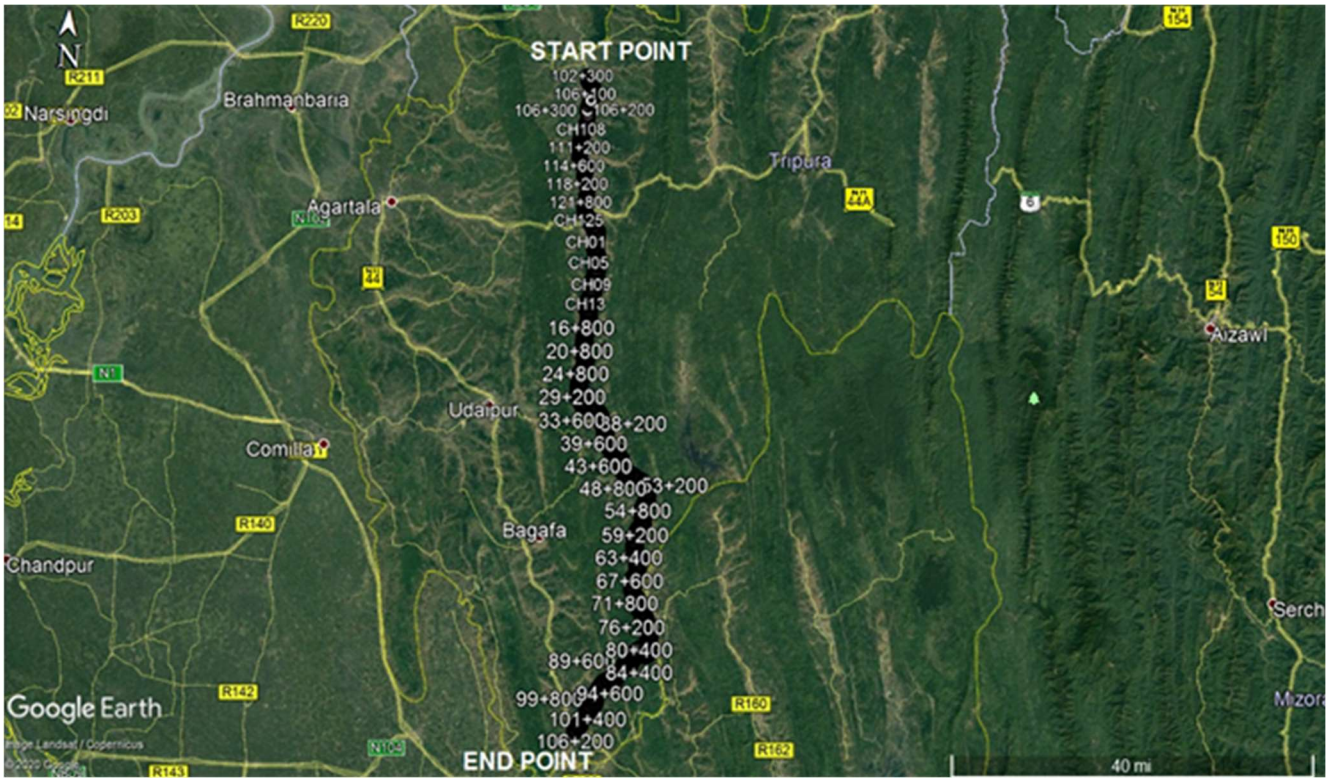
Environmental Impact Assessment (EIA)

FOR

Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208 (Designed Length 134.71 km).



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ACRONYMS

CPR	: Common Property Resource
CPI	: Consumer Price Index
CGWA	: Central Ground Water Authority
CPCB	: Central Pollution Control Board
DGM	: Deputy General Manager
DC	: District Collector
DP	: Displaced Persons
DHs	: Displaced Households
DFs	: Displaced Families
EA	: Executing Agency
EIA	: Environment Impact Assessment
EMP	: Environment Management Plan
FGD	: Focus group discussions
GoI	: Government of India
GP	: Gram Panchayat
GRC	: Grievance Redressal Committee
GSB	: Paved sub base
HIV/AIDS	: Human Immunodeficiency virus / Acquired immunodeficiency syndrome
IA	: Implementing Agency
ICDS	: Integrated Child Development Services
IS	: Indian Standard
IRC	: Indian Road Congress
JBIC	: Japan Bank for International Cooperation
JICA	: Japan International Cooperation Agency
KII	: Key Informant Interview
LA	: Land Acquisition
MT	: Motorized traffic
NGO	: Non-Government Organization
NH	: National Highway
NHIDCL	: National Highways & Infrastructure Development Corporation Limited
NRRP	: National Rehabilitation and Resettlement Policy
NMT	: Non-motorized traffic
NPK	: Nitrogen, Phosphorous and Potassium
MoRTH	: Ministry of Road Transport and Highways
MI	: Monitoring indicators
OBC	: Other Backward Castes
PHC	: Primary health Centre
PMU	: Project Monitoring Unit
PT	: Pedestrian traffic

PAP	: Project Affected Persons
PIU	: Project Implementation Unit
PT	: Performance Target
RP	: Resettle Plan
RCD	: Road Construction Department
Rs	: Rupee, Indian currency
R&R	: Resettlement and Rehabilitation
SDM	: Sub divisional District Magistrate
SH	: State Highway
SC	: Scheduled Castes
ST	: Scheduled Tribes
SPCB	: State Pollution Control Board
TTAADC	: Tripura Tribal Areas Autonomous District Council

Executive Summary

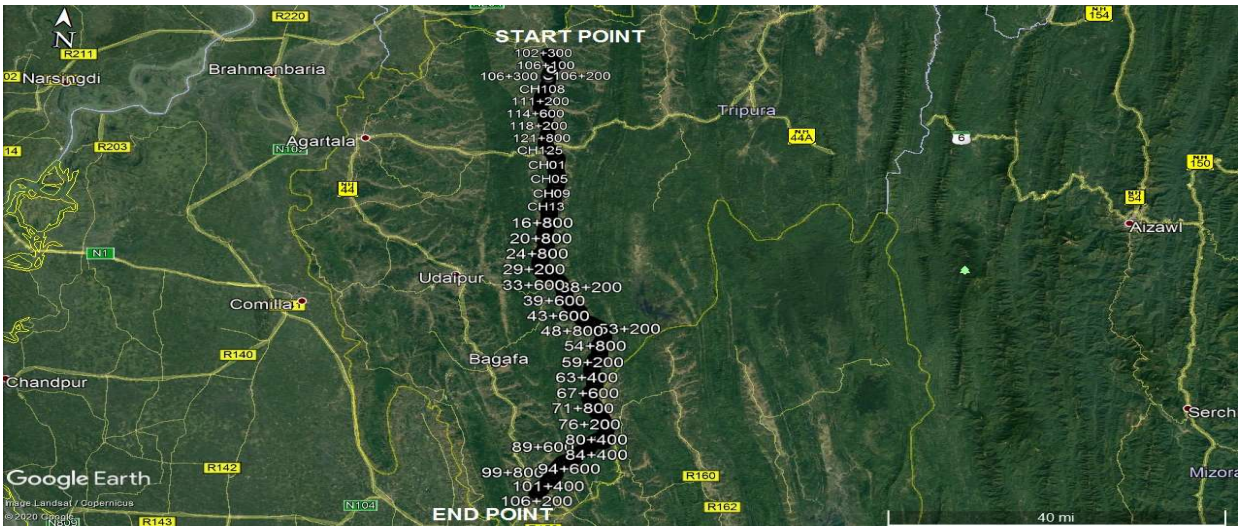
Project Background

National Highways infrastructure Development Corporation Limited (NHIDCL) has decided to take up the development of various NH stretches/Corridors in the country where intensity if traffic increased significantly and there is a requirement of augmentation of capacity for safe and efficient movement of traffic. In pursue of the above, the present section of NH-208 has been considered for upgradation. The project aims to improve transport efficiency of the state road network, which will contribute to expansion of economic opportunities and poverty reduction. This will be realized by (i) improving the state highway network, (ii) facilitating safe and appropriate road usage, (iii) increasing efficiency of transport services and (iv) enhancing Tripura State's PWD (NH) capacity for road asset development and management. Project immediate outcome will be improved accessibility to social services and markets, increased fuel efficiency, reduced travel time, accidents, vehicle emissions, better employment opportunities outside agriculture and improved access to economic Centers and increased industrial activities in the project area. Horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves are found at many locations causing discomfort to the drivers in most of the stretch of the alignment.

The proposed road alignment from Khowai to Sabroom is divided in to 2 section i.e Khowai to Teliamura (Section 1) and Teliamura to Sabroom (Section 2).

The Section 1 of proposed project transverses from 24°2'59.45"N 91°36'40.85"E (near Khowai town) to 23°50'21.88"N 91°37'36.12"E at NH-44 near Teliamura and Section 2 start from 23°49'45.03"N 91°37'50.10"E near Teliamura and Ends at 23° 2'26.16"N 91°40'10.92"E at Harina near Sabroom. The project road has designed length of 134.71km having started CH 101+200 & end at CH 127+300 for section 1 and section 2 start from CH 0+000, ends at CH 108+670. Both section is a part of the NH-208. The project road runs through Khowai, Gomati and South Tripura districts of Tripura. The project road passes through village / localities namely, Khowai, Kalyanpur, Twidu, Sonacherra, Amarpur, Nutan Bazar, Karbook, Ailmara, Khedacherri, Ropaichari and ends at Harina (T-Junction with NH-08). Sabroom is 8.1 km away from Harina junction. The Project road runs parallel to the International border (India – Bangladesh) in some of its length. A project location Map of the present section is enclosed in below.

Project Location Map



Source: Alignment provided in DPR

The Extent and Objective of the EIA Study

This EIA report has been prepared on the basis of detailed engineering design, field investigations including baseline environmental data collection and stakeholder consultations to meet the requirements for environmental assessment process, and JICA guidelines. EIA extent has been decided considering all likely impacts and risks analyzed in the context of the project's area of influence encompassing (i) the primary project site(s) and related facilities like site clearance, utility shifting etc. (ii) associated facilities project viz. Borrowing, quarrying, disposal of debris, construction camp etc. (iii) areas and communities potentially affected by cumulative impacts and (iv) potential impact from unplanned but predictable developments caused by the project that may occur at later stage or at a different location.

National Legal Frame Works & its Applicability to the Project and Gap Analysis against JICA Environmental Guidelines

Within the framework of environmental laws of India, the Environmental (Protection) Act of 1986 and its enforcement rights has been given to Ministry of Environment, Forest & Climate Change (MOEFCC). It has overall authority for the administration and implementation of the EIA related policies, laws and regulations, sustainable development and pollution control in India. MOEFCC identifies the need to enact new laws and to issue amendment to the existing environmental legislations when required, in order to continue to conserve and protect the environment in India. Central Pollution Control Board (CPCB) and respective State Pollution Control Board (SPCB) implement the acts. At the state level, the Department of Environment and Forest of Tripura perform a role similar to MOEFCC.

Description of the Project Components

Project road improvement will broadly follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines. It will be of 7m width carriageway with paved shoulder of 1.5m in rural/hilly. Footpath with cover drain has been proposed in built up area & Brick Masonry drain has been proposed on hill side for proper drainage purpose. The salient features of the project have been presented below.

Salient Features of the Project

1.	Project	Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208 (Designed Length 134.71 km)
2.	Location of the proposed project	The proposed road alignment from Khowai to Sabroom is divided in to 2 section i.e Khowai to Teliamura (Section 1) and Teliamura to Sabroom (Section 2).
3.	Total Length of the proposed project	134.71 km
4.	Terrain	Plain, rolling and hilly
5.	Seismic Zone	Zone V
6.	Geographical Location	The Section 1 of proposed project transverses from 24°2'59.45"N 91°36'40.85"E (near Khowai town) to

		23°50'21.88"N 91°37'36.12"E at NH-44 near Teliamura and Section 2 start from 23°49'45.03"N 91°37'50.10"E near Teliamura and Ends at 23° 2'26.16"N 91°40'10.92"E at Harina near Sabroom.
`	Proposed Bridges and ROB	60 no. of new bridges (02 major & 58 minor).
8.	Bus Bay/ Truck Lay Bye	20 nos. of bus bay and 02 no. of truck lay bye
9.	Design Speed	
	a) Plain Terrain (in general)	Ruling: 100 kmph Minimum: 80 kmph
	b) Rolling Terrain	Ruling: 80 kmph Minimum: 65 kmph
	C) Hilly Terrain	Ruling: 60 kmph Minimum: 40 kmph For Hair Pin Bend: min 20kmph
10.	Carriageway Width	7.0 m
11.	Width of Shoulder	In Rural/Built-up section:
	a) Paved	1.5m either side
	b) Earthen	1.0m either side
12.	Footpath width at built-up areas	1 m over RCC lined drain.
13.	Total Area of Land Acquisition	356.8 Ha in section 2 and 80.524 Ha in section 1.

Source: DPR

The typical cross sections (TCS) as per the following details area enclosed as **Annexure -1.**

- TYPE-1: TCS of 2 lane carriageway with paved shoulder (new construction)
- TYPE-2: TCS of 2 lane carriageway with paved shoulder (over existing road)
- TYPE-3: TCS of 2 lane carriageway with paved shoulder (built-up section)
- TYPE-4: TCS of 2 lane carriageway with paved shoulder (with protections works)
- TYPE-5: TCS of 2 lane carriageway with paved shoulder (both side protections works)
- TYPE-6: TCS of 2 lane carriageway with paved shoulder (With protections works both slide)
- TYPE-7: TCS of 2 lane carriageway with paved shoulder (both slide retaining wall)

Baseline Environment

The project state, Tripura falls under the sub-tropical to temperate climatic region. The climate of the project districts Khowai, Gumti and South Tripura is characterized by moderate temperature and high humid nature. There are three prominent seasons summer, rainy and winter. The State of Tripura comes under the very high risk seismic zone in the country, namely, Zone V of seismic Zoning Map of India. The major geomorphic element observed in Tripura is north-south running parallel hill regions and intervening valleys.

Ambient air and noise quality conformed the prescribed limit. Ground water samples collected from the hand-pumps of various locations as well as surface water quality along with soil quality also

confirm the prescribed limit. Dominant land use in the 10km radius of the project road is vegetation /forest land. It is followed by agriculture land.

The recorded forest area of the state is 6,294 km2, which constitutes 60.02% of its geographical area. The Reserved Forest (RF) constitute 66.33%, Protected Forest (PF) 0.03% and Unclassified Forest constitute 33.64%. The forest cover in the state, based on interpretation of satellite imagery of January 2009 is 7,977 km2 which is 76.04% of the total geographical area. Important flora in the project road are Schima wallichi, Syziguim cuminii, Albizia procerra, Artocarpas chaplasa, Lagerstromia parviflora, Alstonia scholaris, Dillenia pentagyna, careya arborea, Lannea grandis, Amoora wallichii, Cedrella toona, Sapium baccatum, Trewia nudiflora, Grewia microcos, Odina wodier, Garuga pinnata, etc. Bamboo plays a very vital role in the economy of the State along with rubber plantation as it serves the artisan & non-artisan users of the state.

JICA Guidelines

Applicability of JICA's Guidelines for Environment and Social Considerations (here in after, ESC) is required if a project is funded by JICA. If a significantly adverse impact on the environment or society has been identified in JICA-assisted project, the following has to be thoroughly considered and studied.

