAVEL	102	15	15300000	9180000	25°54'54.67"N 25°54'23.93"N 25°54'45.08"N 25°55'1.48"N	92°42'51.96"E 92°43'3.70" E 92°43'34.54"E 92°43'20.39"E
16	KRBH_IS_QTZS_PRO_16	QUARTZITE STONE	185	15	27750000	16650000	25°52'1.44"N 25°51'34.27"N 25°51'44.89"N 25°52'19.65"N	92°40'10.06"E 92°40'24.92"E 92°41'12.30"E 92°40'59.84"E
17	KRBH_IS_ST_PRO_17	STONE	310	15	46500000	27900000	25°52'5.10"N 25°51'33.87"N 25°51'20.17"N 25°51'40.68"N	92°42'35.61"E 92°42'15.85"E 92°43'51.76"E 92°43'57.47"E
18	KRBH_IS_ST_PRO_18	STONE	28.6	15	4290000	2574000	25°51'44.17"N 25°51'30.59"N 25°51'29.47"N 25°51'40.71"N	92°44'22.76"E 92°44'20.72"E 92°44'42.73"E 92°44'41.99"E
19	KRBH_IS_ST_PRO_19	STONE	82.8	15	12420000	7452000	25°50'20.60"N 25°50'3.81"N 25°50'17.32"N 25°50'40.18"N	92°42'40.71"E 92°43'1.55"E 92°43'22.06"E 92°42'49.61"E
20	KRBH_IS_ST_PRO_20	STONE	109	15	16350000	9810000	25°40'46.56"N 25°40'40.02"N 25°41'13.54"N 25°41'12.00"N	92°36'56.88"E 92°37'30.17"E 92°37'31.03"E 92°36'58.11"E
21	KRBH_IS_ST_PRO_21	STONE	14.5	15	2175000	1305000	26° 4'45.33"N 26° 4'31.74"N	92°17'46.37"E 92°17'36.18"E

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

							26° 4'37.23"N 26° 4'46.52"N	92°17'30.41"E 92°17'34.55"E
22	KRBH_IS_ST_PRO_22	STONE	25.2	15	3780000	2268000	26° 4'25.24"N 26° 4'9.35"N 26° 4'6.82"N 26° 4'26.15"N	92°18'17.07"E 92°18'23.20"E 92°18'34.68"E 92°18'30.80"E
23	KRBH_IS_ST_PRO_23	STONE	27	15	4050000	2430000	26° 3'23.02"N 26° 3'11.94"N 26° 3'14.59"N 26° 3'25.28"N	92°17'34.17"E 92°17'34.45"E 92°17'59.79"E 92°17'52.55"E
24	KRBH_IS_ST_PRO_23a	STONE	235	15	35250000	21150000	26° 2'20.13"N 26° 1'49.84"N 26° 1'55.13"N 26° 2'32.13"N 26° 2'41.31"N	92°18'44.10"E 92°18'55.87"E 92°19'39.45"E 92°19'51.96"E 92°19'15.10"E
	TOTAL		1515.9		227385000	136431000		

DISTRICT SURVEY REPORT OF WEST KARBI ANGLONG, HAMREN

➤ **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**

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

➤ **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)**

DISTRICT SURVEY REPORT OF WEST KARBLANGLONG, HAMREN

➤ **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.**

ANNEXURE-VIII
**LAYOUT MAP OF EXISTING
AND
PROPOSED MINERAL ZONE**



EXISTING ZONE MAP OF SAND MAHAL PART - 01



RONGAGORAH (BAITHALANGSO_4.80_DAN ABI SAND 

200 m

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



EXISTING ZONE MAP OF SAND MAHAL PART - 02



AMADUBI GHAT, 2.00_THARVEV ABI



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 03



HONGKRAM_1.5HA



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 04



DIKISIR-LONGRE_5.00HA_BAITHALANGSO



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

200 m



EXISTING ZONE MAP OF SAND MAHAL PART - 05



PHUKUP ABI SAND_3.00HA_BAITHALANGSO



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

EXISTING ZONE MAP OF SAND MAHAL PART - 06



PHUKUP ABI SAND_3.00HA_JOYRAM TISSO

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

200 m



EXISTING ZONE MAP OF SAND MAHAL PART - 07



PHUNG ABI SAND_3.00HA_THONG TERON



LEGEND

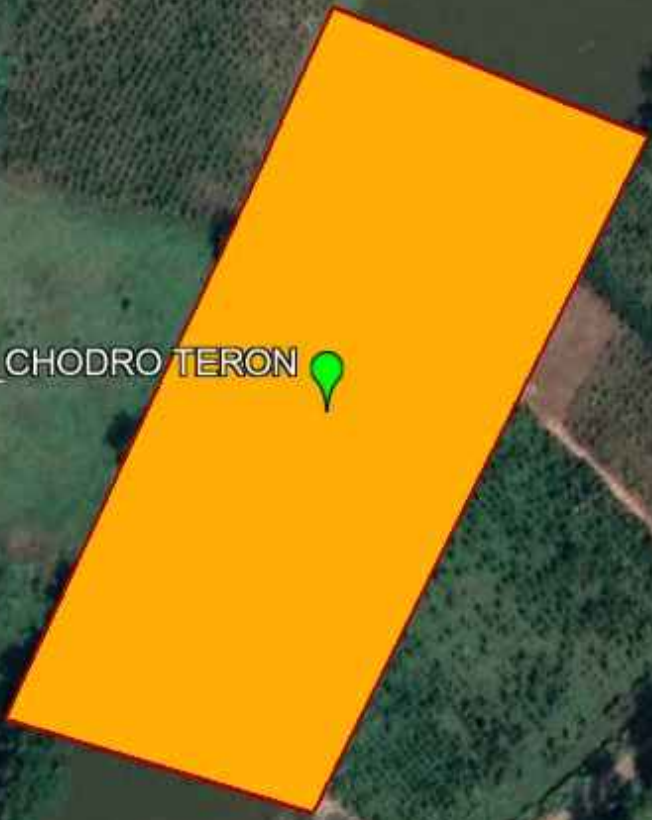
EXISTING ZONE	
DISTRICT BOUNDARY	

200 m



EXISTING ZONE MAP OF SAND MAHAL PART - 08



SOBAILANGSO NO.1_2HA_CHODRO TERON



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

EXISTING ZONE MAP OF SAND MAHAL PART - 09



HONGKRAM _1.50 HA-ARKOI TISSO

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 10



NURSOR ABI_2.00_JOYRAM TISSO



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 11



MAISAM VILLAGE_BAITHALANGSO



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



100 m

EXISTING ZONE MAP OF SAND MAHAL PART - 12



LENGRI SAND_4.48HA_LORCHOTI RONGPI

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

200 m



EXISTING ZONE MAP OF SAND MAHAL PART - 13



HONGKRAM SAND 4.20HA ROWELSON TERANG



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

200 m



EXISTING ZONE MAP OF SAND MAHAL PART - 14



HONGKRAM_0.95HA_MAANSAAN HANSE

100 m

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



EXISTING ZONE MAP OF SAND MAHAL PART - 15



RONGAGORAH_4.80HA_SANDI ENGTIPI



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

EXISTING ZONE MAP OF SAND MAHAL PART - 16



HONGKRAM_11.00HA_ARWIN RONGHANG

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



400 m

EXISTING ZONE MAP OF SAND MAHAL PART - 17



INGHIN ABI SAND_2.00HA

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 18



PHUNG ABI SAND



LEGEND

- EXISTING ZONE 
- DISTRICT BOUNDARY 

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 19



SOBAILANGSO_SAND



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 20



KHUROPINDHA SAND_1.33HA



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 21



ADORSO BAZAR_4.25HA_SANJAY DERA




LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

300 m



EXISTING ZONE MAP OF SAND MAHAL PART - 22



LENGRI SAND_4.80HA_HEADSING BEY 

200 m

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



EXISTING ZONE MAP OF SAND MAHAL PART - 23



LENGRI_CHESON BEY

300 m

LEGEND



EXISTING ZONE	
DISTRICT BOUNDARY	

EXISTING ZONE MAP OF SAND MAHAL PART - 24



KOLONGA_AMLONG RIVER_PEA GRAVEL

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



400 m

EXISTING ZONE MAP OF SAND MAHAL PART - 25



TUMPRENG_KOPII_RIVER_SAND

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

200 m



EXISTING ZONE MAP OF SAND MAHAL PART - 26



DERAMUKH_2_KOPILI_RIVER



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



300 m

EXISTING ZONE MAP OF SAND MAHAL PART - 27



CHEKSO ANGLONG 

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

200 m



EXISTING ZONE MAP OF SAND MAHAL PART - 28



BANIA GHAT_01



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

400 m



EXISTING ZONE MAP OF SAND MAHAL PART - 29



UPPER KOPILI_02



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

200 m

EXISTING ZONE MAP OF SAND MAHAL PART - 30





DAYANGMUKH-PANIMUR_03



100 m

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



EXISTING ZONE MAP OF SAND MAHAL PART - 31



KALIGHAT_04



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



100 m

EXISTING ZONE MAP OF SAND MAHAL PART - 32



SANSIKA

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m

EXISTING ZONE MAP OF SAND MAHAL PART - 33





RAJADUBI GHAT 2_06



400 m

LEGEND



EXISTING ZONE	
DISTRICT BOUNDARY	

EXISTING ZONE MAP OF SAND MAHAL PART - 34



Rajadubi-Kalighat_07

LEGEND

- EXISTING ZONE 
- DISTRICT BOUNDARY 

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 35



PRISEK_08

100 m

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



EXISTING ZONE MAP OF SAND MAHAL PART - 36



Upper Kopili ghat_09_Sand



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE MAP OF SAND MAHAL PART - 37



BOGORIGHAT_10 



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

500 m



EXISTING ZONE MAP OF SAND MAHAL PART - 38



SINERY GHAT_11



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

EXISTING ZONE MAP OF SAND MAHAL PART - 39



LOWER KOPILI_12

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

EXISTING ZONE MAP OF SAND MAHAL PART - 40



Rajadhubi Ghat1_Sand_13

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



60 m

EXISTING ZONE MAP OF SAND MAHAL PART - 41

AMSORLI_RIVER_SAND_02_1.5HA_JOYSING KHOLAR

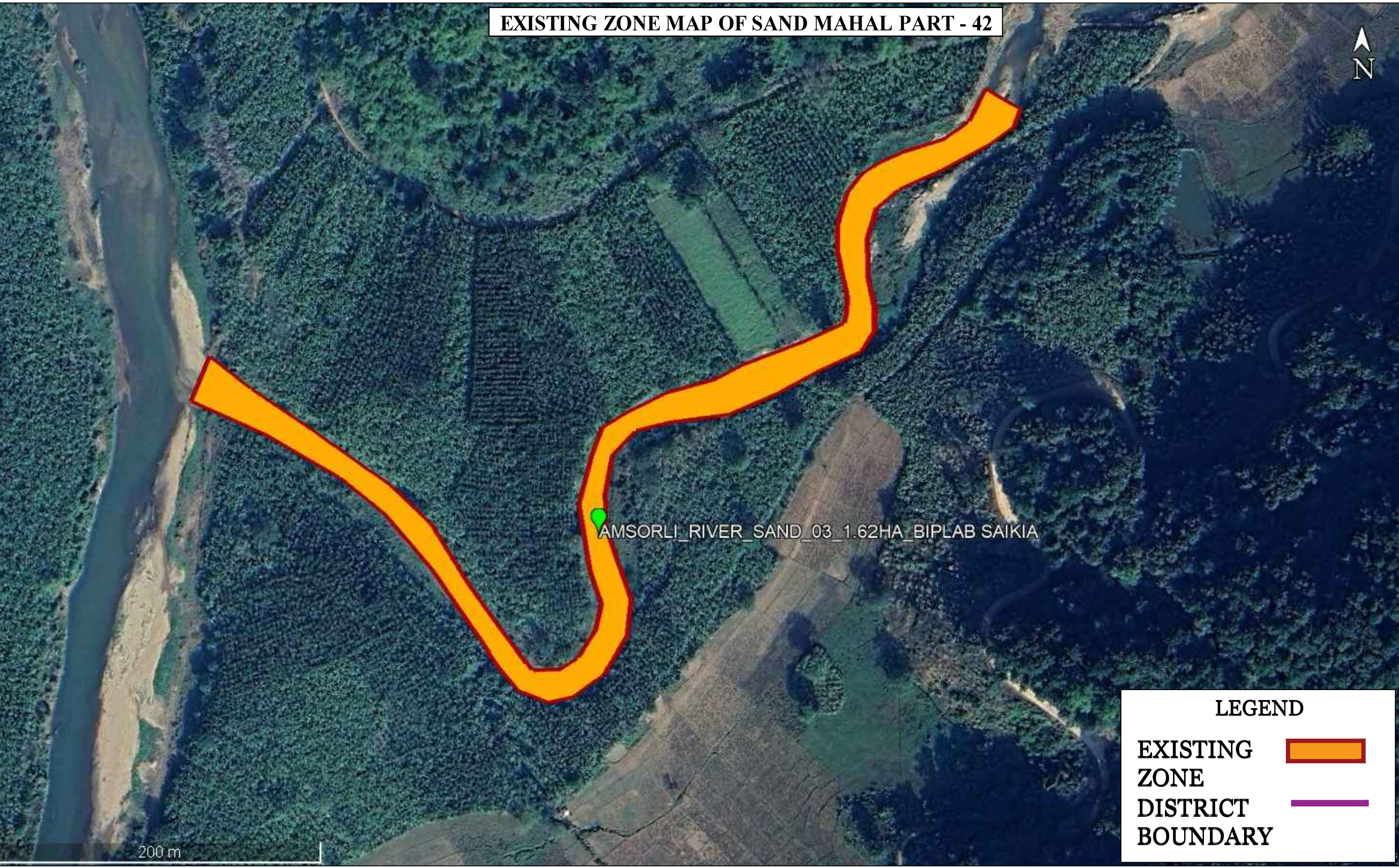


LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



100 m

EXISTING ZONE MAP OF SAND MAHAL PART - 42



AMSORLI_RIVER_SAND_03_1.62HA_BIPLAB_SAIKIA

LEGEND

- EXISTING ZONE 
- DISTRICT BOUNDARY 

200 m



EXISTING ZONE MAP OF SAND MAHAL PART - 43



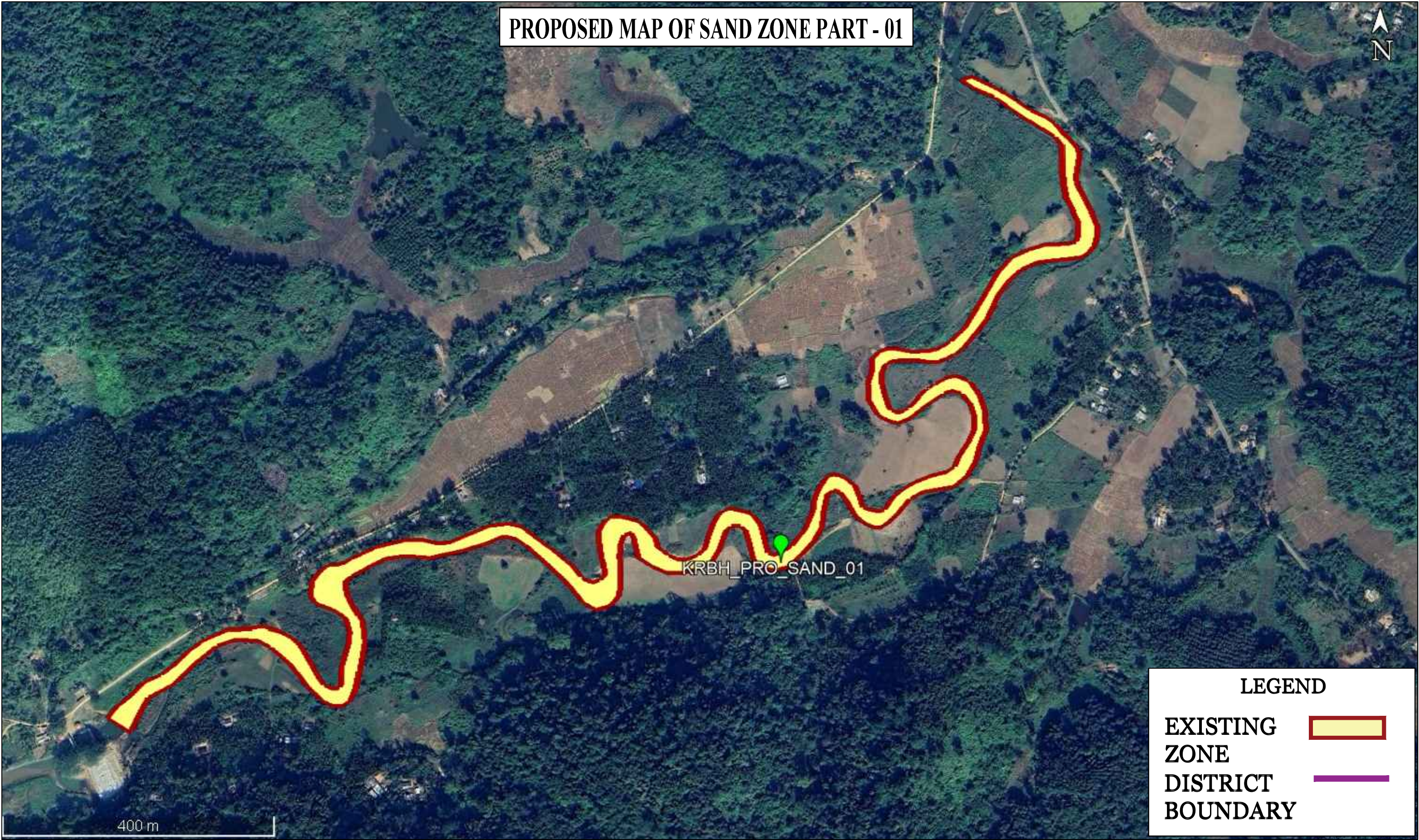
KILLING RIVER_SAND_04_AMGURI_5.24HA_BIDYASING RONGPI

600 m



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

PROPOSED MAP OF SAND ZONE PART - 01



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

400 m

KRBH_PRO_SAND_01



PROPOSED MAP OF SAND ZONE PART - 02



KRBH_PRO_SAND_02b

KRBH_PRO_SAND_02a

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



600 m

PROPOSED MAP OF SAND ZONE PART - 03



KRBH_PRO_SAND_02

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



500 m

PROPOSED MAP OF SAND ZONE PART - 04



KRBH_PRO_SAND_02c

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

400 m



PROPOSED MAP OF SAND ZONE PART - 05



KRBH_PRO_SAND_02d



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



300 m

PROPOSED MAP OF SAND ZONE PART - 06



KRBH_PRO_SAND_03

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



500 m

PROPOSED MAP OF SAND ZONE PART - 07



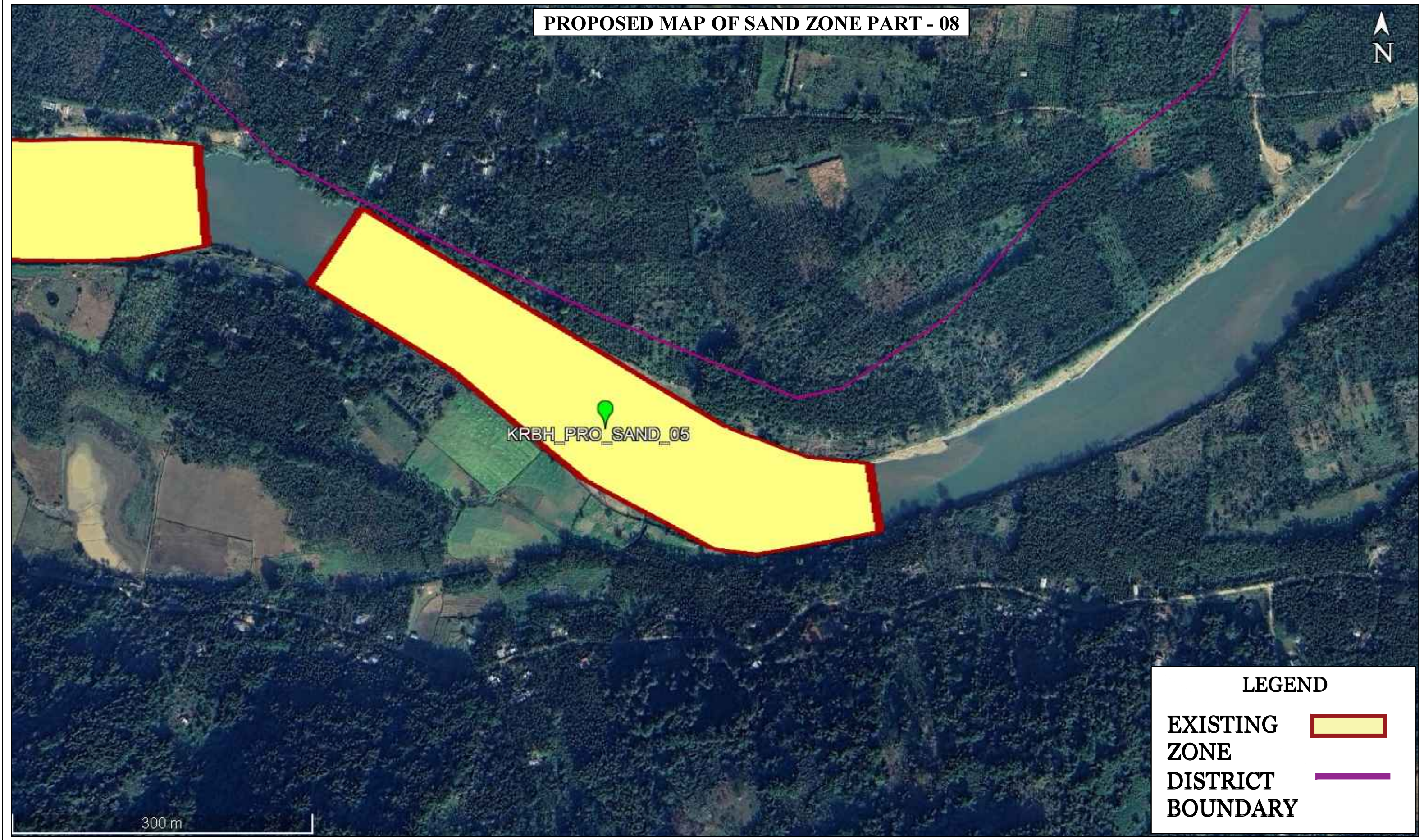
KRBH_PRO_SAND_04

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



300 m

PROPOSED MAP OF SAND ZONE PART - 08



KRBH_PRO_SAND_05

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

300 m

PROPOSED MAP OF SAND ZONE PART - 09



KRBH_PRO SAND_06



LEGEND	
EXISTING ZONE	
DISTRICT BOUNDARY	



100 m

PROPOSED MAP OF SAND ZONE PART - 10



KRBH_PRO_SAND_07 

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

300 m 

PROPOSED MAP OF SAND ZONE PART - 11



KRBH_PRO_SAND_08

LEGEND	
EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

PROPOSED MAP OF SAND ZONE PART - 12



KRBH_PRO_SAND_09

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

300 m

PROPOSED MAP OF SAND ZONE PART - 13



KRBH_PRO_SAND_10

LEGEND	
EXISTING ZONE	
DISTRICT BOUNDARY	

200 m



PROPOSED MAP OF SAND ZONE PART - 14



KRBH_PRO_SAND_11



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

PROPOSED MAP OF SAND ZONE PART - 15



KRBH_PRO_SAND_12

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

300 m



PROPOSED MAP OF SAND ZONE PART - 16



KRBH_PRO_SAND_18

KRBH_PRO_SAND_14

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

500 m

PROPOSED MAP OF SAND ZONE PART - 17



KRBH_PRO_SAND_16



LEGEND	
EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

PROPOSED MAP OF SAND ZONE PART - 18



KRBH_PRO_SAND_17

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

600 m

PROPOSED MAP OF SAND ZONE PART - 19





KRBH_PRO_SAND_19

KRBH_PRO_SAND_13

KRBH_PRO_SAND_15

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



600 m

PROPOSED MAP OF SAND ZONE PART - 20



KRBH_PRO_SAND_20

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

300 m



PROPOSED MAP OF SAND ZONE PART - 21



KRBH_PRO_SAND_21

600 m

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



PROPOSED MAP OF SAND ZONE PART - 22



KRBH_PRO_SAND_22