1) ESCs are pre-requisite

a. JICA will take necessary measures to ensure that the appropriate ESC is given;

b. When JICA reviews a project proposal and finds that the project could cause negative impacts on the environment or society, JICA advises the project proponents to provide appropriate ESC;

c. If the negative impact of the project cannot be avoided or mitigated to an acceptable level, JICA will not support its implementation.

2) Respect human rights

a. Development project should aim for fair distribution of its benefits and must not burden or exclude certain stakeholders for the sake of others;

b. The project proponents must respect the rights of all people concerned, and pay special attention to vulnerable social groups such as women, elderly, the poor, people with disabilities, indigenous peoples, ethnic minorities, and other minority groups to ensure that they are involved in decision-making processes and that they benefit from the project;

c. JICA's ESC Guidelines defines 'stakeholders' as local residents including non- titleholders who are affected by the project as well as local NGOs. By involving local stakeholders from the early stage of the project, the project proponents can receive their inputs and plan appropriate measures to address their concerns, avoid conflict, and achieve higher results with their support. For this reason, the project proponents should conduct a series of consultations with local stakeholders in an interactive and meaningful manner. During this process, appropriate

consideration must be given to socially vulnerable or different people such as women, children, the elderly and ethnic minorities.

3) Avoid adverse impacts

a. Priority should be given to the avoidance of adverse impacts on the environment or society when a project is planned;

b. Minimization or mitigation of impacts should be considered only if avoidance is not feasible and if the benefit of the project outweighs the cost of mitigation measures;

c. The project proponents must assess the environmental and social impacts at the earliest possible stage of planning, and implement ESC measures in accordance with the ESC Guidelines.

4) Information on ESC must be disclosed to the public

a. Information disclosure is key in ESC. Project proponents must proactively release relevant information to the public;

b. Sharing information with a wide range of stakeholders from the early stage, the project proponents can utilize their feedback to improve the plan/project. In addition, the project proponents can ensure that unnecessary concerns and misunderstandings among the stakeholders are ameliorated.

5) Host country's laws, standards, policies and plans

a. JICA-funded project must comply with the laws, standards, policies, and plans of the host country;

b. If the standard set by the host country differs from the international standard, the project proponents are advised to adopt international standard that better serves the purpose of attaining a higher level of ESC.

6) The World Bank's Safeguard Policies

ESC in a JICA project must be in line with the World Bank's Safeguard Policies including:

a. Operational Policy on Environmental Assessment (OP 4.01);

b. Natural Habitats (OP 4.04);

c. Involuntary Resettlement (OP 4.12);

d. Indigenous Peoples (OP 4.10), and other relevant policies.

The National and State Regulations relevant to the project and its applicability to the project are described below:

National and State Regulations and its applicability for the Project

Law	Description	Applicability in the project
EIA Notification	The EIA Notification of 2006 set out the requirement for environmental assessment in India. Environmental Clearance is required for certain defined activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence.	Not Applicable as project activity does not attract provisions of EIA notification 2006 and its amendment till date.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments(1987)	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water, by Central and State Pollution Control Boards and for conferring on and assigning to CPCB/SPCBs powers and functions relating to water pollution control. Such projects have to obtain Consent to Establish (CTE) under Section 25 of the Act from State Pollution Control Board (SPCB) before starting implementation and Consent to Operate (CTO) before commissioning.	Consent to Establish (CTE) before start of construction works and Consent to Operate (CTO) before start of operation will be required for (if any)- Batching Plant Hot mix plants; and Sand mining
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	This Act was enacted to achieve prevention, control and abatement of air pollution activities by assigning regulatory powers to Central and State boards for all such functions. The Act also establishes ambient air quality standards.	Following will require CTE and CTO from SPCB: Establishment of DG sets more than 10 KVA. Batching Plant Hot mix plants; and Sand mining, if any
Environment (Protection) Act, 1986 and CPCB Environmental Standards. (National Ambient Air Quality Standards 2009)	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards.	Ensure applicable standards for ambient air quality. Ensure Emission Limits standards for New DG Sets Ensure Stake Height standards Requirement for DG Sets.
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Ensure applicable noise standards and noise limits for DG sets.
Central Motor Vehicle Act Central Motor Vehicle Rules	Objective of this Act is to check vehicular air and noise pollution. Vehicles to be used for construction and other purposes need to	Ensure vehicle exhaust emission standards.

and (Amendment) Rules (1988 and amendment thereafter)	meet the standards and certificates prescribed as per the Rules, 1989 to control noise, pollution, etc.	
Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010	The Act designates areas within 100 meters (m) of the "protected monument/area" as "prohibited area" and beyond that up to 200 m as "regulated area" respectively. No "construction" is permitted in the "prohibited area" and any construction activity in the "regulated area" requires prior permission of the Archaeological Survey of India (ASI).	Not applicable as no such monuments within the project corridors.
The Right to fair compensation and transparency in land acquisition, rehabilitation and resettlement Act, 2013	Private land acquisition is guided by the provisions and procedures of this Act.	Applicable to this project as there is private land acquisition and resettlement.
Seventy Third Constitution Amendment Act 1992	This act guides Governments to establish rules for Panchayat involvement in project preparation and implementation. The Act stipulates involvement of the institutions especially, the Gram Sabha/ Panchayat during project preparation and implementation. The Panchayats at the village level will be involved for preparation and implementation of the project.	Ensure involvements of Gram Sabha/Gram Panchayat in the project design.
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.
The Sexual Harassment of Women at workplace (Prevention, Prohibition and Redressal) Act, 2013	Whereas sexual harassment results in violation of the fundamental rights of a women to equality under article 14 and 15 of the Constitution of India and her right to life and to live with dignity under article 21 of the Constitution and right to practice any profession or to carry on any occupation,	Applicable

	trade or business which includes a right to safe environment free from sexual harassment.	
The schedule caste and schedule tribe amendment act 2015 and rules 2016	The acts and rules are to provide the protection to tribal people.	Applicable
Biodiversity Act of 2002	The Biodiversity Act 2002 primarily addresses access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.	Not applicable
Wildlife Protection Act, 1972 amendment 1991	This overarching Act provides protection to wild animals, birds, plants and matters connected with habitat protection, processes to declare protected areas, regulation of wildlife trade, constitution of state and national board for wildlife, zoo authority, tiger conservation authority, penalty clauses and other important regulations.	The Gumti Wildlife Sanctuary is located within 10 km from the end point of the road. The final ESZ notification no. 3663 dated 08.11.2019 of the sanctuary has been published. As per this notification the alignment is approx. 5.0 km away from the ESZ boundary and wildlife clearance is not applicable as project alignment do not fall in ESZ boundary. The other wildlife sanctuaries of Tripura that is Rowa, Sepahijala and Trishna are more than 10 km away from the proposed alignment. Therefore wildlife clearance is not applicable
Forest (Conservation) Act, 1980	The Forest (Conservation) Act prohibits the use of forest land for non-forest purposes without the approval of Ministry of Environment and Forests and Climate Change (MoEFCC), Government of India	Forest land is required for project. The stage-1 clearance has already been obtained in section 1 and section 2 under process.
Solid Waste Management Rules 2016	Responsibility of Solid Waste Generator (i) segregate and store the waste generated in three separate streams namely bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorized waste pickers or waste collectors as per the direction or notification by the local authorities from time to time.	Contractor to follow all the rules during construction works.
Construction and Demolition Waste Management Rules 2016	(i) Every waste generator shall segregate construction and demolition waste and deposit at collection center or handover it to the authorized processing facilities	Contractor to follow all the rules during construction works.

	(ii) Shall ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains. (iii) Large generators (who generate more than 20 tons or more in one day or 300 tons per project in a month) shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or re-modeling work, (iv) Large generators shall have environment management plan to address the likely environmental issues from construction, demolition, storage, transportation process and disposal / reuse of C & D Waste. (v) Large generators shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar, Large generators shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities;	
Hazardous Waste Rules 2016	Responsibilities of the occupier for management of hazardous and other wastes.- (1) For the management of hazardous and other wastes, an occupier shall follow the following steps, namely:- (a) prevention; (b) minimization; (c) reuse, (d) recycling; (e) recovery.	Contractor to comply all the requirements of this Act during construction works.
International conventions and treaties		
Ramsar Convention, 1971	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. India is one of the signatories to the treaty. The Ramsar convention made it mandatory for the signatory countries to include wetland conservation in their national land use plans.	Not applicable to this project as not site within the vicinity of the project.
Wetlands (Conservation and Management) Rules, 2017	The Rules specify activities which are harmful and prohibited in the wetlands such as industrialization, construction, dumping of untreated waste and effluents, and reclamation. The Central Government may permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	Not applicable as subprojects components are not located in designated wetland area.

Montreal Protocol 1992	India is a signatory of this convention which aims to reduction in the consumption and production of ozone-depleting substances (ODS), while recognizing differences in a nation's responsibilities. Ozone depleting substances are divided in two groups Chlorofluorocarbons (CFCs) and Hydro chlorofluorocarbons (HCFCs).	Not applicable in this project as no ODS are involved in construction works.
Basel Convention on Trans-boundary Movement of Hazardous Wastes, 1989	India is a signatory of this convention which aims to reduce trans-boundary movement and creation of hazardous wastes.	Contractor to follow the provisions of Hazardous Waste Rules 2016 for storage, handling, transport and disposal of hazardous waste emerged during construction works.
Convention on Migratory Species of Wild Animals (CMS), 1979 (Bonn convention)	CMS, also known as Bonn convention was adopted in 1979 and entered into force on 1 November 1983, which recognizes that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve terrestrial, marine and avian migratory species throughout their ranges. CMS Parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.	Not applicable to this project as no migratory species of wild animals are reported in the project areas.

Source: EIS

The table below shows the clearances to be checked in the project.

Clearances of the Project

Required Clearance names	Ministry/Agency in charge	Status	Reason
Before Construction			
Environmental Clearance	MOEF&CC	Not required	Not Applicable as project activity does not attract provisions of EIA notification 2006 and its amendment till date.
Forest Clearance	MOEF&CC	Required	Forest land is required for project. The stage-1 clearance has already been obtained in section 1 and section 2 is under process.
Wildlife Clearance	MOEF&CC	Required	The Gumti Wildlife Sanctuary is located within 10 km from the end point of the road. The final ESZ notification no. 3663 dated 08.11.2019 of the sanctuary has been published. As per this

			notification the alignment is approx. 5.0 km away from the ESZ boundary and wildlife clearance is not applicable as project alignment do not fall in ESZ boundary. The other wildlife sanctuaries of Tripura that is Rowa, Sepahijala and Trishna are more than 10 km away from the proposed alignment. Therefore wildlife clearance is not applicable
During Construction			
Construction machinery Clearance (hot-mix plants, batching plants, sand mining etc.) under Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments(1987)	State Pollution Control Board - SPCB	Required	This will be taken by the contractor during construction period.
Construction machinery Clearance (hot-mix plants, batching plants, sand mining etc.) under Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	State Pollution Control Board - SPCB	Required	This will be taken by the contractor during construction period.
Solid Waste Management Rules 2016	State Pollution Control Board - SPCB	Required	Contractor to follow all the rules during construction works.
Construction and Demolition Waste Management Rules 2016	State Pollution Control Board - SPCB	Required	Contractor to follow all the rules during construction works.

Source: EIS

Study of Alternative Options

A comparative analysis of various alternatives considered to avoid, prevent or minimize impacts that would be inevitable if technically (based on design speed and geometrics) best-fit alignment is followed. The consideration of alternatives to a proposal is a requirement of the EIA report. During the scoping process, alternatives to a proposal can be generated or refined, either directly or by reference to the key issues identified. A comparative analysis of the alternatives will help to determine the best method of achieving project objectives while minimizing environmental and social impacts. Three options have been selected to decide the final alignment, these three options are:-

1. Zero option: No project intervention is implemented i.e. transportation by present roads is continued to be used.
2. Other option (widening options): The option is to widen the existing road to the level of planned road.

3. Another option with some curve correction and alternative bypass using some of the existing alightment.
4. The selected option: The option is used for this EIA impact study

Zero option has been ruled out as present road is not able to withstand increased traffic. The widening option of existing road was also not feasible due to its geometric design, R&R issues, socioeconomic viability, environmental & road safety aspects. Another option with some curve correction and alternative bypass using some of the existing alignment. It is the second shortest route, however rejected due to more impact on water bodies, residential and commercial structure. The initial site visit and detailed ground reconnaissance by the consultants revealed that by and large this selected alignment having less/minor effect on environmental and social components is acceptable. The proposed alignment was selected after finalization of various options such as realignments, bypasses, keeping in view objectives of the project, traffic condition, obligatory points, geometric designs, congestions and socioeconomic viability, environmental & road safety aspects.

Anticipated Environmental Impacts and Proposed Mitigation Measures

The road will benefit the residents and other stakeholders in the settlement areas of important nearby towns of Khowai, Kalyanpur, Twidu, Sonacherra, Amarpur, Nutan Bazar, Karbook, Ailmara, Khedacherri, Ropaichari, Harina and Sabroom by providing improved connectivity to state capital and other important destination of nearby states of Assam, Meghalaya & Mizoram. Total 21.690 Km length of bypasses have been proposed bypassing Telimur Twidu, Ompi, Amarpur, Nutan Bazar, Jatanbari and Karbook Towns. The realignment length 59.37 Km. Most of the project road is proposed for either realignment or bypass. This process involves diversion of both agriculture and forest land along with eviction of some existing structures including shops, school boundary wall and temples. More than 75% of the land use in 10km radius of the project road is forest cover. The widening of the project road along with realignment and bypass development shall cause loss of vegetation/tree felling, other ecological imbalance and habitat destruction. Another significant impact identified during site visit is water quality deterioration of ponds abutting the project road. However, with effective environmental management plan, all these aspects can be mitigated.

Public Consultation and Information Disclosure

The first stage Public/stake holder consultation has been conducted during first week of September, 2020 in six locations covering all the three benefits districts as per JICA guidelines. Generally, stakeholder welcome the project .

Environmental Management Plan

The Environmental Management Plan is prepared for avoidance, mitigation and management of the negative impacts of the project. It also covers remedial measures require to be taken EMP includes the list of all the project related activities, their impacts at different stages of project during pre-construction phase / design phase, construction phase and operational phase on environment and remedial measures to be undertaken to mitigate these impacts. Environmental Management Plan (EMP) is intended to set out clearly and unambiguously the likely negative impacts of construction and/or operation of the project, the action that is required to avoid or mitigate each impact and the responsibility for taking each action. Responsibility is made legally binding when actions are

subsequently specified in contracts. A comprehensive environmental management plan has been designed for the project road; 1) to ensure compliance and regulatory requirements of Tripura and the Government of India, 2) To formulate avoidance, mitigation and compensation measures for anticipated adverse environmental impacts during construction and maintenance and ensure that environmentally sound, sustainable and good practices are adopted and to stipulate monitoring and institutional requirements for ensuring safeguard compliance. A strict environmental monitoring program also formulated for implementation during both construction and operation stage of the project road.

Findings and Conclusion

The significant environmental impacts attributable to the upgrading of the road sections pertains to tree cutting, construction of bridges, temporary deterioration of environmental attributes/ambient during construction phase from land clearing, silt run off, borrowing of earth, camp operations and community and occupational health and safety. These impacts can be mitigated adopting good construction practices and effective implementation of Environmental Management Plan (EMP). During operation stage, the main impacts are increase in mobile emissions, noise level, accident risk to motorist, pedestrian and animals. Road safety measures are proposed as per IRC: SP: 44-1996 like road delineators, signage, metal beam crash barriers and guideposts etc. Retaining walls have been proposed on embankment slopes where ponds are abutting to avoid seepage into sub grade and erosion of road embankment.