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

600 m

PROPOSED MAP OF SAND ZONE PART - 23



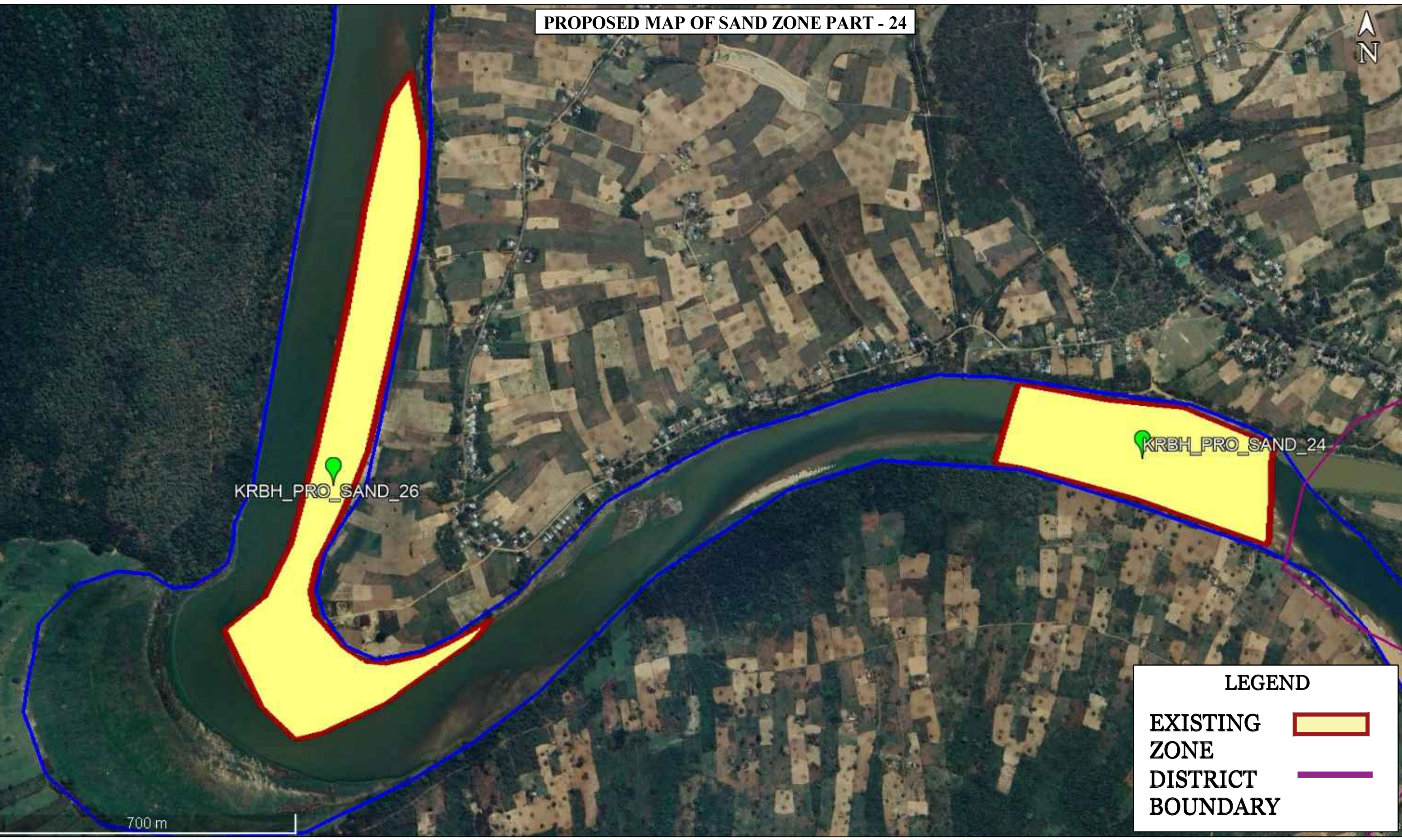
KRBH_PRO_SAND_23

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

600 m



PROPOSED MAP OF SAND ZONE PART - 24



KRBH_PRO_SAND_26

KRBH_PRO_SAND_24

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

700 m



PROPOSED MAP OF SAND ZONE PART - 25



KRBH_PRO_SAND_25

300 m

LEGEND



EXISTING ZONE	
DISTRICT BOUNDARY	

PROPOSED MAP OF SAND ZONE PART - 26



KRBH_PRO_SAND_27

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

300 m

PROPOSED MAP OF SAND ZONE PART - 27



KRBH_PRO_SAND_28


LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



1 km

PROPOSED MAP OF SAND ZONE PART - 28



KRBH_PRO_SAND_29 

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



600 m

PROPOSED MAP OF SAND ZONE PART - 29



KRBH_PRO_SAND_29a

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

500 m



EXISTING ZONE OF IN SITU MINERALS PART - 01



LANGHERANG, HONGKRAM



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



100 m

EXISTING ZONE OF IN SITU MINERALS PART - 02



UMCHERA

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 03



SORMINTHO, KHANDULI



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 04



SOBAILANGSO USF



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 05



LONGPAI USF



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 06



MOPULANGSO



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

70 m



EXISTING ZONE OF IN SITU MINERALS PART - 07



UMDAP-1



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 08



SOBAILANGSO



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

90 m



EXISTING ZONE OF IN SITU MINERALS PART - 09



SOBAILANGSO, RONG ALI



LEGEND



EXISTING ZONE	
DISTRICT BOUNDARY	

100 m

EXISTING ZONE OF IN SITU MINERALS PART - 10



MALA ALUM, HAMREN

LEGEND	
EXISTING ZONE	
DISTRICT BOUNDARY	



100 m

EXISTING ZONE OF IN SITU MINERALS PART - 11



UMBASO

LEGEND

- EXISTING ZONE 
- DISTRICT BOUNDARY 

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 12



THARVE ANGLONG, TUMPROP



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 13



UMAT AREA



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 14



KUNCHI MCA AREA



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



100 m

EXISTING ZONE OF IN SITU MINERALS PART - 15



TARADUBI

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

600 m



EXISTING ZONE OF IN SITU MINERALS PART - 16



PHONGHONTHOR_PROPOSED_STONE



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

600 m



EXISTING ZONE OF IN SITU MINERALS PART - 17



QUARTZITE STONE AREA AT RONG-ALUM



LEGEND



EXISTING ZONE	
DISTRICT BOUNDARY	

200 m

EXISTING ZONE OF IN SITU MINERALS PART - 18



SERLONGCHOR_STONE_PERMIT CONTRACT



LEGEND	
EXISTING ZONE	
DISTRICT BOUNDARY	

200 m

EXISTING ZONE OF IN SITU MINERALS PART - 19



TELEHOR_STONE_PERMIT_AREA_NOT AVAILABLE MINERAL

LEGEND	
EXISTING ZONE	
DISTRICT BOUNDARY	

100 m

EXISTING ZONE OF IN SITU MINERALS PART - 20





KUTHEPI_SAND GRAVEL 01



300 m

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

EXISTING ZONE OF IN SITU MINERALS PART - 21




KUTHEPI_SAND GRAVEL 01



100 m

LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



EXISTING ZONE OF IN SITU MINERALS PART - 22



ANGLONG_STONE_01



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

200 m

EXISTING ZONE OF IN SITU MINERALS PART - 23





BAULAGOG_O6_STONE_1.11HA_JITU AMSI



100 m

LEGEND



- EXISTING ZONE** 
- DISTRICT BOUNDARY** 

EXISTING ZONE OF IN SITU MINERALS PART - 24



PUMAKUCHI GSB QUARRY_07_1.5HA_M/S SMK PDCC (JV)