1. INTRODUCTION

1.1 General

Tripura is located in north-eastern part of India and covers an area of 10,491.69 km^2. Agartala is its capital. The total population is 329.66 million which accounts for 2.72% of the country. One-third of its total population composed by scheduled tribes' population. It is third smallest state of India. The Gross State Domestic Product (GSDP) at current prices increased from Rs.8, 903.53 crores in 2004-05 to Rs.26, 809.60 crore in 2013-14 (P). The per capita income of the State also rose steadily from Rs.24, 394 in 2004-05 to Rs.31,111 in 2007-08 and to Rs.50,859 in 2011-12 and to Rs.69,705 in 201314 (P).

The deficient network and quality of the road infrastructure is an important deterrent factor constraining the development of major part of the state. The overall length of roads in Tripura is 42,200 km. As of 2015, the National Highways make up of 645 km and the State Highways including major district road and other district road consist of 1817 km. Tripura lies in a geographically disadvantageous location in India, as only one major highway, the National Highway 44, connects it with the rest of the country.

1.2 The Project

Project aims to improve transport efficiency of the state road network, which will contribute to expansion of economic opportunities and poverty reduction. This will be realized by (i) improving the state highway network, (ii) facilitating safe and appropriate road usage, (iii) increasing efficiency of transport services and (iv) enhancing Tripura State's NHIDCL capacity for road asset development and management. Project immediate outcome will be improved accessibility to social services and markets, increased fuel efficiency, reduced travel time, accidents, vehicle emissions, better employment opportunities outside agriculture and improved access to economic Centers and increased industrial activities in the project area.

The proposed road alignment from Khowai to Sabroom is divided in to 2 section i.e Khowai to Teliamura (Section 1) and Teliamura to Sabroom (Section 2). The Section 1 of proposed project transverses from 24°2'59.45"N 91°36'40.85"E (near Khowai town) to 23°50'21.88"N 91°37'36.12"E at NH-44 near Teliamura and Section 2 start from 23°49'45.03"N 91°37'50.10"E near Teliamura and Ends at 23° 2'26.16"N 91°40'10.92"E at Harina near Sabroom. The project road has designed length of 134.71km having started CH 101+200 & end at CH 127+300 for section 1 and section 2 start from CH 0+000, ends at CH 108+670. Both section is a part of the NH-208. The project road runs through Khowai, Gomati and South Tripura districts of Tripura. The project road passes through village / localities namely, Khowai, Kalyanpur, Twidu, Sonacherra, Amarpur, Nutan Bazar, Karbook, Ailmara, Khedacherri, Ropaichari and ends at Harina (T-Junction with NH-08). Sabroom is 8.1 km away from Harina junction. The Project road runs parallel to the International border (India – Bangladesh) in some of its length. A key Map of the project corridor is enclosed in figure 1.1. Photographs showing starting and end points of the propject alignment have been presented in figure 1.2

NHIDCL has been constituted by the Government of India (GoI) with the purpose of development of highways and any structures thereon/other infrastructure projects entrusted to it and as part of this endeavor, the NHIDCL has been mandated to undertake improvement and up-gradation of various National Highways at different location in Tripura. Hence, NHIDCL has invited proposal for carrying out Feasibility Study and Detailed project preparation for Detailed Project Report for improvement and Widening to two lanes of newly declared NH-208 (designed length 134.71km) for execution on EPC Mode.

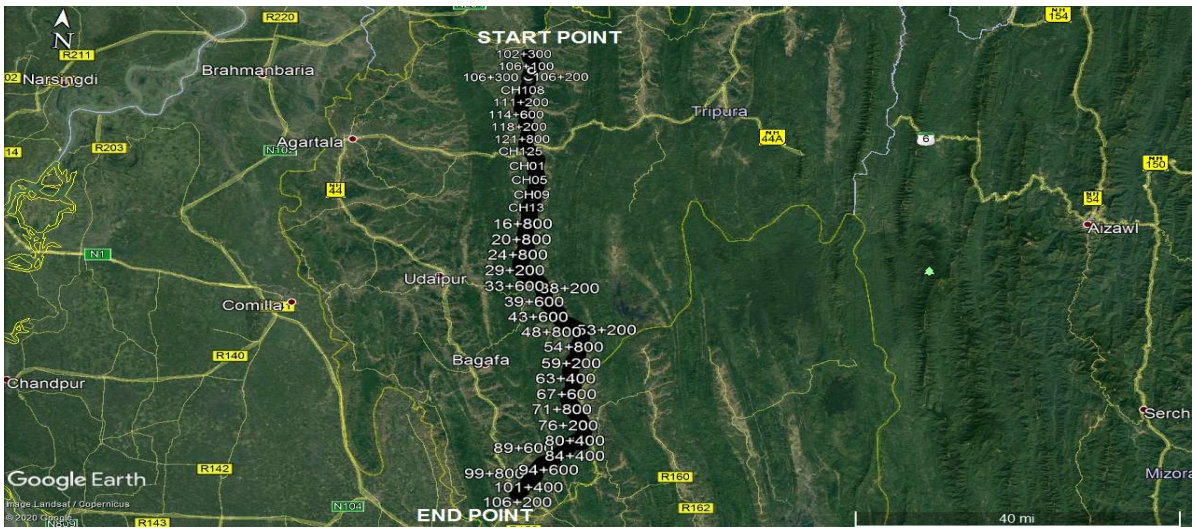


Figure 1.1: Project Location Map

Starting Point of Khowai – Teliamura section

End point of Khowai – Teliamura section

Starting point Teliamura – Sabroom section

End point of Teliamura – Sabroom section

Figure 1.2: Photographs showing starting and end points of the project alignment

1.3 EIA Objectives

The EIA report covers the general environmental profile of the study area and includes an overview of the potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the project's influence area during design, construction, and operation stages. An Environmental Management Plan (EMP) is also proposed as part of this report which includes mitigation measures for significant environmental impacts during implementation of the project, environmental monitoring program, and the responsible entities for mitigation and monitoring. EIA has four basic objectives; (i) identify the environmental issues that should be taken into account due to project interventions (ii) determine the magnitude of potential environmental concerns and to ensure that environmental considerations are given adequate weight at planning/design stage (iii) identify need for further environmental studies or Environmental Impact Assessment (EIA) and (iv) suggest enhancement measures, if any.

1.4 Extent of the EIA

This EIA report has been prepared on the basis of detailed engineering design, field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation as per prevailing Policy Statement. EIA extent has been decided considering all likely impacts and risks analyzed in the context of the project's area of influence encompassing (i) the primary project site(s) and related facilities like site clearance, utility shifting etc. (ii) associated facilities project viz. Borrowing, quarrying, disposal of debris, construction camp etc. (iii) areas and communities potentially affected by cumulative impacts and (iv) potential impact from unplanned but predictable developments caused by the project that may occur at later stage or at a different location. The core zone of impact is taken as 15 m on the either side of the alignment. However, the study area is considered up to 10 km on either side of road alignment for larger analysis of landuse and other environmental features.

1.5 EIA Methodology

EIA commenced with the review of technical details provided by the DPR team and preceding environmental assessment reports conducted for the project road. This was followed by a reconnaissance site visit and discussion with the implementing agency to reconfirm the technical details of the project road improvement work. This helped to identify those environmental attributes which may get altered with the passage of time and incorporate additional information to the baseline environmental scenario/environmental setting of the project. Further steps followed for EIA has been concisely described in following paragraphs.

Review of Country's Legal Framework: India has a well-defined policy/legal framework for safeguard of environment. Prior to initiation of any civil work, it is essential to analyze the various permissions/clearances required for any developmental project. Same has been presented in later section of this chapter.

Primary Data Collection: Environmental resource inventory will be prepared for all environmental features viz. terrain, land use, waterways/water bodies, road side vegetation, sensitive receptors, common property resources, utilities, drainage, flooding/water logging, industries, accident prone areas etc. within the area of interest/core zone. Information about this will be done by trained persons under the supervision of an expert team. Similarly, biodiversity survey was also carried out. Baseline monitoring was conducted at the locations for which data was not available in environmental assessment report conducted by detailed design team.

Secondary Data Collection: Secondary sources include published government reports, environmental impact assessments conducted in the similar region, government websites, recognized institutions and relevant government departments (forest, irrigation, pollution control board, fisheries, statistics, Indian Meteorological Department (IMD) and Tripura Space Application Centre (TSAC) etc. Recent Google images have been captured to view environmental features at regional scale.

Public Consultation: Meaningful consultations were organized with the NHIDCL, local people/beneficiary population to know the level of project acceptability, understand their concerns, apprehensions, and overall opinion. Information were gathered about existing baseline environmental condition viz. ambient levels and its effects on health, water resources, water logging/flooding, flora and fauna, socio-economic standing of local people, impact due to loss of land other assets and common property resources, accident risk during construction and operation stage, perceived benefits and losses, etc. Information thus gathered was used to integrate it in project design and formulate mitigation measures and environmental management plan.

Other Tools, Surveys and Studies: Assessment of landuse of larger area beyond the project site has been prepared for better planning and decision-making. Remote sensing and Geographic Information System (GIS) based landuse map of the study area (10 km buffer) was prepared through recent satellite imagery. A rapid bio-diversity assessment was also carried out to generate baseline on floral and faunal elements in the project area. The survey also helped in assessing impact on any rare threatened or endangered species of floral species in the project area. Extensive air, noise, water & soil quality monitoring & analysis has been carried out in the project road. Primary and Secondary Information Sources has been provided below in table 1.1.

Table 1.1: Primary and Secondary Information Sources

Information	Sources
Technical Details	NHIDCL and Design Team
Inventory of road features	Ground Physical surveys
Climatic condition	Indian Meteorological Department Websites
Geology, Seismicity, Soil and Topography	State of Environment Report, Pollution Control Board, journal and research publications and Primary Survey
Land Use/ Land Cover	State of the Environment Report, Satellite Imagery based land use analysis, primary survey (Ground Truthing)
Drainage Pattern	GIS Map and Tooling, Detail Project Report and onsite observations, primary survey
Roadside Forest/Vegetation	Forest Range Offices/State Forest Department, Tripura & Primary Survey
Archaeological / Heritage sites	Archaeological Survey of India, Primary Survey
Air quality Noise, Soil and Water	Primary survey
Borrow areas, quarries and other construction material source	NHIDCL, Detailed Project Report and Consultation
River geo-morphology, hydrology, drainage, flood patterns,	Detailed Project Report, Consultation and site verification
Soil profile	Primary Survey
Groundwater Conditions	Central Groundwater Board
Socio-economic environment	Different Govt. agencies/civic bodies, official websites maintained by state govt., census of India 2011, and public Consultation during the Field survey

Assessment of Potential Impacts: The assessment of the type, nature, direct, indirect, cumulative or induced impacts and their significance to the physical, biological, and socio-economic components of the environment will be done to ascertain whether the project is environmentally sustainable or not. Nature of impacts will be classified as significant, insignificant, short-term, long-term, reversible, irreversible etc. After identification of nature and extent of impacts, mitigation measures will be suggested.

Preparation of the Environment Management Plan: The project specific Environment Management Plan (EMP) was formulated with an aim to avoid, reduce, mitigate, or compensate for adverse environmental impacts/risks and propose enhancement measures. This includes

- Mitigation of potentially adverse impacts
- Monitoring of impacts and mitigation measures during project implementation and operation
- Institutional capacity building and training
- Compliance to statutory requirements
- Integration of EMP with Project planning, design, construction and operation.

Environment Monitoring Plan: The monitoring and evaluation are critical activities in implementation of the project. Monitoring involves periodic checking to ascertain whether activities are going according to plan or not. It provides the necessary feedback for project management to ensure project objectives are met and on schedule. The reporting system is based on accountability to ensure that the environmental mitigation measures are implemented. Environmental monitoring program has the underlying objective to ensure that the intended environmental mitigations are realized and these results in desired benefits to the target population causing minimal deterioration to the environmental parameters. Such program targets proper implementation of the EMOP. The broad objectives are:

- To evaluate the performance of mitigation measures proposed in the EMP.
- To evaluate the adequacy of environmental assessment.
- To suggest ongoing improvements in management plan based on the monitoring
- To enhance environmental quality through proper implementation of mitigation measures.
- To meet existing environmental regulatory framework and community obligations.

Performance Indicators: The significant physical, biological and social components affecting the environment at critical locations serve as wider/overall performance Indicators. However, the following specific environmental parameters can be quantitatively measured and compared over a period of time and are, therefore, selected as specific Performance Indicators (PIs) for monitoring because of their regulatory importance and the availability of standardized procedures and relevant expertise. Performance indicators requiring quantitative measurements are:

- Air quality with respect to PM2.5, PM10, NOx and SO2 at selected location.
- Water quality as per CPCB prescribed Standards
- Noise levels at sensitive receptors (schools, hospitals, community/religious places).
- Survival rates of trees planted as compensatory plantation.

Assessment of EA Capacity to address the environmental concern of the project: EIA assess the capacity of the executing agency for effective implementation of EMP. Accordingly, if needed, a training and awareness program will be formulated to enhance the capacity of officials for implementing proposed mitigation measures and monitoring the resultant effects, as well as create awareness amongst workers and public. The institutions/agencies like regional office of MoEF, SPCB/CPCB, and Indian Institute of Technologies can be consulted for such trainings. Independent subject's experts/consultants (e.g., for the environmental awareness program, impact assessment specialist will be the resource person) can also be the resource persons to impart trainings. These experts /agencies shall be appointed based on specific need for the training. A separate budget for training will be allocated under the Construction Supervision Consultant budget.

1.6 Structure of the Report

The EIA has been structured as recommended in Terms of Reference. An introduction section has been included to have a general overview of the project. The report has been compiled and presented as follows-

Chapter 1-Introduction

Chapter 2- Policy, Legal and Administrative Framework

Chapter 3- Description of Project

Chapter 4- Baseline Environmental Studies

Chapter 5-Anticipated Impacts and Mitigation Measures

Chapter 6- Public Consultation & Information Disclosure

Chapter 7-Environmental Management Plan, Monitoring Plan and Grievance Redress Mechanism

Chapter 8 -Conclusion and Recommendation

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

The chapter presents a review of the existing institutions and legislations relevant to the project at the National and State level. The Environmental Assessment process needs to adopt environmental regulations and guidelines of Government of India (GoI).

2.1 Country's Legal Framework and Regulatory Requirements

The Government of India has laid out various policy guidelines, acts and regulations for the safeguard and conservation environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Ministry of Environment and Forests (MoEF&CC) and the Central Pollution Control Board (CPCB)/Tripura State Pollution Control Board (TSPCB) in the present context. Environmental Regulations/ Legislations and its Applicability to the Project has been provided in Table 2.1.