LEGEND	
EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 25



AMSORLI_STONE_01_6HA_CI-EM HANSSE



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	

100 m



EXISTING ZONE OF IN SITU MINERALS PART - 26



AMSORLI_STONE_QUARRY_05_2.26HA_L&T CONSTRUCTIONS



LEGEND

EXISTING ZONE	
DISTRICT BOUNDARY	



200 m

PROPOSED ZONE OF IN SITU MINERALS PART - 01



KRBH_IS_ST_PRO_01

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	

400 m



PROPOSED ZONE OF IN SITU MINERALS PART - 02



KRBH_IS_ST_PRO_02

400 m

LEGEND



PROPOSED ZONE	
DISTRICT BOUNDARY	

PROPOSED ZONE OF IN SITU MINERALS PART - 03



KRBH_IS_ST_PRO_03



400 m

LEGEND	
PROPOSED ZONE	
DISTRICT BOUNDARY	

PROPOSED ZONE OF IN SITU MINERALS PART - 04



KRBH_IS_ST_PRO_04

LEGEND	
PROPOSED ZONE	
DISTRICT BOUNDARY	

400 m



PROPOSED ZONE OF IN SITU MINERALS PART - 05



KRBH_IS_ST_PRO_05

600 m

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	



PROPOSED ZONE OF IN SITU MINERALS PART - 06



KRBH_IS_ST_PRO_06

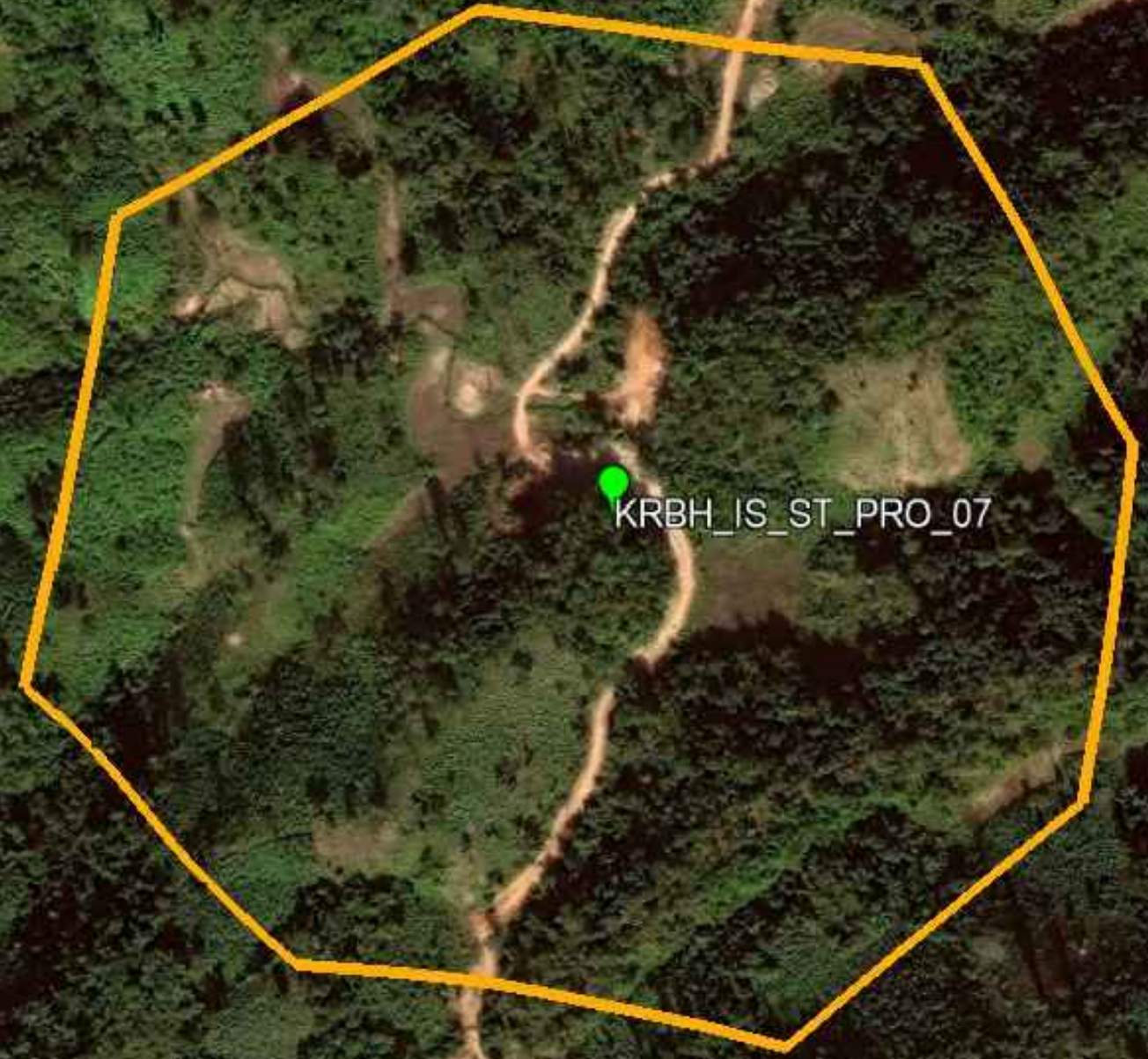


LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	



300 m

PROPOSED ZONE OF IN SITU MINERALS PART - 07



KRBH_IS_ST_PRO_07

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	

300 m



PROPOSED ZONE OF IN SITU MINERALS PART - 08



KRBH_IS_ST_PRO_08



LEGEND



PROPOSED ZONE	
DISTRICT BOUNDARY	

300 m

PROPOSED ZONE OF IN SITU MINERALS PART - 09

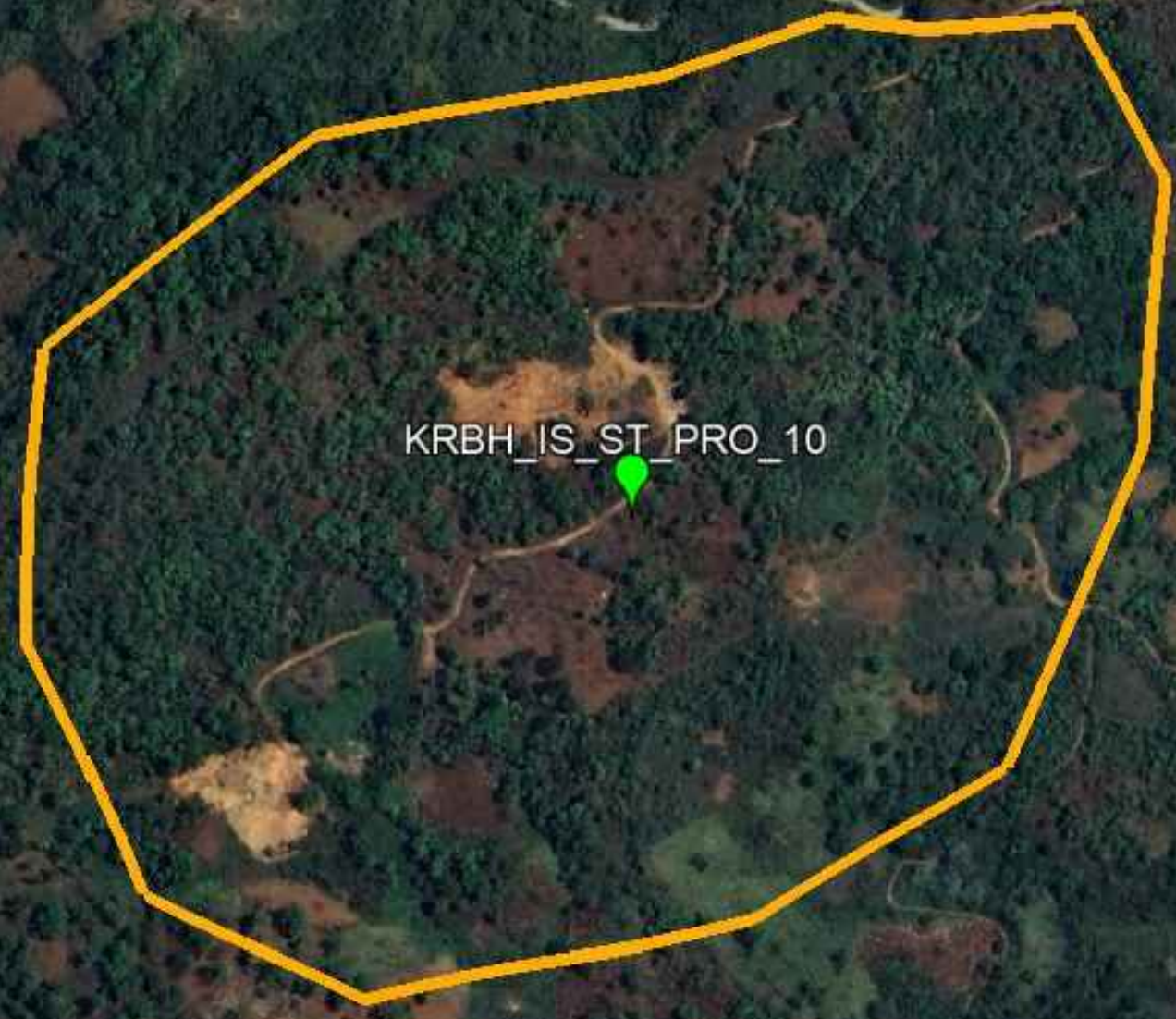


KRBH_IS_ST_PRO_09



LEGEND	
PROPOSED ZONE	
DISTRICT BOUNDARY	

300 m

PROPOSED ZONE OF IN SITU MINERALS PART - 10



KRBH_IS_ST_PRO_10

LEGEND	
PROPOSED ZONE	
DISTRICT BOUNDARY	



400 m

PROPOSED ZONE OF IN SITU MINERALS PART - 11



KRBH_IS_ST_PRO_11

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	



500 m

PROPOSED ZONE OF IN SITU MINERALS PART - 12



KRBH_IS_ST_PRO_12

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	

600 m

PROPOSED ZONE OF IN SITU MINERALS PART - 13



KRBH_IS_ST_PRO_13





KRBH_IS_ST_PRO_14



600 m

LEGEND



PROPOSED ZONE	
DISTRICT BOUNDARY	

PROPOSED ZONE OF IN SITU MINERALS PART - 14



KRBH_IS_SGVL_PRO_15

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	



700 m

PROPOSED ZONE OF IN SITU MINERALS PART - 15



KRBH_IS_QTZS_PRO_16

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	

1 km



PROPOSED ZONE OF IN SITU MINERALS PART - 16



KRBH_IS_ST_PRO_17

KRBH_IS_ST_PRO_18