Table 2.1: Environmental Regulations/ Legislations and its Applicability to the Project

Law	Description	Applicability in the project
EIA Notification	The EIA Notification of 2006 set out the requirement for environmental assessment in India. Environmental Clearance is required for certain defined activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence.	Not Applicable as project activity does not attract provisions of EIA notification 2006 and its amendment till date.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments(1987)	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water, by Central and State Pollution Control Boards and for conferring on and assigning to CPCB/SPCBs powers and functions relating to water pollution control. Such projects have to obtain Consent to Establish (CTE) under Section 25 of the Act from State Pollution Control Board (SPCB) before starting implementation and Consent to Operate (CTO) before commissioning.	Consent to Establish (CTE) before start of construction works and Consent to Operate (CTO) before start of operation will be required for (if any)- • Batching Plant • Hot mix plants; and • Sand mining
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	This Act was enacted to achieve prevention, control and abatement of air pollution activities by assigning regulatory powers to Central and State boards for all such functions. The Act also establishes ambient air quality standards.	Following will require CTE and CTO from SPCB: Establishment of DG sets more than 10 KVA. • Batching Plant • Hot mix plants; and • Sand mining, if any
Environment (Protection) Act, 1986 and CPCB Environmental Standards. (National	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards.	Ensure applicable standards for ambient air quality. Ensure Emission Limits standards for New DG Sets Ensure Stake Height standards Requirement for DG Sets.

Ambient Air Quality Standards 2009)		
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Ensure applicable noise standards and noise limits for DG sets.
Central Motor Vehicle Act Central Motor Vehicle Rules and (Amendment) Rules (1988 and amendment thereafter)	Objective of this Act is to check vehicular air and noise pollution. Vehicles to be used for construction and other purposes need to meet the standards and certificates prescribed as per the Rules, 1989 to control noise, pollution, etc.	Ensure vehicle exhaust emission standards.
Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010	The Act designates areas within 100 meters (m) of the "protected monument/area" as "prohibited area" and beyond that up to 200 m as "regulated area" respectively. No "construction" is permitted in the "prohibited area" and any construction activity in the "regulated area" requires prior permission of the Archaeological Survey of India (ASI).	Not applicable as no such monuments within the project corridors.
The Right to fair compensation and transparency in land acquisition, rehabilitation and resettlement Act, 2013	Private land acquisition is guided by the provisions and procedures of this Act.	Applicable to this project as there is private land acquisition and resettlement.
Seventy Third Constitution Amendment Act 1992	This act guides Governments to establish rules for Panchayat involvement in project preparation and implementation. The Act stipulates involvement of the institutions especially, the Gram Sabha/ Panchayat during project preparation and implementation. The Panchayats at the village level will be involved for preparation and implementation of the project.	Ensure involvements of Gram Sabha/Gram Panhayat in the project design.
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to	Applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.

	men and women for work of equal value or type.	
The Sexual Harassment of Women at workplace (Prevention, Prohibition and Redressal) Act, 2013	Whereas sexual harassment results in violation of the fundamental rights of a women to equality under article 14 and 15 of the Constitution of India and her right to life and to live with dignity under article 21 of the Constitution and right to practice any profession or to carry on any occupation, trade or business which includes a right to safe environment free from sexual harassment.	Applicable
The schedule caste and schedule tribe amendment act 2015 and rules 2016	The acts and rules are to provide the protection to tribal people.	Applicable
Biodiversity Act of 2002	The Biodiversity Act 2002 primarily addresses access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.	Not applicable
Wildlife Protection Act, 1972 amendment 1991	This overarching Act provides protection to wild animals, birds, plants and matters connected with habitat protection, processes to declare protected areas, regulation of wildlife trade, constitution of state and national board for wildlife, zoo authority, tiger conservation authority, penalty clauses and other important regulations.	The Gumti Wildlife Sanctuary is located within 10 km from the end point of the road. The final ESZ notification no. 3663 dated 08.11.2019 of the sanctuary has been published. As per this notification the alignment is approx. 5.0 km away from the ESZ boundary and wildlife clearance is not applicable as project alignment does not fall in ESZ boundary. The other wildlife sanctuaries of Tripura that is Rowa, Sepahijala and Trishna are more than 10 km away from the proposed alignment. Therefore wildlife clearance is not applicable
Forest (Conservation) Act, 1980	The Forest (Conservation) Act prohibits the use of forest land for non-forest purposes without the approval of Ministry of Environment and Forests and Climate Change (MoEF&CC), Government of India	Forest land is required for project. The stage-1 clearance has already been obtained in section 1 and section 2 is under process.
Solid Waste Management Rules 2016	Responsibility of Solid Waste Generator (i) segregate and store the waste generated in three separate streams namely bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to	Contractor to follow all the rules during construction works.

	authorized waste pickers or waste collectors as per the direction or notification by the local authorities from time to time.	
Construction and Demolition Waste Management Rules 2016	(i) Every waste generator shall segregate construction and demolition waste and deposit at collection centre or handover it to the authorized processing facilities (ii) Shall ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains. (iii) Large generators (who generate more than 20 tons or more in one day or 300 tons per project in a month) shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or re-modeling work, (iv) Large generators shall have environment management plan to address the likely environmental issues from construction, demolition, storage, transportation process and disposal / reuse of C & D Waste. (v) Large generators shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar, Large generators shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities;	Contractor to follow all the rules during construction works.
Hazardous Waste Rules 2016	Responsibilities of the occupier for management of hazardous and other wastes.- (1) For the management of hazardous and other wastes, an occupier shall follow the following steps, namely:- (a) prevention; (b) minimization; (c) reuse, (d) recycling; (e) recovery.	Contractor to comply all the requirements of this Act during construction works.
International conventions and treaties		
Ramsar Convention, 1971	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. India is one of the signatories to the treaty. The Ramsar convention made it mandatory for the signatory countries to include wetland conservation in their national land use plans.	Not applicable to this project as not site within the vicinity of the project.
Wetlands (Conservation and	The Rules specify activities which are harmful and prohibited in the wetlands such as industrialization, construction, dumping	Not applicable as subprojects components are not located in designated wetland area.

Management) Rules, 2017	of untreated waste and effluents, and reclamation. The Central Government may permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	
Montreal Protocol 1992	India is a signatory of this convention which aims to reduction in the consumption and production of ozone-depleting substances (ODS), while recognizing differences in a nation's responsibilities. Ozone depleting substances are divided in two groups Chlorofluorocarbons (CFCs) and Hydro chlorofluorocarbons (HCFCs).	Not applicable in this project as no ODS are involved in construction works.
Basel Convention on Trans-boundary Movement of Hazardous Wastes, 1989	India is a signatory of this convention which aims to reduce trans-boundary movement and creation of hazardous wastes.	Contractor to follow the provisions of Hazardous Waste Rules 2016 for storage, handling, transport and disposal of hazardous waste emerged during construction works.
Convention on Migratory Species of Wild Animals (CMS), 1979 (Bonn convention)	CMS, also known as Bonn convention was adopted in 1979 and entered into force on 1 November 1983, which recognizes that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve terrestrial, marine and avian migratory species throughout their ranges. CMS Parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.	Not applicable to this project as no migratory species of wild animals are reported in the project areas.

2.2 Procedure for Forest Clearance

MOEFCC has initiated online submission and disposal of forest clearance cases. The detail procedure is available on ministry website http://forestsclearance.nic.in/. However, the work-flow is unchanged which has been illustrated in figure below (**Figure-2.1**). Steps and Procedure for Obtaining Borrow Area Permit and Applicable Indian Road Congress (IRC) Codes have been provided in Table 2.2 and 2.3 respectively.

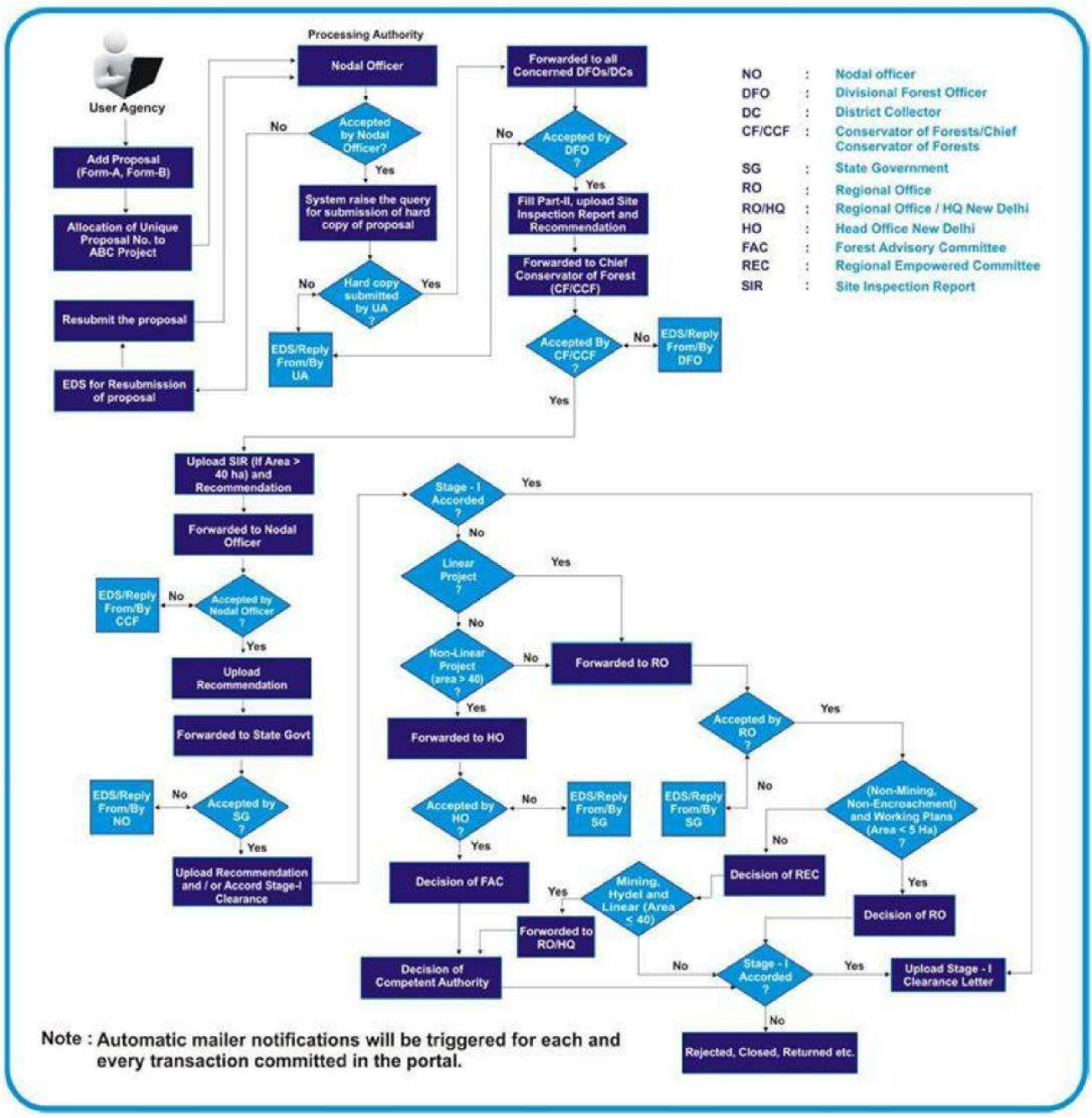


Figure 2.1: Procedure and Work Flow for Forest Clearance

Table 2.2: Steps and Procedure for Obtaining Borrow Area Permit

Steps	Activities
1	Contractor identifies the Borrow Area (BA) quantity based on prospective BA identified in F/S/DPR
2	Contractor identifies the Borrow pits with quantity and raise Request for Inspection (RFI) to IE/CSC.
3	IE/CSC inspects borrow pit in the presence of Environmental Engineer of contractor and land owner with his lease document.

4	Contractor takes the sampling of soil in identified pit and test in lab. IE/CSC approves the pit based on the test report (Moisture contents, particle size etc.)
5	Contractor makes the agreement with land owner and get NOC from Gram Panchayat if necessary
6	If BA is more than 5Ha (B1 category), contractor submit application for clearance to State Environment Impact Assessment Authority (SEIAA) the project is treated as B1 EIA and Public Hearing needs to be carried out.
7	If BA is < 5Ha (B2 category), contractor submit application in Form 1M, Prefeasibility report and approved mine plan to District Environment Impact Assessment Authority (DEISAA). DEIAA gives clearance base on the recommendation of District Environment Appraisal Committee (DEAC).
8	Contractor pays Royalty amount to state government at the prescribed rate.
9	Contractor submit Borrow Area Redevelopment plan to IE/CSC.
10	Contractor raise RFI to IE/CSC for Borrow pit excavation
11	Contractor fulfills the compliance of EC agency observations if any.
12	Contractor will maintain haul road and ensure for fugitive dust suppression
13	Contractor does sampling of each pit at the time of excavation test and gets approval of IE/CSC.
14	Contractor raises RFI to IE/CSC before closing the pit.
15	Contract reclaims borrow pit as per owner agreement and gets clearance from him.

Key Considerations prior to selection of Borrow Areas:

- Cluster shall be formed if the distance between peripheries of one lease to the other and is less than 500m in homogenous mineral area.
- Minimum distance between two clusters is 500 meters.
- Maximum depth of excavation 2000mm from existing ground level.
- In case of fertile land; 15 cm top soil is stock piled. Further up to max.30 cm depth.
- Maintain 5m distance from the toe of the final section of the road/Embankment.
- BA not to be dug within 1500 m of village. If unavoidable should not exceed 30 cm in depth.
- Ridges not less than 8m width shall be left an interval of not exceeding 300m.

Applicable Indian Road Congress (IRC) Codes to the Project Road: Key IRC guidelines have been summarized that have a direct/indirect bearing on the environmental management during design and construction stages.

Table 2.3: Applicable Indian Road Congress (IRC) Codes

S. No	Code Title/Theme	Code
1	Guidelines on requirement of environmental clearance for road projects	IRC:SP:93-2011 & IRC:SP:93-2017
2	Guidelines on Landscaping and tree plantation	IRC:SP: 21-2009
3.	Guidelines for EIA of Highway projects	IRC:104-1988
4.	Guidelines for Borrow area identification, use and its rehabilitation	IRC:10-1961
5	Guidelines for Pedestrian Facilities	IRC: 103 -1988
6.	Ribbon developments on highways and its prevention	IRC: SP: 1996
7.	Manual on Landscaping of road	IRC: SP: 21-1979

8.	Report on recommendations of IRC Regional workshops on highway safety	IRC: SP: 27-1984
9.	Road safety for Children (5-12 years old)	IRC: SP: 32-1988
10	Guidelines on road drainage	IRC: SP: 42-1994
11	Highway safety code	IRC: SP: 44-1994
12	Guidelines for safety in construction zones	IRC: SP: 55-2001
13	Recommended practice For treatment of embankment slopes and erosion control	IRC: 56-1974

2.3 JICA Guidelines and Indian Laws

Applicability of JICA's Guidelines for Environment and Social Considerations **(here in after, ESC)** is required if a project is funded by JICA. If a significantly adverse impact on the environment or society has been identified in JICA-assisted project, the following has to be thoroughly considered and studied. Table 2.4 below shows the comparison JICA Guideline and Laws in India regarding EIA.

Table 2.4: Gaps between JICA Guideline and Laws in India regarding ESC

No.	Items	JICA Guideline	Laws in India	Principle for this Project
1	ESC requirement	ESCs are pre-requisite and integratedly discussed in JICA guidelines. JICA will take necessary measures to ensure that the appropriate ESC is given; When JICA reviews a project proposal and finds that the project could cause negative impacts on the environment or society, JICA advises the project proponents to provide appropriate ESC;	Separately discussed in each constitution, law, standard.	Compliance with JICA guidelines, the national constitution, law, standards will be referred and ensured.
		Environmental and social surveys at the EIA level (Category A projects) Proposed projects likely to have significant adverse impacts on the environment and society. Category A includes projects in sensitive sectors (ex. Roads, railways, and bridges), projects that have characteristics that are liable to cause adverse environmental impacts (ex. Large-scale	EAI notification of 2006 (Category A projects) i) New National Highways ii) Expansion of National Highways greater than 100km involving an additional right of way or land acquisition greater than 40m on the existing alignments and 60m on re-alignments and bypasses. Projects whose	EIA will be prepared as category A in accordance

2	Requirement of EIA	involuntary resettlement), and projects located in or projects) Projects whose potential adverse impacts on the environment and society are less adverse than those of Category A projects.	requirements of EIA are judged by the state level Environment Impact Assessment Authority (Category B projects) i) State Highway ii) State highway Expansion projects in hilly terrain (above 1,000 m AMSL) and or ecologically sensitive areas	with JICA Guidelines though not required by Laws in India
3	Scope of Impacts to Be Assessed	In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent.	Factors which could lead to environmental effects or the potential for cumulative impacts shall be identified. Indirect impacts on the avifauna of the area shall be examined.	Derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined.
4	Avoid Adverse effects	Priority should be given to the avoidance of adverse impacts on the environment or society when a project is planned; Minimization or mitigation of impacts should be considered only if avoidance is not feasible and if the benefit of the project outweighs the cost of mitigation measures; The project proponents must assess the environmental and social impacts at the earliest possible stage of planning, and implement ESC measures in accordance with the ESC Guidelines.	Separately discussed in each constitution, law, standard.	The national and international laws and standards will be referred and ensured.
5	Stakeholder meetings/ Public consultation	Stakeholder meetings shall be held at the stages of the scoping draft and report draft.	Public consultation shall be conducted after submission of draft report.	To hold Stakeholder meetings at the stages of scoping draft and report draft.

6	Disclosure of EIA	EIA reports are required to be made available to local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents; and copying must be permitted.	MOEF&CC shall display the Summary of the draft EIA report on its website, and also make the full draft EIA available for reference at a notified place during normal office hours at the Ministry in Delhi.	To disclose EIA in accordance with JICA Guidelines.
7	Certificate regarding the environment and society	If the project requires a certificate other than an EIA regarding the environment and society, indicate the title of said certificate and confirm the approval.	Forest Clearance will be required. The Contractor has to obtain permits from MSPCB for setting up hot-mix plants, batching plants, etc., under the Air and the Water Acts, whose results shall be reported to the Project proponents.	To confirm requirement of permits in accordance with the laws in India.
8	Monitoring	available to local project stakeholders.	Project proponents are required to submit environmental management plan & monitoring programme. It shall be mandatory for the project management to submit every half a year compliance reports in respect to the stipulated prior environmental clearance terms and conditions.	To implement environmental monitoring in accordance with the laws in India.

9	Human rights	Development project should aim for fair distribution of its benefits and must not burden or exclude certain stakeholders for the sake of others; The project proponents must respect the rights of all people concerned, and pay special attention to vulnerable social groups such as women, elderly, the poor, people with disabilities, indigenous peoples, ethnic minorities, and other minority groups to ensure that they are involved in decision-making processes and that they benefit from the project It defines 'stakeholders' as local residents including non-titleholders who are affected by the project as well as local NGOs. By involving local stakeholders from the early stage of the project, the project proponents can receive their inputs and plan appropriate measures to address their concerns, avoid conflict, and achieve higher results with their support. For this reason, the project proponents should conduct a series of consultations with local stakeholders in an interactive and meaningful manner. During this process, appropriate consideration must be given to socially vulnerable or different people such as women, children, the elderly and ethnic minorities.	Six fundamental human rights in Indian Constitution. Rights Vulnerable social groups such as women, elderly, the poor, people with disabilities are covered. Regarding indigenous peoples, ethnic minorities, and other minority groups TTAADC will cover the situation.	To ensure human rights should be properly protected throughout the project period according as the national standards.

Source: EIS

3. PROJECT DESCRIPTION

3.1 Location of the Project

The proposed road alignment from Khowai to Sabroom is divided in to 2 section i.e Khowai to Teliamura (Section 1) and Teliamura to Sabroom (Section 2). The Section 1 of proposed project transverses from 24°2'59.45"N 91°36'40.85"E (near Khowai town) to 23°50'21.88"N 91°37'36.12"E at NH-44 near Teliamura and Section 2 start from 23°49'45.03"N 91°37'50.10"E near Teliamura and Ends at 23° 2'26.16"N 91°40'10.92"E at Harina near Sabroom. The project road has designed length of 134.71km having started CH 101+200 & end at CH 127+300 for section 1 and section 2 start from CH 0+000, ends at CH 108+670. Both sections is a part of the NH-208. The project road runs through Khowai, Gomati and South Tripura districts of Tripura. The project road passes through village / localities namely, Khowai, Kalyanpur, Twidu, Sonacherra, Amarpur, Nutan Bazar, Karbook, Ailmara, Khedacherri, Ropaichari and ends at Harina (T-Junction with NH-08). Sabroom is 8.1 km away from Harina junction. The Project road runs parallel to the International border (India – Bangladesh) in some of its length.

3.2 Need of the Project Road

Poor road infrastructure of Tripura, both in terms of its network connectivity and riding quality, is an important factor constraining the development of the state despite its vast potential. Proposed road will be a vital link to connect existing national highway (NH-44) with nearby areas of the three project districts besides connecting significant rural population. This will resuscitate the local economy and help local people to be part of main stream society. Horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves are found at many locations causing discomfort to the drivers in most of the stretch of the alignment.

3.3 Characteristics of Exiting Road

The project road passes through rolling and hilly terrain with a considerable part of the road passing through settlement areas. The existing road also passes through agriculture land, barren land, residential/commercial establishments, public utilities such as schools, health care centres & other government offices etc. The existing road also passes through forest area for considerable portion. The existing road has general carriage way varied from 3.5m to 7.5m. Pavement condition is below average with presence of pot holes, raveling, rutting and patching is observed on the pavement surface. Existing project road is passing through numbers of schools, health centers, veterinary centre, panchayat offices and religious structures.

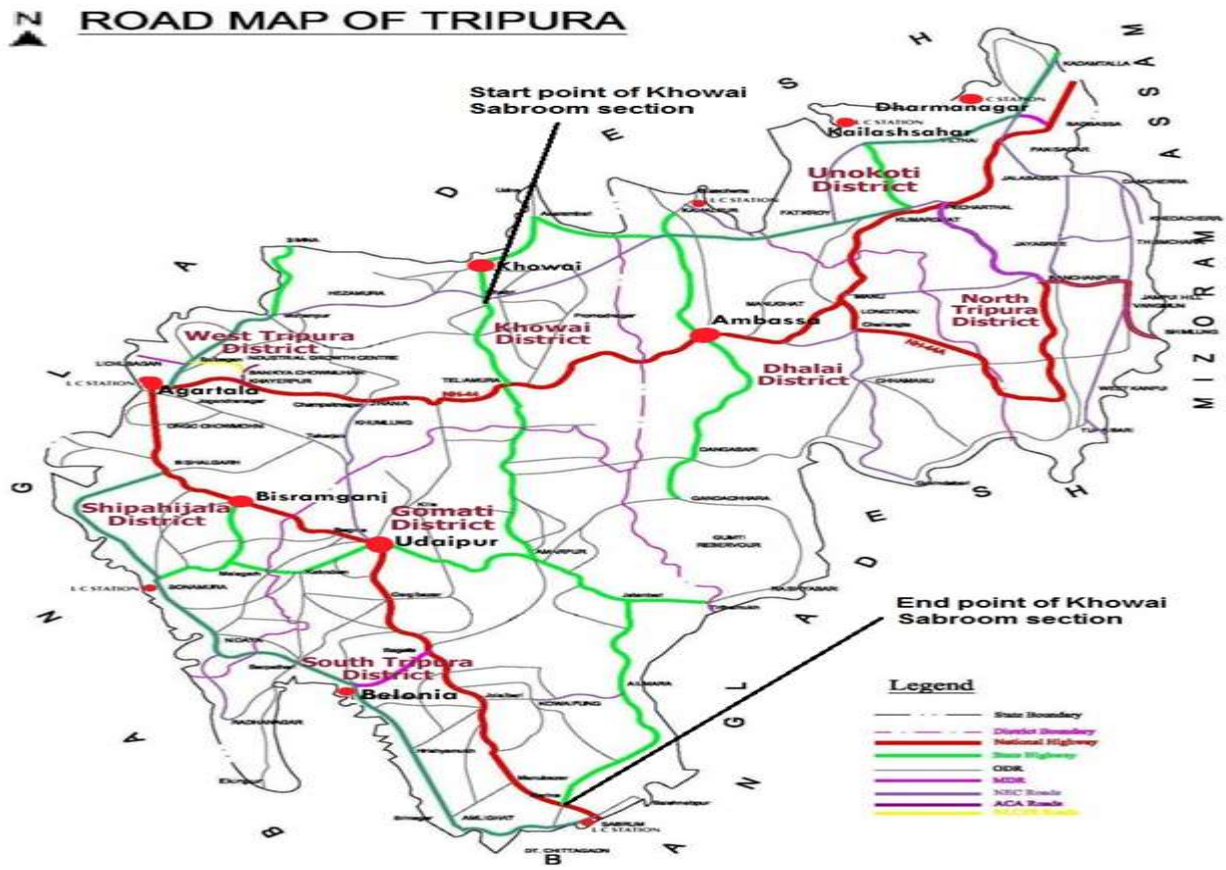
3.4 Study of Alternate Options

A comparative analysis of various alternatives considered to avoid, prevent or minimize impacts that would be inevitable if technically (based on design speed and geometrics) best-fit alignment is followed. The consideration of alternatives to a proposal is a requirement of the EIA report. During the scoping process, alternatives to a proposal can be generated or refined, either directly or by reference to the key issues identified. A comparative analysis of the alternatives will help to determine the best method

of achieving project objectives while minimizing environmental and social impacts. Four options have been selected to decide the final alignment, these three options are:-

1. Without Plan: No project intervention is implemented i.e. transportation by present roads is continued to be used.
2. The selected option: The option is used for this EIA impact study
3. Another option with some curve correction and alternative bypass using some of the existing alignment.
4. Others options (widening options): The option is to widen the existing road to the level of the planned road.

Figure 3.1 shows the existing road network covering National Highway (NH), State Highway (SH), Major District Roads (MDR) and Other District Roads (ODR) in Tripura. The present section is a part of newly declared NH- 208 (earlier known as NH- 44).



Source: Tripura.gov.in

Figure 3.1 Road Network in Tripura

3.4.1 Alternative Analysis

(1) Comparison with & without Project Scenario

In the state of Tripura, the traffic load on existing roads are increasing rapidly and likely to be doubled in next 10 years. The 'With' and' without' project scenarios are analysed with this backdrop of requirement of reliable quality infrastructure for sustained growth of state's economy and consequent well-being of its citizens.

The project will have multiple benefits. The project will unlock the potential of development of the area and fast connectivity. This project will also reduce the travel time substantially and it is expected that the journey from Khowai to Sabroom reduced to 50-60 minutes. In addition this project road will provide further other benefits like:

- Transporting, processing and marketing of agricultural products;
- Fast and safe connectivity resulting in saving in fuel, travel time and Total Transportation Cost to the Society;
- Better approach to Medical & Educational services and quick transportation of Perishable goods like fruits, Vegetables and Dairy products;
- Reduction in accidents;
- Reduction in pollution;
- Employment opportunities to people;
- Development of local industry, agriculture and handicrafts;
- Opening of opportunities for new occupations;
- Providing better connectivity will ensure that goods and people from areas covered by the road can move in and out of the areas quicker and save time. Increased trade and commerce activity are expected.

Accounting just for the savings in the Vehicle Operating Costs makes the project viable. However, there would be an increase in the vehicular pollution-air and noise, in the vicinity of the highway. Some agricultural land will have to be diverted for road use to widen and realignments planned. This construction will result in loss of private properties and loss of living. If the project is not implemented, the area will keep the rural landscapes of the croplands and forest land, so this is the positive environmental effects for without project option. However, there are a lot of negative environmental effects for without project option. There is a likelihood that the roads presently carrying the traffic between Khowai-Sabroom Road will deteriorate further and rampant traffic disruptions will hinder the free flow of the traffic. In the absence of the project, the road agencies responsible for construction and maintenance of NH-208 will also find it extremely difficult to generate funds for such a massive improvement of the road infrastructure from their own resources. Increased air pollution, due to slow moving traffic and congestion, will follow suit. Noise levels in built up portions will rise due to deterioration of the pavement as well as increased honking.

Therefore, "With" project scenario, with its minor adverse impacts is more acceptable than the "Without" project scenario which would mean an aggravation of the existing problems. The potential benefits of the proposed road improvements are substantial and far- reaching both in terms of the geographical spread and time. Hence, it is clear that the implementation of the project will be a definite advantage to State of Tripura in order to achieve all-round development of its economy and progress of its people.

(2) Alternative Analysis

The criteria for selecting the preferred Alignment based on alternative alignment study are:

- Design Speed: The proposed alignment should maintain design speed between 80-100 kmph.
- Riding Comfort: The proposed alignment is such that passengers of the vehicle feel comfort while traveling through the proposed Road.
- Land Acquisition: Minimum land to be acquired with maximum avoidance of involuntary resettlement. Try to acquire Govt. land as much as possible and minimum acquisition of existing structures has been used for fixation of proposed alignment.
- Social Impact & Severance: The proposed alignment has minimized effect upon the existing structures which minimizes the resettlement and rehabilitation impact of that locality.
- Cost Effectiveness: The Project cost consisting of Civil construction Cost, LA & resettlement and rehabilitation Utility Shifting cost of the proposed alignment has been kept minimal.
- Safety: The proposed alignment has been prepared in such a way that it requires minimum safety hazards along its entire length.
- Environment: Lost Forest land Expected Pollution

(A). Alternative Alignment Option Study forTeliamura Bypass

The overview of all the seven alternatives along with features of the alternative plan is described in table 3.1 to 3.7 and figure 3.2 to 3.8.