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	

1 km



PROPOSED ZONE OF IN SITU MINERALS PART - 17



KRBH_IS_ST_PRO_19

800 m

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	



PROPOSED ZONE OF IN SITU MINERALS PART - 18



KRBH_IS_ST_PRO_20

800 m

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	



PROPOSED ZONE OF IN SITU MINERALS PART - 19



KRBH_IS_ST_PRO_21



LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	

300 m



PROPOSED ZONE OF IN SITU MINERALS PART - 20



KRBH_IS_ST_PRO_22

400 m

LEGEND



PROPOSED ZONE	
DISTRICT BOUNDARY	

PROPOSED ZONE OF IN SITU MINERALS PART - 21



KRBH_IS_ST_PRO_23



LEGEND	
PROPOSED ZONE	
DISTRICT BOUNDARY	

400 m



PROPOSED ZONE OF IN SITU MINERALS PART - 22



KRBH_IS_ST_PRO_23a

1 km

LEGEND

PROPOSED ZONE	
DISTRICT BOUNDARY	

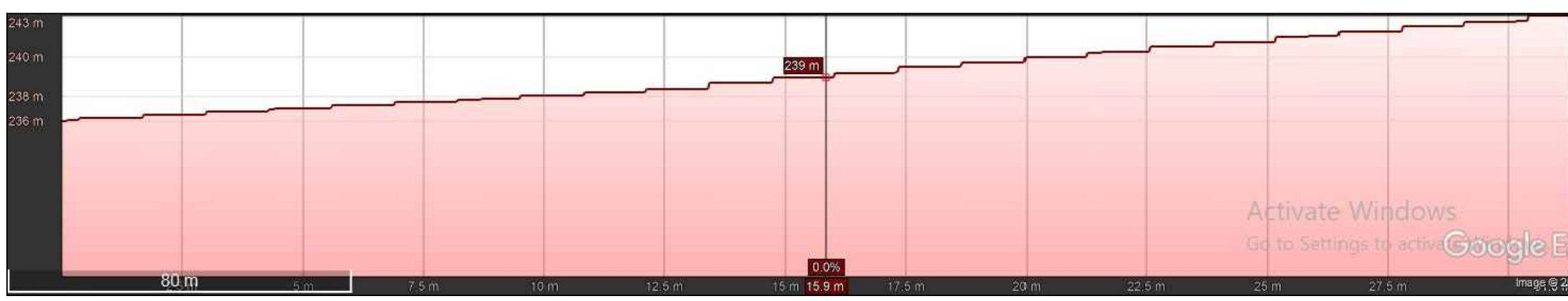
ANNEXURE-IX

CROSS-SECTION AND L SECTION OF FINAL PROPOSED ZONES

CROSS SECTION OF AMLONG RIVER UP STREAM



SL.NO	LATITUDE	LONGITUDE
A	25°52'53.42"N	92°41'28.99"E
A'	25°52'53.13"N	92°41'29.85"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF AMLONG RIVER MIDDLE STREAM



SL.NO	LATITUDE	LONGITUDE
A	25°53'54.12"N	92°45'12.07"E
A'	25°53'53.68"N	92°45'12.73"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF AMLONG RIVER DOWN STREAM



SL.NO	LATITUDE	LONGITUDE
A	25°57'22.68"N	92°46'1.23"E
A'	25°57'22.12"N	92°46'1.62"E



LEGEND

- EXISTING ZONE**
- DISTRICT BOUNDARY**
- SECTION LINE**

CROSS SECTION OF AMRENG RIVER UP STREAM



SL.NO	LATITUDE	LONGITUDE
A	25°45'9.47"N	92°44'32.83"E
A'	25°45'8.29"N	92°44'35.16"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF AMRENG RIVER MIDDLE STREAM



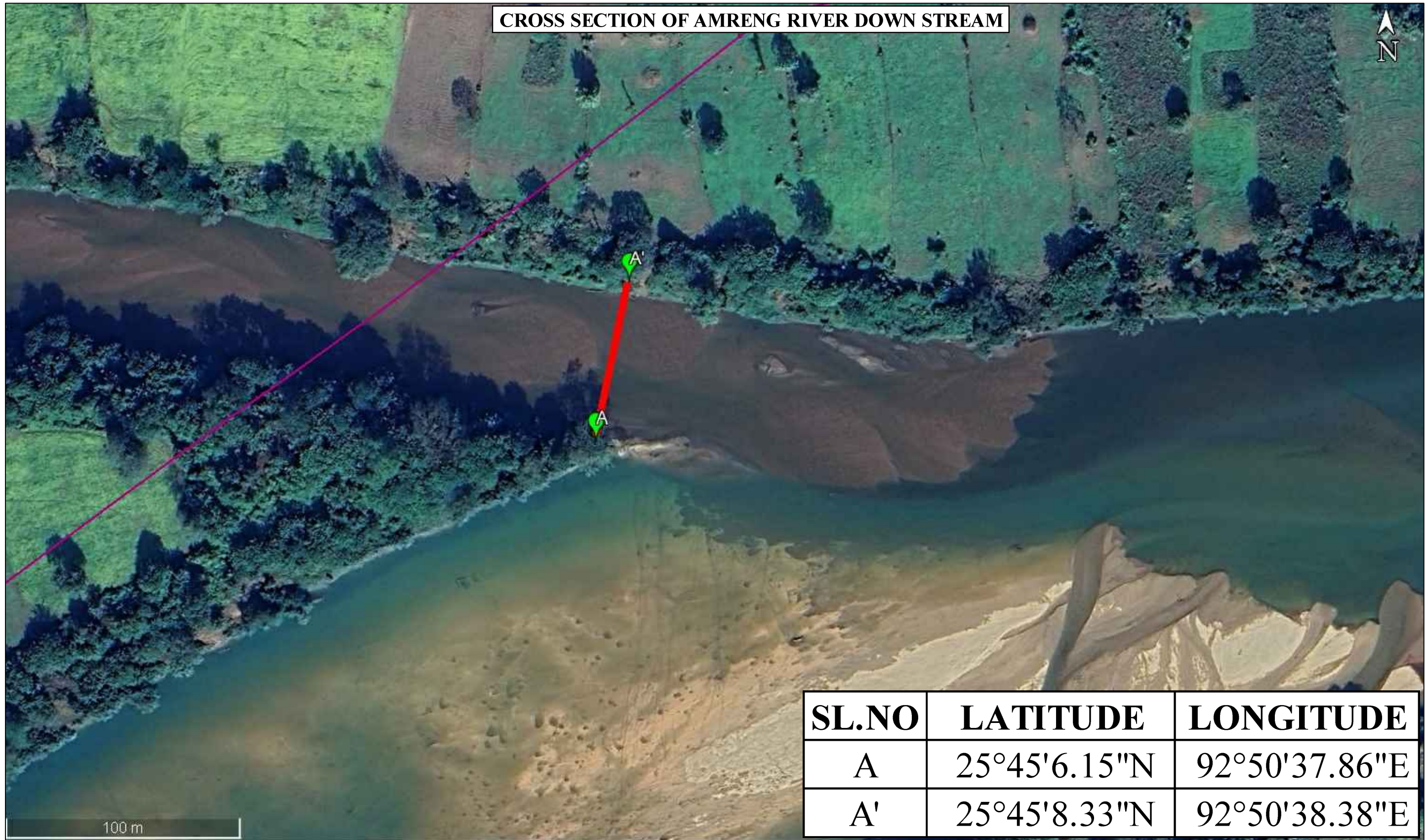
SL.NO	LATITUDE	LONGITUDE
A	25°45'24.89"N	92°47'26.53"E
A'	25°45'27.11"N	92°47'28.92"E



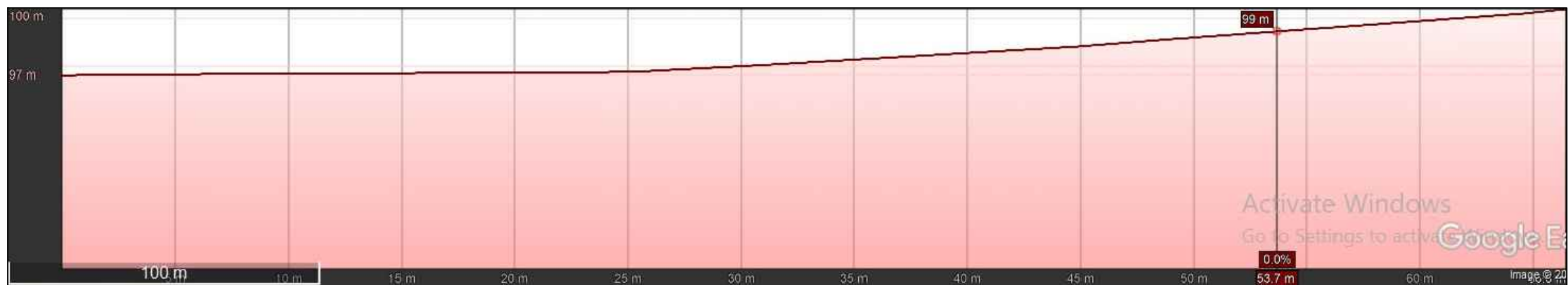
LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF AMRENG RIVER DOWN STREAM



SL.NO	LATITUDE	LONGITUDE
A	25°45'6.15"N	92°50'37.86"E
A'	25°45'8.33"N	92°50'38.38"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF AMSORLI RIVER UP STREAM



SL.NO	LATITUDE	LONGITUDE
A	26° 5'6.29"N	92°21'32.69"E
A'	26° 5'5.70"N	92°21'33.48"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF AMSORLI RIVER MIDDLE STREAM



SL.NO	LATITUDE	LONGITUDE
A	26° 3'41.05"N	92°19'25.53"E
A'	26° 3'40.49"N	92°19'26.09"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF AMSORLI RIVER DOWN STREAM



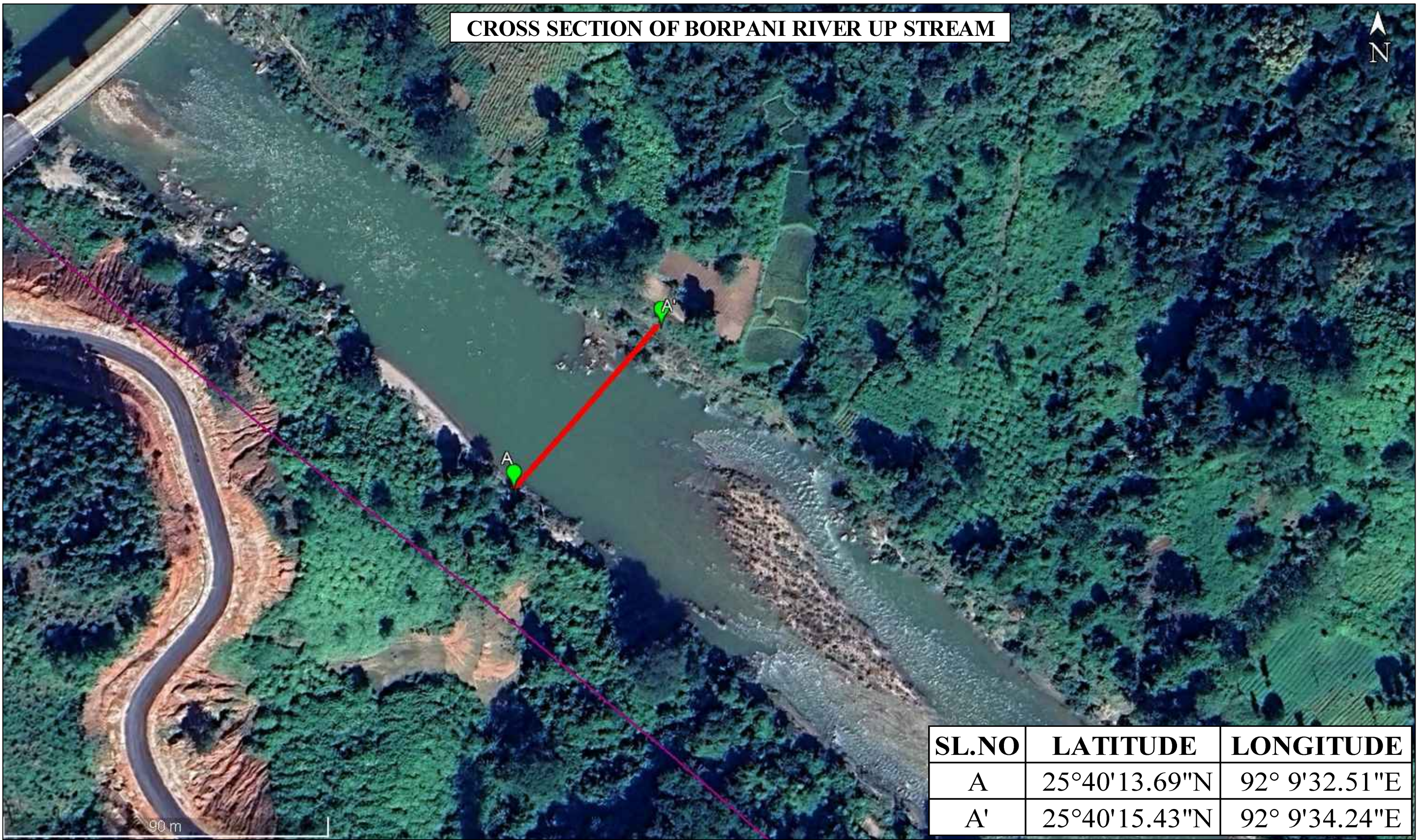
SL.NO	LATITUDE	LONGITUDE
A	26° 2'49.89"N	92°16'12.98"E
A'	26° 2'50.66"N	92°16'13.36"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF BORPANI RIVER UP STREAM



SL.NO	LATITUDE	LONGITUDE
A	25°40'13.69"N	92° 9'32.51"E
A'	25°40'15.43"N	92° 9'34.24"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF BORPANI RIVER MIDDLE STREAM



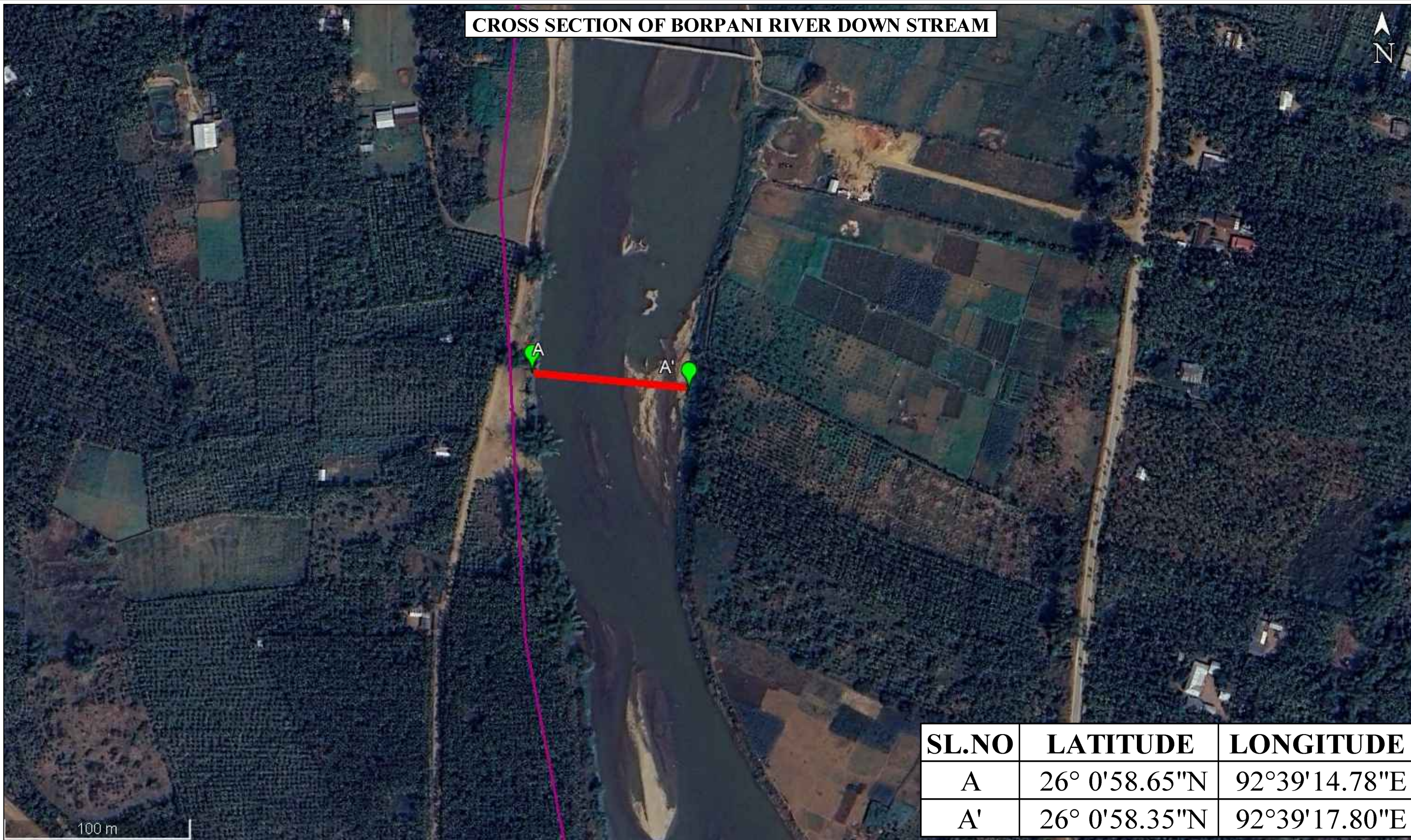
SL.NO	LATITUDE	LONGITUDE
A	25°53'8.88"N	92°26'38.06"E
A'	25°53'6.50"N	92°26'39.29"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF BORPANI RIVER DOWN STREAM



SL.NO	LATITUDE	LONGITUDE
A	26° 0'58.65"N	92°39'14.78"E
A'	26° 0'58.35"N	92°39'17.80"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF KILLING RIVER UP STREAM



SL.NO	LATITUDE	LONGITUDE
A	26° 0'29.55"N	92°13'42.66"E
A'	26° 0'32.00"N	92°13'43.49"E



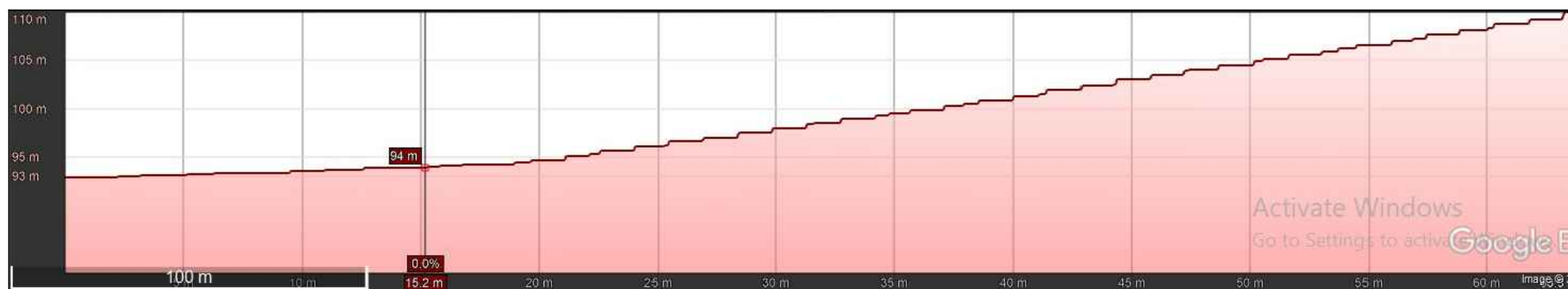
LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF KILLING RIVER MIDDLE STREAM