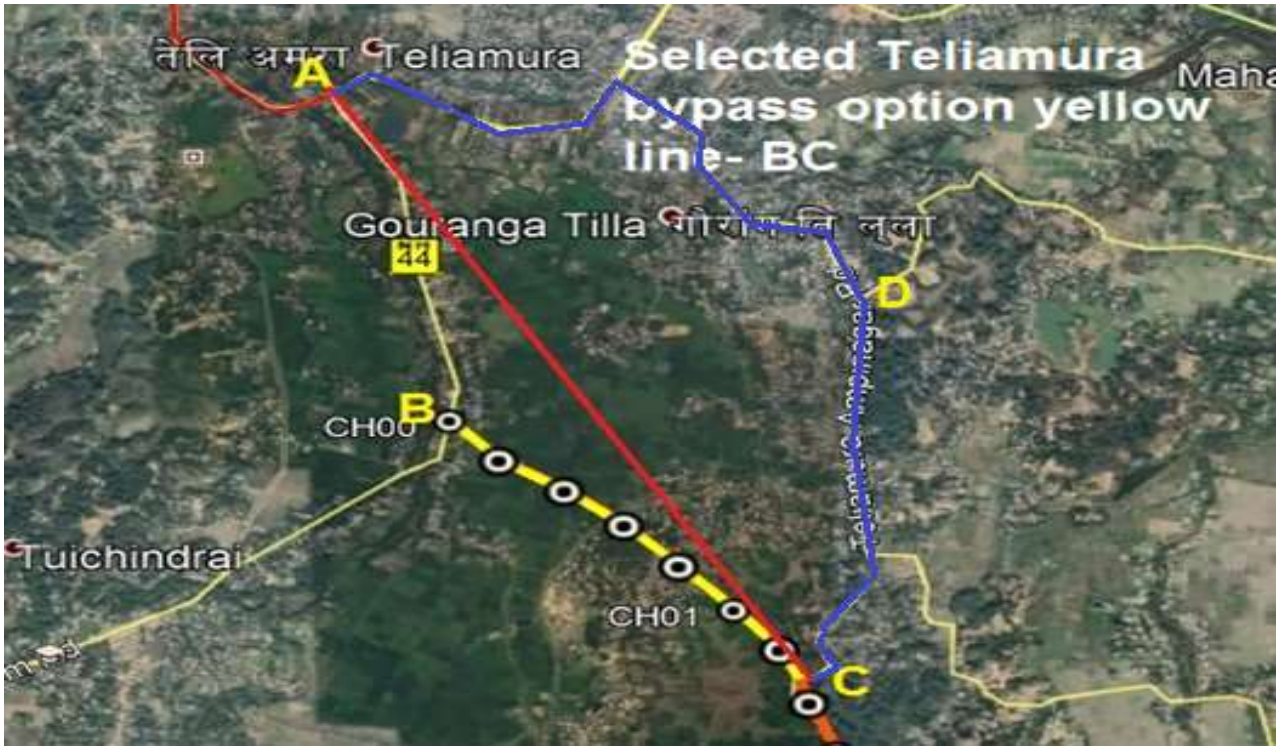


Figure 3.2: GIS image of Alternative Alignment Option Study for Teliamura Bypass

Options	Symbol	Node	Length (km)

Option 1		A-D-C	3.4
Option 2		A-C	2.45
Option 3		B-C	1.3

Table 3.1 Teliamura Bypass analysis

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
1	Design Speed	60 to 80 Kmph	100 Kmph	100 Kmph
2	Total Length	3.4 km	2.45 km	1.3 km
3	Land Acquisition (Ha)	9.1	9.5	4.9
4	Description of alignment	Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines	This option has shortest connectivity from A to C.	Selected bypass will improve the horizontal geometry and eliminate the reverse curves, it also use existing alignment from A to B which is already two lane .
5	Environment-Lost Forest land	No forest land diversion. Approximately 210 number of trees to be cut.	No forest land diversion. Approximately 97 number of trees to be cut.	No forest land diversion. Approximately 54 number of trees to be cut.
6	Environment-Expected Pollution	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.
7	Social Impact and R&R	Nearly 197 nos. structures are affected	Nearly 70 nos. structures are affected	Nearly 37 nos. structures are affected
8	Affected Family	Nearly 118 nos. Families are affected	Nearly 42 nos. Families are affected	Nearly 22 nos. Families are affected
8	Structures and Protective Works	12 nos. box culverts are required.	3 nos. box culverts are required.	4 nos. box culverts are required.
9	Civil Cost*	-	-	-
10	resettlement and rehabilitation & LA Cost*	-	-	-
11	Total Cos*t Including resettlement and rehabilitation and LA	-	-	-
12	Utility Shifting Cost*	-	-	-

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
13	Result			✔
14	Comment	• More nos. of structures and family are affected as compare to option 2 & 3 • More nos. of trees are affected as compare to option 2 & 3 • Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines such as minimum radius of horizontal curves, super elevation, design speed as terrain varies from plain, rolling and hilly due to poor geometry, sharp curves etc. of existing road.	• More nos. of structures and family are affected as compare to option 3 • More nos. of trees are affected as compare to option 3 • The overall length of AC is more as compared to selected option BC, therefore more resettlement and land acquisition impacts.	• Less nos. of structures and family are affected as compare to option 1 & 2 • Less nos. of trees are affected as compare to option 1 & 2 • The AB has already 2 lane road therefore can be used. • Selected bypass will improve the horizontal geometry and eliminate the reverse curves.

* This is under process and will be done after finalization of land acquisition plan

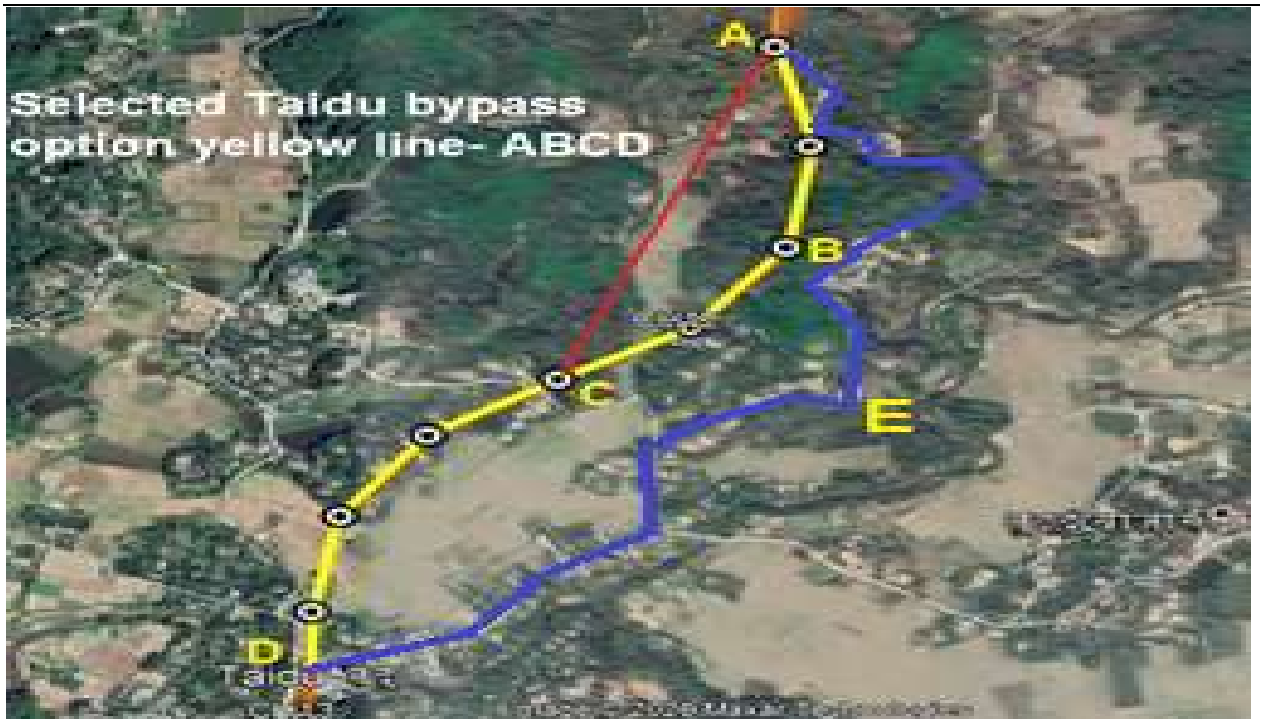


Figure 3.3: GIS image of Alternative Alignment Option Study for Taidu Bypass

Options	Symbol	Node	Length (km)
Option 1		A-E-D	2.0
Option 2		A-C-D	1.4
Option 3		A-B-C-D	1.54

Table 3.2 Taidu Bypass analysis

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
1	Design Speed	60 to 80 Kmph	100 Kmph	100 Kmph
2	Total Length	2.0 km	1.4 km	1.54 km
3	Land Acquisition (Ha)	7.2	6.3	6.9
4	Description of alignment	Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines	This option is initially considered due to shortest length as compared to select option ABCD	Selected bypass will improve the horizontal geometry and eliminate the reverse curves.
5	Environment-Lost Forest land	4.2 ha forest land diversion is required. Approximately 212 number of trees to be cut.	3.5 ha forest land diversion is required Approximately 146 number of trees to be cut.	2.6 ha forest land diversion is required. Approximately 120 number of trees to be cut.
6	Environment-Expected Pollution	During construction & Operation phase both air, water, noise &	During construction & Operation phase both air, water, noise &	During construction & Operation phase both air, water, noise &

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
		vibration pollution will be a concern.	vibration pollution will be a concern.	vibration pollution will be a concern.
7	Social Impact and R&R	Nearly 62 nos. of structures are affected	Nearly 26 nos. of structures are affected	Nearly 20 nos. of structures are affected
8	Affected Family	Nearly 47 nos. Families are affected	Nearly 18 nos. Families are affected	Nearly 12 nos. Families are affected
8	Structures and Protective Works	9 nos. box culverts are required.	6 nos. box culverts are required.	5 nos. box culverts are required.
9	Civil Cost*	-	-	-
10	resettlement and rehabilitation & LA Cost*	-	-	-
11	Total Cos*t Including resettlement and rehabilitation and LA	-	-	-
12	Utility Shifting Cost*	-	-	-
13	Result			✔
14	Comment	• More nos. of structures and family are affected as compare to option 2 & 3 • More nos. of trees are affected as compare to option 2 & 3 • Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines such as minimum radius of horizontal curves, super elevation, design speed as terrain varies from plain, rolling and hilly	• More nos. of structures and family are affected as compare to option 3 • More nos. of trees are affected as compare to option 3 • This option is initially considered due to shortest length as compared to select option ABCD but rejected due to major water body is impacted.	• Less nos. of structures and family are affected as compare to option 1 & 2 • Less nos. of trees are affected as compare to option 1 & 2 • Selected bypass will improve the horizontal geometry and eliminate the reverse curves.

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
		due to poor geometry, sharp curves etc. of existing road.		

* This is under process and will be done after finalization of land acquisition plan

Figure 3.4: GIS image of Alternative Alignment Option Study for Ompi nagar Bypass

Options	Symbol	Node	Length
Option 1		A-E-D	3.9
Option 2		A-B-D	2.8
Option 3		A-C-D	2.75

Table 3.3 Ompi nagar Bypass analysis

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
1	Design Speed	60 to 80 Kmph	100 Kmph	100 Kmph
2	Total Length	3.9 km	2.8 km	2.75 km
3	Land Acquisition (Ha)	13.6	12.6	12.4
4	Description of alignment	Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines	Length is more as compare to selected option ACD	Selected bypass will improve the horizontal geometry and eliminate the reverse curves.

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
5	Environment-Lost Forest land	7.2 ha forest land diversion is required. Approximately 873 number of trees to be cut.	6.9 ha forest land diversion is required. Approximately 690 number of trees to be cut.	6.33 ha forest land diversion is required. Approximately 540 number of trees to be cut.
6	Environment-Expected Pollution	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.
7	Social Impact and R&R	Nearly 132 nos. of structures are affected	Nearly 74 nos. of structures are affected	Nearly 38 nos. of structures are affected
8	Affected Family	Nearly 85 nos. Families are affected	Nearly 37 nos. Families are affected	Nearly 14 nos. Families are affected
8	Structures and Protective Works	4 nos. of major bridges and 10 nos. box culverts are required.	5 nos. of major bridges and 8 nos. box culverts are required.	3 nos. of major bridges and 7 nos. box culverts are required.
9	Civil Cost*	-	-	-
10	resettlement and rehabilitation & LA Cost*	-	-	-
11	Total Cos*t Including resettlement and rehabilitation and LA	-	-	-
12	Utility Shifting Cost*	-	-	-
13	Result			✔
14	Comment	• More nos. of structures and family are affected as compare to option 2 & 3 • More nos. of trees are affected as compare to option 2 & 3 • Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and	• More nos. of structures and family are affected as compare to option 3 • More nos. of trees are affected as compare to option 3 • This option is rejected as length is more as compare to selected option ACD. Village houses and one community	• Less nos. of structures and family are affected as compare to option 1 & 2 • Less nos. of trees are affected as compare to option 1 & 2 • Selected bypass will improve the horizontal geometry and eliminate the reverse curves.

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
		Highways (MoRTH) Guidelines such as minimum radius of horizontal curves, super elevation, design speed as terrain varies from plain, rolling and hilly due to poor geometry, sharp curves etc. of existing road.	structure is getting impacted.	

* This is under process and will be done after finalization of land acquisition plan

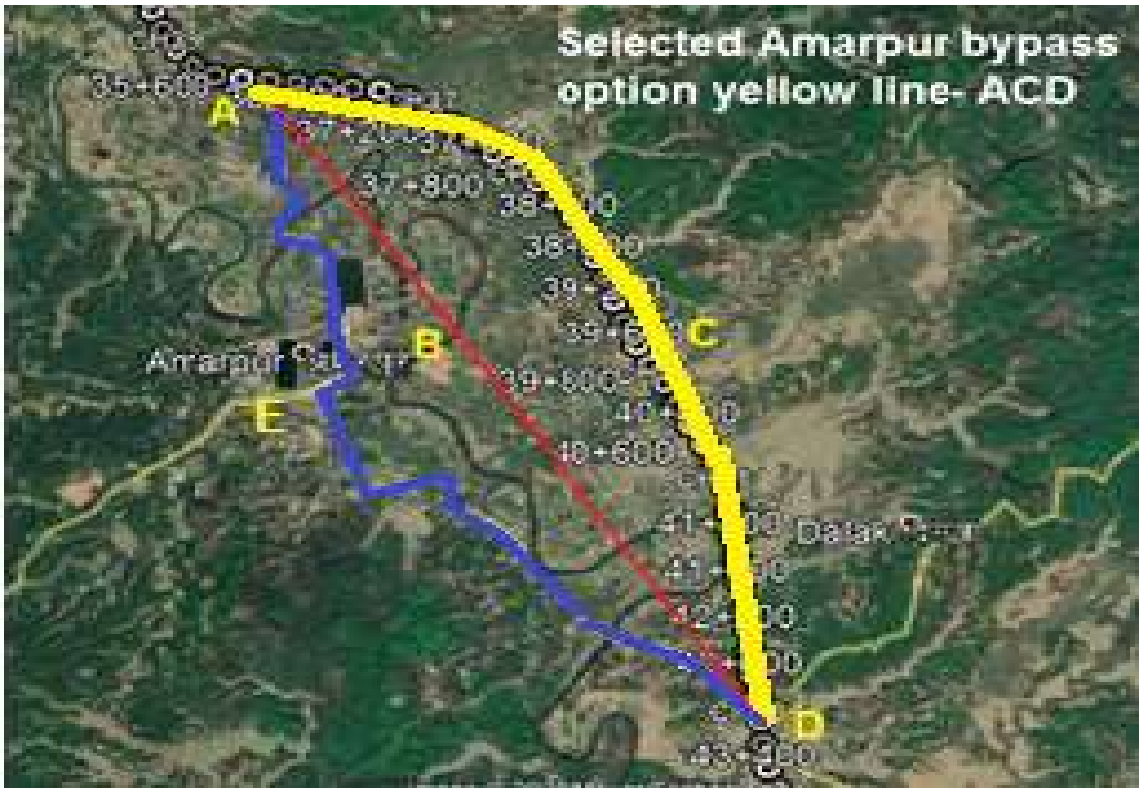


Figure 3.5: GIS image of Alternative Alignment Option Study for Amarpur Bypass

Options	Symbol	Node	Length (km)
Option 1		A-E-D	8.2
Option 2		A-B-D	6.7
Option 3		A-C-D	7.5

Table 3.4 Amarpur Bypass analysis

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
1	Design Speed	60 to 80 Kmph	100 Kmph	100 Kmph
2	Total Length	8.2 km	6.7 km	7.5 km
3	Land Acquisition (Ha)	28.7	30.2	33.8
4	Description of alignment	Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines	The option ABD has shortest length and crosses river at six locations	Selected bypass will improve the horizontal geometry and eliminate the reverse curves.
5	Environment-Lost Forest land	No forest land diversion. Approximately 2162 number of trees to be cut.	No forest land diversion. Approximately 1235 number of trees to be cut.	No forest land diversion. Approximately 810 number of trees to be cut.
6	Environment-Expected Pollution	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.
7	Social Impact and R&R	Nearly 247 nos. of structures are affected	Nearly 210 nos. of structures are affected	Nearly 114 nos. of structures are affected
8	Affected Family	Nearly 148 nos. Families are affected	Nearly 122 nos. Families are affected	Nearly 67 nos. Families are affected
8	Structures and Protective Works	20 nos. box culverts are required	3 no. of minor bridges and 8 nos. of major bridges and 20 nos. box culverts are required.	1 no. of minor bridges and 5 nos. of major bridges and 23 nos. box culverts are required.
9	Civil Cost*	-	-	-
10	resettlement and rehabilitation & LA Cost*	-	-	-
11	Total Cos*t Including resettlement and rehabilitation and LA	-	-	-
12	Utility Shifting Cost*	-	-	-
13	Result			✔
14	Comment	• More nos. of structures and family are affected as	• More nos. of structures and family are affected as compare to option 3	• Less nos. of structures and family are affected as

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
		compare to option 2 & 3 • More nos. of trees are affected as compare to option 2 & 3 • Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines such as minimum radius of horizontal curves, super elevation, design speed as terrain varies from plain, rolling and hilly due to poor geometry, sharp curves etc. of existing road.	• More nos. of trees are affected as compare to option 3 • The option ABD is selected initially due to shortest length but rejected as it crosses river at six locations and more impact on water bodies due to construction of six bridges moreover cost will also be very high.	compare to option 1 & 2 • Less nos. of trees are affected as compare to option 1 & 2 • Selected bypass will improve the horizontal geometry and eliminate the reverse curves.