SL.NO	LATITUDE	LONGITUDE
A	26° 2'24.27"N	92°15'39.58"E
A'	26° 2'25.04"N	92°15'41.16"E



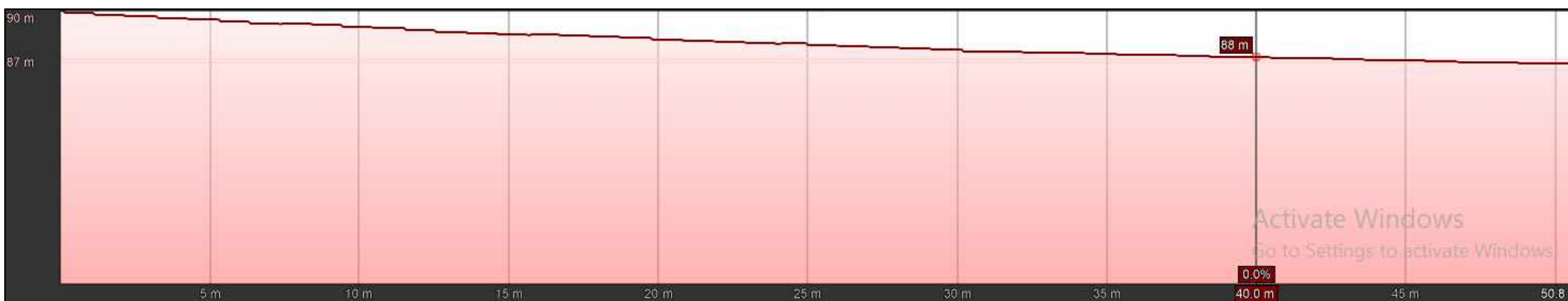
LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF KILLING RIVER DOWN STREAM



SL.NO	LATITUDE	LONGITUDE
A	26° 4'23.31"N	92°17'3.64"E
A'	26° 4'23.08"N	92°17'5.43"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF KOPIL RIVER UP STREAM



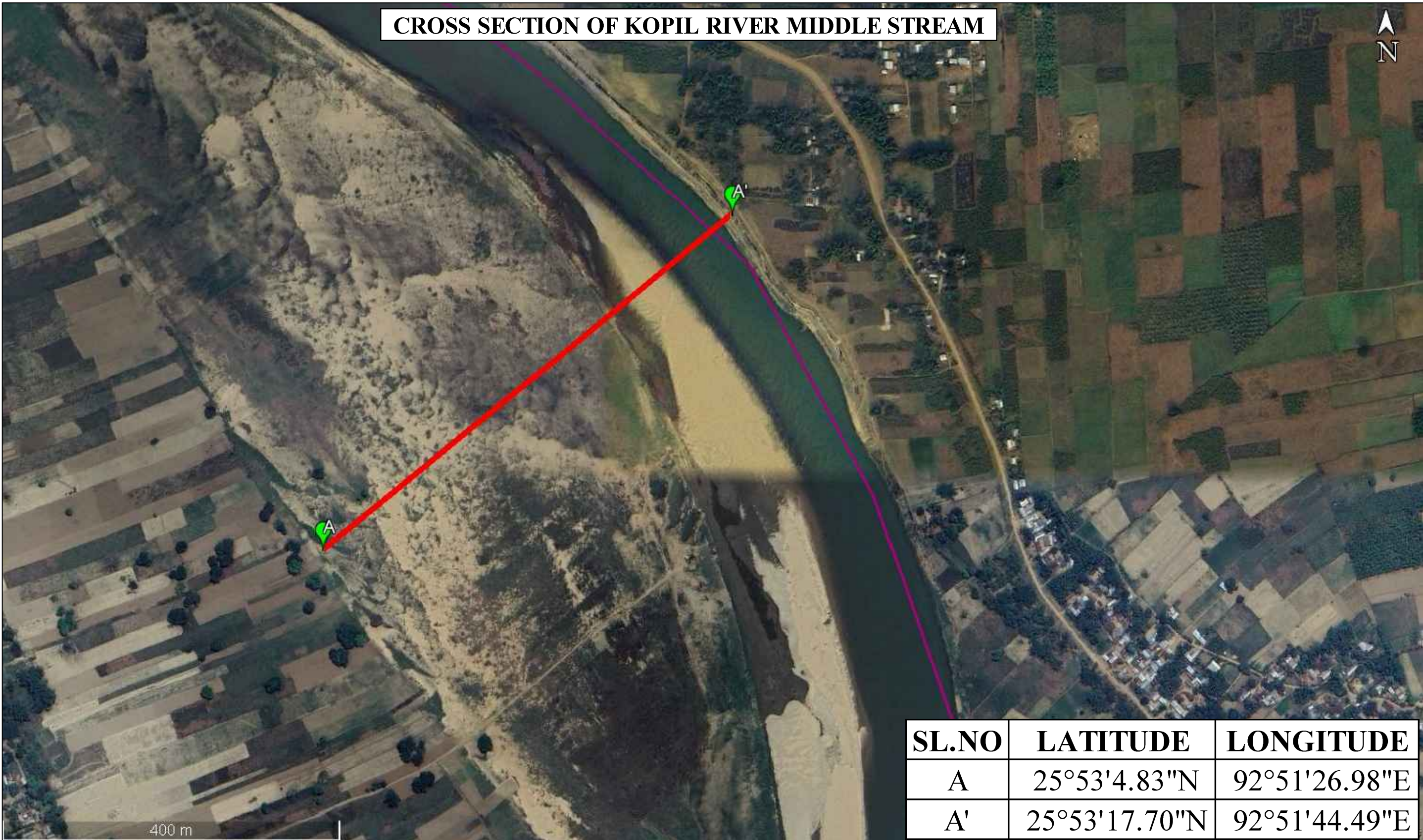
SL.NO	LATITUDE	LONGITUDE
A	25°41'24.32"N	92°47'54.18"E
A'	25°41'20.74"N	92°47'57.50"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF KOPIL RIVER MIDDLE STREAM



400 m

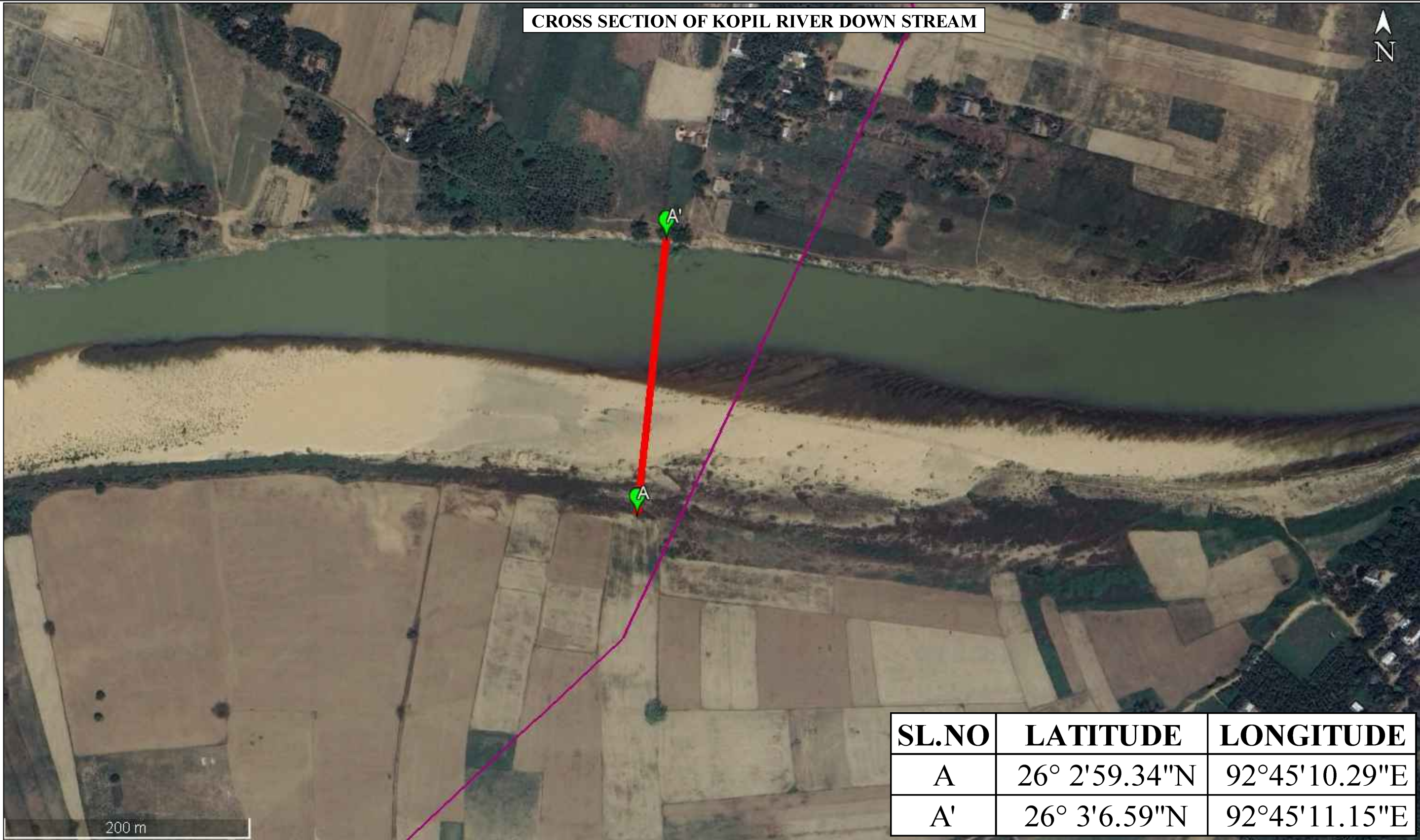
SL.NO	LATITUDE	LONGITUDE
A	25°53'4.83"N	92°51'26.98"E
A'	25°53'17.70"N	92°51'44.49"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

CROSS SECTION OF KOPIL RIVER DOWN STREAM



SL.NO	LATITUDE	LONGITUDE
A	26° 2'59.34"N	92°45'10.29"E
A'	26° 3'6.59"N	92°45'11.15"E



LEGEND

- EXISTING ZONE
- DISTRICT BOUNDARY
- SECTION LINE

L SECTION OF AMLONG RIVER, SOMUPONG TO RAIKATA KACHRI GAON (UP TO 24.8km SOUTH TO EAST), (A - A') PART - 01



L SECTION OF AMRENG RIVER, AMTUKAPAM TO AMRENG (UP TO 12.4km SOUTH TO EAST), (A - A') PART - 01



L SECTION OF AMSORLI RIVER, AMDUBIGHAI TO BAULAGOG (UP TO 12.1km WEST TO NORTH), (A - A') PART - 01



Activate Windows
Go to Settings to activate Windows.