* This is under process and will be done after finalization of land acquisition plan

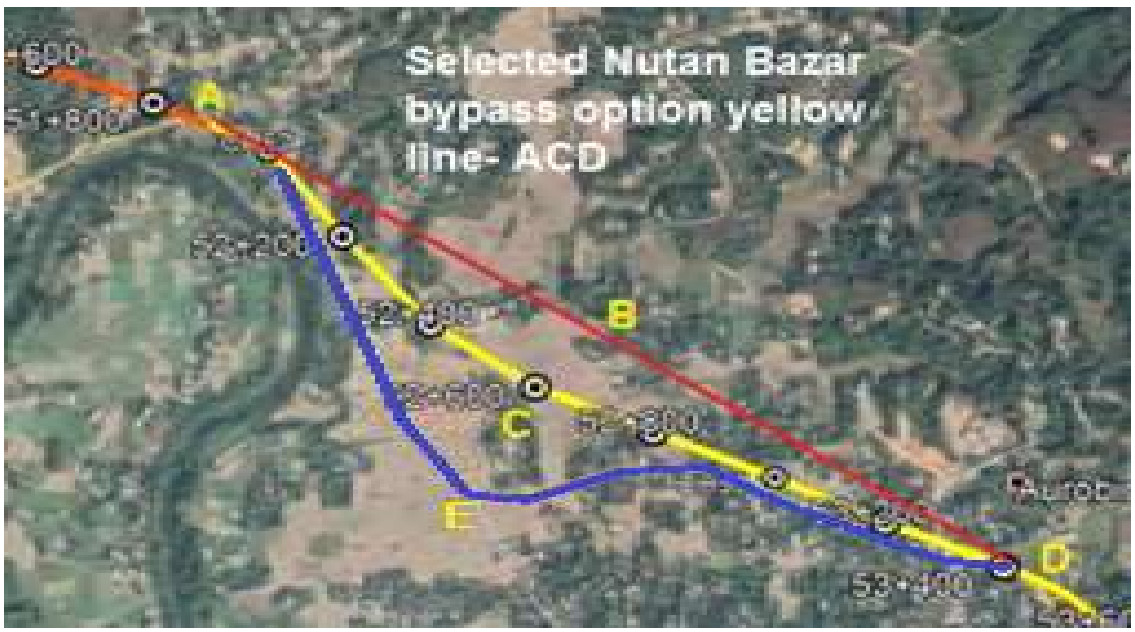


Figure 3.6: GIS image of Alternative Alignment Option Study for Nutan Bazar Bypass

Options	Symbol	Node	Length (km)

Option 1		A-E-D	1.7
Option 2		A-B-D	1.3
Option 3		A-C-D	1.6

Table 3.5 Nutan Bazar Bypass analysis

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
1	Design Speed	60 to 80 Kmph	100 Kmph	100 Kmph
2	Total Length	1.7 km	1.3 km	1.6 km
3	Land Acquisition (Ha)	2.9	4.1	5.0
4	Description of alignment	Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines	The option ABD has shortest length and residential settlements is very high along this alignment.	Selected bypass will improve the horizontal geometry and eliminate the reverse curves.
5	Environment-Lost Forest land	No forest land diversion. Approximately 190 number of trees to be cut.	No forest land diversion. Approximately 154 number of trees to be cut.	No forest land diversion. Approximately 98 number of trees to be cut.
6	Environment-Expected Pollution	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.
7	Social Impact and R&R	Nearly 48 nos. of structures are affected	Nearly 42 nos. of structures are affected	Nearly 30 nos. of structures are affected
8	Affected Family	Nearly 28 nos. Families are affected	Nearly 24 nos. Families are affected	Nearly 15 nos. Families are affected
8	Structures and Protective Works	7 nos. box culverts are required	1 no. of minor bridge and 4 nos. box culverts are required.	1 no. of major bridge and 5 nos. box culverts are required.
9	Civil Cost*	-	-	-
10	resettlement and rehabilitation & LA Cost*	-	-	-
11	Total Cos*t Including resettlement and rehabilitation and LA	-	-	-
12	Utility Shifting Cost*	-	-	-

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
13	Result			✔
14	Comment	• More nos. of structures and family are affected as compare to option 2 & 3 • More nos. of trees are affected as compare to option 2 & 3 • Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines such as minimum radius of horizontal curves, super elevation, design speed as terrain varies from plain, rolling and hilly due to poor geometry, sharp curves etc. of existing road.	• More nos. of structures and family are affected as compare to option 3 • More nos. of trees are affected as compare to option 3 • This option is initially selected due to shortest length however rejected later as number of residential settlements is more along this alignment.	• Less nos. of structures and family are affected as compare to option 1 & 2 • Less nos. of trees are affected as compare to option 1 & 2 • Selected bypass will improve the horizontal geometry and eliminate the reverse curves.

* This is under process and will be done after finalization of land acquisition plan

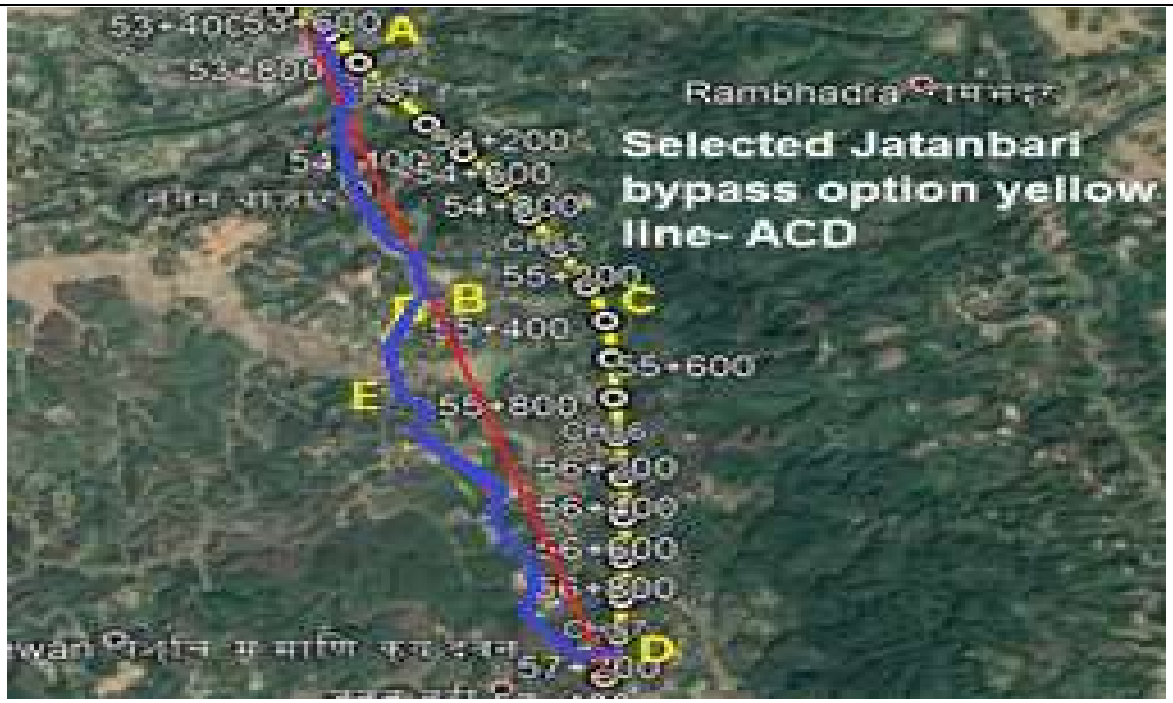


Figure 3.7: GIS image of Alternative Alignment Option Study for Jatanbari Bypass

Options	Symbol	Node	Length (km)
Option 1		A-E-D	4.0
Option 2		A-B-D	3.4
Option 3		A-C-D	3.7

Table 3.6 Jatanbari Bypass analysis

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
1	Design Speed	60 to 80 Kmph	100 Kmph	100 Kmph
2	Total Length	4.0 km	3.4 km	3.7 km
3	Land Acquisition (Ha)	14.0	15.3	16.7
4	Description of alignment	Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines	This option has shortest length and also it is very close to the existing road however there are residential and commercial settlements along the road	Selected bypass will improve the horizontal geometry and eliminate the reverse curves.
5	Environment-Lost Forest land	1.2 ha forest land diversion is required Approximately 1275 number of trees to be cut.	1.82 ha forest land diversion is required Approximately 1120 number of trees to be cut.	1.67 ha forest land diversion is required. Approximately 980 number of trees to be cut.

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
6	Environment-Expected Pollution	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.
7	Social Impact and R&R	Nearly 134 nos. of structures are affected	Nearly 115 nos. of structures are affected	Nearly 72 nos. of structures are affected
8	Affected Family	Nearly 80 nos. Families are affected	Nearly 68 nos. Families are affected	Nearly 35 nos. Families are affected
8	Structures and Protective Works	8 nos. box culverts are required	1 no. of minor bridge, 2 nos. of major bridge and 14 nos. box culverts are required.	2 nos. of major bridge and 11 nos. box culverts are required.
9	Civil Cost*	-	-	-
10	resettlement and rehabilitation & LA Cost*	-	-	-
11	Total Cos*t Including resettlement and rehabilitation and LA	-	-	-
12	Utility Shifting Cost*	-	-	-
13	Result			✔
14	Comment	• More nos. of structures and family are affected as compare to option 2 & 3 • More nos. of trees are affected as compare to option 2 & 3 • Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines such as minimum radius of	• More nos. of structures and family are affected as compare to option 3 • More nos. of trees are affected as compare to option 3 • This option is initially selected due to shortest length and also it is very close to the existing road however due to extended residential and commercial settlements of Nutan Bazar and Jatanbari	• Less nos. of structures and family are affected as compare to option 1 & 2 • Less nos. of trees are affected as compare to option 1 & 2 • Selected bypass will improve the horizontal geometry and eliminate the reverse curves.

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
		horizontal curves, super elevation, design speed as terrain varies from plain, rolling and hilly due to poor geometry, sharp curves etc. of existing road.	bypass, this option is not viable.	

* This is under process and will be done after finalization of land acquisition plan

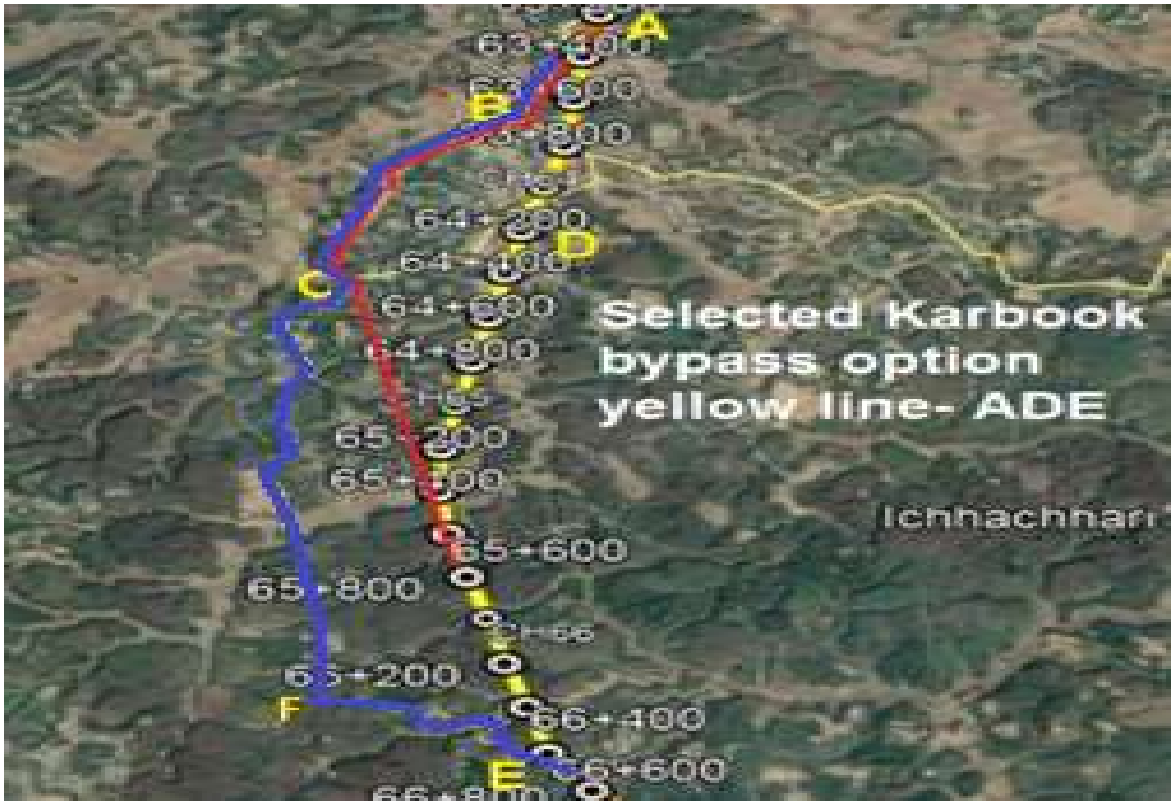


Figure 3.8: GIS image of Alternative Alignment Option Study for Karbook Bypass

Options	Symbol	Node	Length (km)
Option 1		A-B-C-F-E	4.3
Option 2		A-B-C-E	3.6
Option 3		A-D-E	3.3

Table 3.7 Karbook Bypass analysis

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
1	Design Speed	60 to 80 Kmph	100 Kmph	100 Kmph
2	Total Length	4.3 km	3.6 km	3.3 km
3	Land Acquisition (Ha)	14.8	16.2	15.0
4	Description of alignment	Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines	This option utilize existing road from point A to C	Selected bypass will improve the horizontal geometry and eliminate the reverse curves.
5	Environment-Lost Forest land	No forest land diversion. Approximately 1047 number of trees to be cut.	No forest land diversion. Approximately 782 number of trees to be cut.	No forest land diversion. Approximately 526 number of trees to be cut.
6	Environment-Expected Pollution	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.	During construction & Operation phase both air, water, noise & vibration pollution will be a concern.
7	Social Impact and R&R	Nearly 138 nos. of structures are affected	Nearly 102 nos. of structures are affected	Nearly 57 nos. of structures are affected
8	Affected Family	Nearly 86 nos. Families are affected	Nearly 67 nos. Families are affected	Nearly 28 nos. Families are affected
8	Structures and Protective Works	4 nos. of minor bridge and 14 nos. box culverts are required.	3 nos. of minor bridge and 10 nos. box culverts are required.	3 nos. of minor bridge and 8 nos. box culverts are required.
9	Civil Cost*	-	-	-
10	resettlement and rehabilitation & LA Cost*	-	-	-
11	Total Cos*t Including resettlement and rehabilitation and LA	-	-	-
12	Utility Shifting Cost*	-	-	-
13	Result			✔
14	Comment	• More nos. of structures and family are affected as compare to option 2 & 3	• More nos. of structures and family are affected as compare to option 3	• Less nos. of structures and family are affected as compare to option 1 & 2

S. No.	Design, Safety & other Parameters	Alignment Option- 1 (follows existing alignment)	Alignment Option –2 (Red alignment: the discarded bypass)	Alignment Option – 3 (Yellow alignment: the selected bypass)
		• More nos. of trees are affected as compare to option 2 & 3 • Project road widening will not follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines such as minimum radius of horizontal curves, super elevation, design speed as terrain varies from plain, rolling and hilly due to poor geometry, sharp curves etc. of existing road.	• More nos. of trees are affected as compare to option 3 • This option is selected to utilize existing road from point A to C. however finally rejected due to the following reasons: – The selected option ADE is having lesser length. – Nos. of sharp curves are more in option ABCE.	• Less nos. of trees are affected as compare to option 1 & 2 • Selected bypass will improve the horizontal geometry and eliminate the reverse curves.