L SECTION OF BORPANI RIVER, THADRANG TO UMSARANG (UP TO 12.6km NORTH TO SOUTH), (A - A') PART - 01



L SECTION OF BORPANI RIVER, UMSARANG TO MUPIRCHUNG (UP TO 25.2km NORTH TO SOUTH), (B - B') PART - 02



L SECTION OF BORPANI RIVER, MUPIRCHUNG TO THANGSING SENAR (UP TO 25.2km NORTH TO SOUTH), (C - C') PART - 03



L SECTION OF BORPANI RIVER, THANGSING SENAR TO AMDUBI (UP TO 25.1km NORTH TO SOUTH), (D - D') PART - 04



L SECTION OF KILLING RIVER, AMKHANG TO AMGURI (UP TO 12.4km SOUTH TO EAST), (A - A') PART - 01



L SECTION OF KOPIL RIVER, RONGTAR - ME TO JIRIBASA (UP TO 25.1km NORTH TO SOUTH), (A - A') PART - 01



L SECTION OF KOPII RIVER, JIRIBASA TO KURKUT (UP TO 25km NORTH TO SOUTH), (B - B') PART - 02



L SECTION OF KOPIL RIVER, KURKUT TO SIBPUR (UP TO 31.6km NORTH TO SOUTH), (C - C') PART - 03



ANNEXURE-X

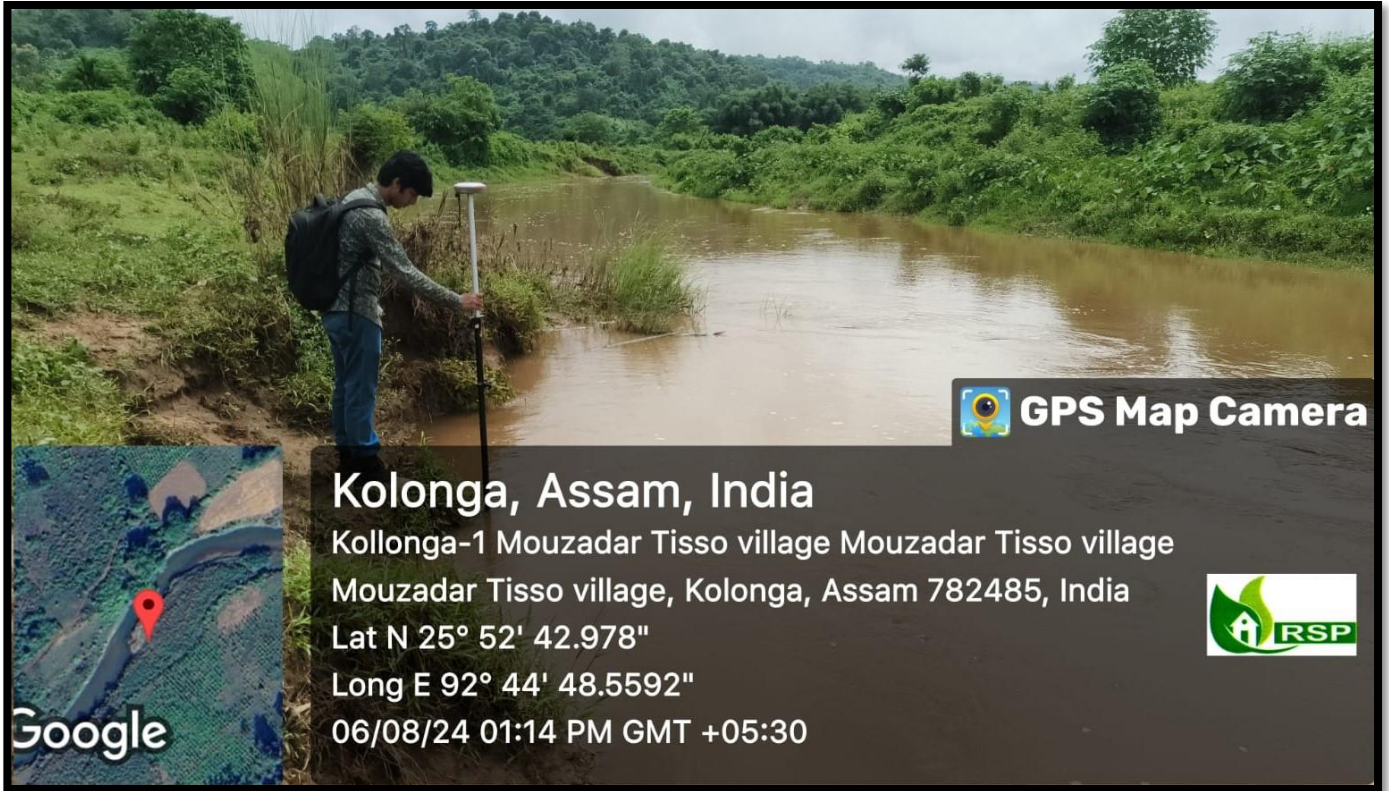
FIELD PHOTOGRAPHS



PHOTOGRAPH 1: DGPS survey in Kopili River in West Karbi Anglong district.



PHOTOGRAPH 2: Lithological Study in Kopili River in West Karbi Anglong district.



PHOTOGRAPH 3: DGPS survey in Amlong River in West Karbi Anglong District.



PHOTOGRAPH 4: DGPS survey in Borpani River in West Karbi Anglong District



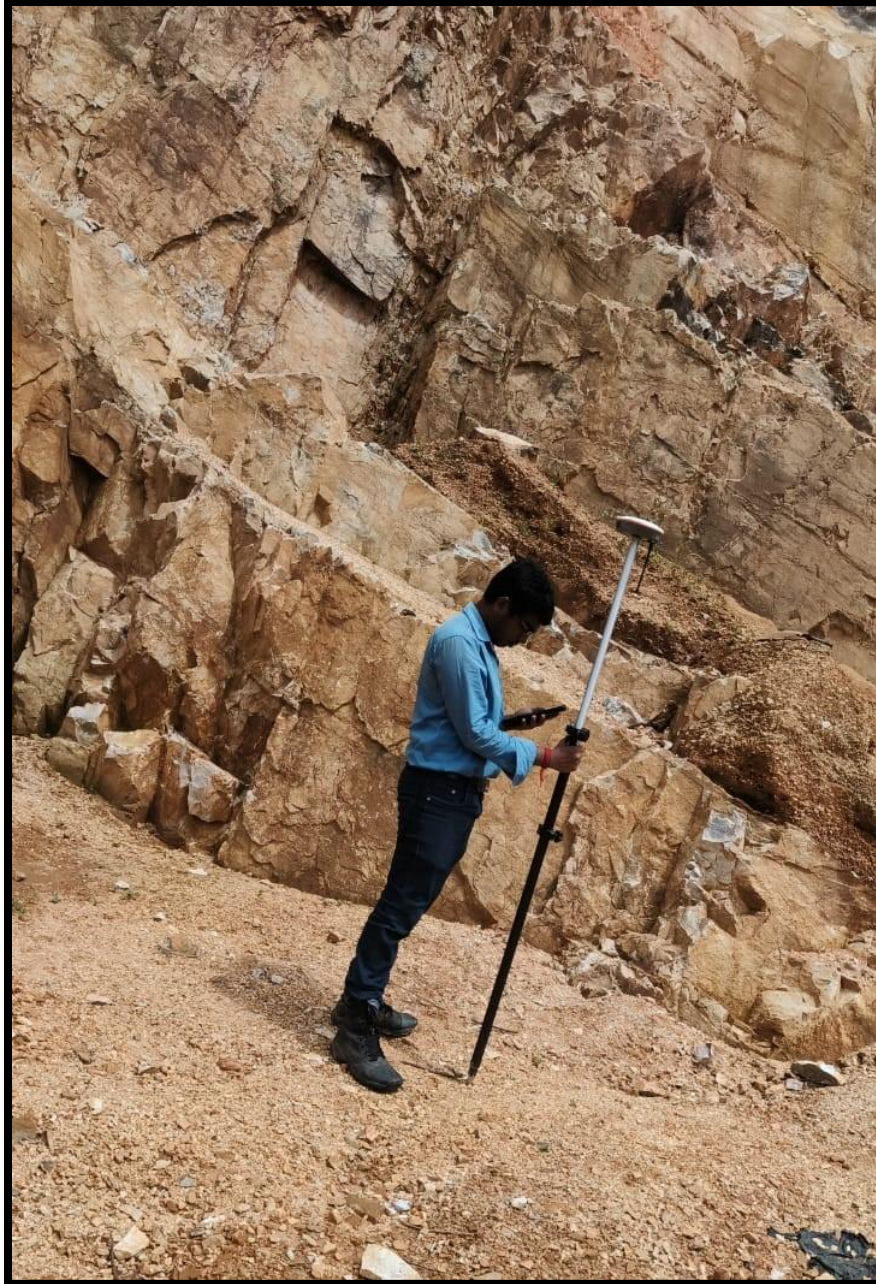
PHOTOGRAPH 5: Deposition of sand in Borpani River in West Karbi Anglong District



PHOTOGRAPH 6: Geological Study at stone quarry in Central Range in West Karbi Anglong District.



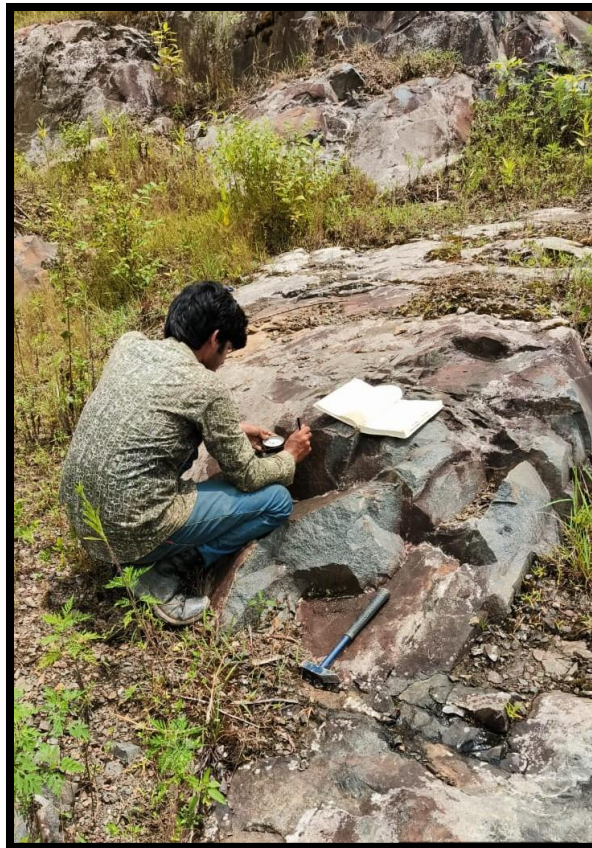
PHOTOGRAPH 7: Three sets of Joint Present at Stone Quarry in Central Range of West Karbi Anglong District.



PHOTOGRAPH 8: DGPS Survey in Stone Quarry in Central Range in West Karbi Anglong District.



PHOTOGRAPH 9: DGPS survey Sand & Gravel in Donkamukam Range of West Karbi Anglong District.



PHOTOGRAPH 10: Geological Study of Stone Quarry at Amri Range, West Karbi Anglong district.