* This is under process and will be done after finalization of land acquisition plan

Source: EIS and DPR

3.4.2 Conclusion:

Without Plan has been ruled out as present road is not able to withstand increased traffic & safety norms. The widening option (Option 1) of existing road (163 km) was also not feasible due to its geometric design, R&R issues, socioeconomic viability, environmental & road safety aspects. The initial site visit and detailed ground reconnaissance revealed that by and large the selected alignment having less/minor effect on environmental and social components is acceptable. The new alignment (Option 3, length 134.71 km) was selected after finalization of various options such as realignments, keeping in view objectives of the project, traffic condition, obligatory points, geometric designs, congestions and socioeconomic viability, environmental & road safety aspects. The Option 3 is better than Option 2 (140.28) by making the shorter bypass and less resettlement.

3.5 Development/Improvement Proposals

Project road improvement will broadly follow IRC: SP: 73-2007 and Ministry of Road Transport and Highways (MoRTH) Guidelines. It will be of 7m width carriageway with paved shoulder of 1.5m in rural/hilly. Footpath with cover drain has been proposed in built up area & Brick Masonry drain has been proposed on hill side for proper drainage purpose. Design criteria adopted for the project along with silent features is summarized in Table 3.8.

Table 3.8: Design Standards and silent features of the project

1.	Project	Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208 (Designed Length 134.71 km)
2.	Location of the proposed project	The proposed road alignment from Khowai to Sabroom is divided in to 2 section i.e Khowai to Teliamura (Section 1) and Teliamura to Sabroom (Section 2).
3.	Total Length of the proposed project	134.71 km
4.	Terrain	Plain, rolling and hilly
5.	Seismic Zone	Zone V
6.	Geographical Location	The Section 1 of proposed project transverses from 24°2'59.45"N 91°36'40.85"E (near Khowai town) to 23°50'21.88"N 91°37'36.12"E at NH-44 near Teliamura and Section 2 start from 23°49'45.03"N 91°37'50.10"E near Teliamura and Ends at 23° 2'26.16"N 91°40'10.92"E at Harina near Sabroom.
7.	Proposed Bridges and ROB	60 no. of new bridges (02 major & 58 minor).
8.	Bus Bay/ Truck Lay Bye	20 nos. of bus bay and 02 no. of truck lay bye
9.	Design Speed	
	a) Plain Terrain (in general)	Ruling: 100 kmph Minimum: 80 kmph
	b) Rolling Terrain	Ruling: 80 kmph Minimum: 65 kmph
	C) Hilly Terrain	Ruling: 60 kmph Minimum: 40 kmph For Hair Pin Bend: min 20kmph
10.	Carriageway Width	7.0 m
11.	Width of Shoulder	In Rural/Built-up section:
	a) Paved	1.5m either side
	b) Earthen	1.0m either side

12.	Footpath width at built-up areas	1 m over RCC lined drain.
13.	Total Area of Land Acquisition	356.8 Ha in section 2 and 80.524 Ha in section 1.

3.5.1 Cross Section

Cross-section for the improved facility should be adequate to cater to the traffic expected over the design period and offer safe and convenient traffic operation at speeds consistent with the terrain conditions and functional classification of this road.

The cross-sectional elements (lane/shoulder width etc.) shall be as per standards specified in geometric design standard mentioned above. Following typical cross-sections for section I and II have been envisaged for the subject project as mentioned below in Table 3.9 and 3.10 respectively.

Table 3.9: Details of Typical Cross-sections Adopted in different Stretches for section I

TCS Type	TCS Description
TCS-1	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA (RECONSTRUCTION) APPLICABLE FOR PLAIN/ROLLING TERRAIN
TCS-2	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS AND REALIGNMENT STRETCH (NEWCONSTRUCTION) APPLICABLE FOR PLAIN/ROLLING TERRAIN
TCS-3	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS AND REALIGNMENT STRETCH APPLICABLE FOR PLAIN/ROLLING TERRAIN IN CUTTING SECTION (NEWCONSTRUCTION)
TCS-4	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RCC COVER DRAIN IN BUILTUP AREA APPLICABLE FOR PLAIN/ROLLING TERRAIN (RECONSTRUCTION)
TCS-5	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-6	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND LEFT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-7	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND RIGHT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-8	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER LEFT SIDE BREAST WALL AND RIGHT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)

TCS-9	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER RIGHT SIDE BREAST WALL AND LEFT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-10	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER RIGHT SIDE RETAINING WALL AND LEFT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-11	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER LEFT SIDE RETAINING WALL AND RIGHT SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-12	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER LEFT SIDE BREAST WALL AND RIGHT SIDE RETAINING WALL APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-13	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER RIGHT SIDE BREAST WALL AND LEFT SIDE RETAINING WALL APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-14	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RETAINING WALL APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)
TCS-15	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE BREAST WALL APPLICABLE FOR MOUNTAINOUS TERRAIN (NEWCONSTRUCTION)
TCS-16	TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN
TCS-17	NEW CONSTRUCTION OF 2 LANE CARRIAGEWAY IN ROB APPROACHES WITH BOTH SIDE SERVICE ROAD

Table 3.10: Details of Typical Cross-sections Adopted in different Stretches for section II

TCS Type	TCS Description
TCS-1	TWO LANE WITH PAVED SHOULDER (NEW CONSTRUCTION)
TCS-2	WIDENING TO TWO LANE WITH PAVED SHOULDER OVER EXISITNG ROAD
TCS-3	TWO LANE WITH PAVED SHOULDER (BUILT-UP SECTION)
TCS-4	TWO LANE WITH PAVED SHOULDER (HILL SIDE PROTECTION WORKS)
TCS-5	TWO LANE WITH PAVED SHOULDER (BOTH SIDE PROTECTION WORKS)
TCS-6	TWO LANE WITH PAVED SHOULDER BOTH SIDE (HILL) PROTECTION WORKS
TCS-7	TWO LANE WITH PAVED SHOULDER (BOTH SIDE RETAINING WALL)

Source: DPR

3.5.2 Pavement Design

Considering a growth rate of 5 % and VDF as 1.5 & 3.5 obtained from the IRC, design of pavement as per IRC 37 -2018 for a design life of minimum 15 years. Accordingly design traffic has been worked out as 20MSA (as per 5.4.1 (i) of two lane manual 2015) and considering sub-grade construction with soil of CBR not less than 8%. The proposed pavement thickness of the project road has been mentioned below in Table 3.11(a), 3.11(b) and 3.11 (c).

Table 3.11(a): Recommended Flexible Pavement Thickness for section I

BC (mm)	DBM (mm)	WMM (mm)	GSB (mm)
40	85	250	200

Table 3.11(b): Recommended Flexible Pavement Thickness for section II

BC (mm)	DBM (mm)	WMM (mm)	GSB (mm)
30	90	250	200

Optional pavement Design: Rigid pavement is also designed as other option of pavement design, on basis of below consideration, the rigid pavement will be

Table 3.11 (c): Optional pavement Design

Consideration	Crust
Period – 40Years, Max. CVPD – 3000	PQC – 280mm, DLC – 150mm & GSB – 150mm

3.5.3 Realignment & Bypass

For section I

Total 6.820 km is proposed in entire project length for realignment, the details are presented in table 3.12 below.

Table 3.12: Details of realignment

SL No.	Design Chainage		Length(m)
	From (m)	To(m)	
1	103760	103900	140

2	105840	106140	300
3	106300	106970	670
4	110170	111680	1510
5	112430	112670	240
6	113200	113650	450
7	115370	116030	660
8	116760	116830	70
9	117000	117240	240
10	117460	117610	150
11	117790	118140	350
12	118390	118760	370
13	119350	119530	180
14	119640	119800	160
15	119980	120130	150
16	120850	121340	490
17	122100	122410	310
18	125550	125930	380

For section II

Total 7 bypasses of 21.690 km are proposed in entire Project length, the details are presented in table 3.13 below.

Table 3.13: Details of bypass

Sl. No	Existing Chainage (Km)			Design Chainage (Km)			Bypass Name
	From	To	Length (m)	From	To	Length (m)	
1	0+000	2+560	2.560	0+000	1+300	1.300	Teliamura Bypass
2	13+550	15+550	2.000	11+400	12+940	1.540	Twidu Bypass
3	20+650	24+750	4.100	17+200	19+950	2.750	Ompi Nagar Bypass
4	42+450	50+900	8.450	35+500	43+000	7.500	Amarpur Bypass
5	61+800	-	-	51+900	53+500	1.600	Nutan Bazar Bypass
6	63+850	67+750	3.900	53+500	57+200	3.700	Jatanbari Bypass
7	75+000	79+350	4.350	63+400	66+700	3.300	Karbook Bypass

	Total Length	**25.360**	**Total Length**	**21.690**	

Total 59.370 km are proposed in entire Project length for realignment, the details are presented in table 3.14 below.

Table 3.14: Details of realignment

Sl. No	Existing Chainage (Km)			Design Chainage (Km)		
	From	To	Length	From	To	Length
1	2.560	3.960	1.400	1.300	2.600	1.300
2	4.650	5.370	0.720	3.300	4.000	0.700
3	5.770	6.100	0.330	4.400	4.700	0.300
4	6.400	8.050	1.650	5.000	6.400	1.400
5	8.450	10.800	2.350	6.800	8.800	2.000
6	16.700	20.660	3.960	14.000	17.200	3.200
7	24.850	28.800	3.950	20.050	23.300	3.250
8	29.700	30.900	1.200	24.200	25.300	1.100
9	31.350	38.050	6.700	25.700	31.300	5.600
10	38.750	40.820	2.070	32.000	34.000	2.000
11	41.220	42.450	1.230	34.400	35.500	1.100
12	50.900	56.450	5.550	43.000	47.500	4.500
13	56.990	61.800	4.810	48.000	51.900	3.900
14	67.750	68.920	1.170	57.200	58.200	1.000
15	69.450	71.250	1.800	58.700	60.250	1.550

16	71.300	74.500	3.200	60.330	63.000	2.670
17	79.350	80.300	0.950	66.700	67.500	0.800
18	80.800	89.570	8.770	68.000	75.800	7.800
19	89.850	105.050	15.200	76.100	85.500	9.400
20	119.510	124.750	5.240	97.400	101.400	4.000
21	126.200	128.400	2.200	102.800	104.600	1.800
	Total Length		**74.450**	**Total Length**		**59.370**

3.5.4 Bridges and Culverts

For Section I

Total 15 bridges exist on project alignment.

- 13 existing minor bridges and 01 major bridge are proposed for reconstruction.
- 1 existing bridge is retained due to realignment.

Total 32 culverts exist on Project alignment in which –

- 32 existing culverts are proposed for reconstruction.
- 14 new culverts are proposed in entire length.

For Section II

- Total 32 bridges exist on project alignment.
- 1 existing bridge is proposed to reconstruction.
- 31 existing bridges are retained due to realignment.
- 59 additional new bridges are proposed on the realignment and bypass.

Total 258 culverts exist on Project alignment in which -

- 28 culverts are proposed for reconstruction.
- 230 culverts are retained due to proposal of realignments /bypasses.

- 306 new culverts are proposed in entire length as balancing culverts.

3.5.5 ROB

Section I

A ROB is proposed over railway crossing at the design chainage 124+311km in the proposed alignment.

Section II

No any Railway track existing on this section.

3.5.6 Junctions/Intersections Improvement

Section I

There is 1 major intersection in the project road which is proposed to be improved at grade and 34 existing minor junctions are proposed to be improved for the project road. The details of major Junctions have been given in Table 3.15.

Table 3.15 List of Major Junctions

Sl No	Existing Chainage (Km)	Design Chainage (Km)	Side	Type	Remarks
1	117+800	106+970	Right	3-Legged	Road leads to Ramchandra Ghat Market
2	139+425	127+319	Right	3-Legged	Road leads to Agartala

Source: DPR

3.5.7 Bus Bay/ Truck Lay Bye

Section I

Bus bays are proposed at 4 locations along the project road. The list of proposed bus bay Truck Lay Bye location is mentioned below in Table 3.16.

Table 3.16: Location of proposed Bus Bay/Truck Lay Bye

Sl No	Design Chainage(km)	Side	Remarks
1	102+025	Both	Bus Bay
2	107+380	Both	Bus Bay
3	113+875	Both	Bus Bay
4	126+565	Both	Bus Bay

Source: *DPR*

Section II

Bus bays are proposed at 11 locations along the project road. The list of proposed bus bay Truck Lay Bye location is mentioned below in Table 3.17.

Table 3.17: Location of proposed Bus Bay/Truck Lay Bye

Sl. No.	Design Chainage (Km)		Remarks
	LHS	RHS	
1	1.400	1.000	
2	17.300	17.100	
3	33.400	33.300	
4	42.700	42.600	
5	51.150	51.300	
6	63.500	63.100	
7	67.000	67.350	
8	76.350	76.200	
9	83.100	83.450	
10	95.400	95.300	
11	104.300	104.500	

No Truck lay bye exist along the Project road, 2 nos. of Truck lay byes are proposed at Km.28.700 (LHS) and Km. 71.400 (LHS)

3.5.8 Drainage Work

2.5 km length of 1.0m width RCC Cover Drain for service road proposed in the project road.

3.5.9 Protective Work

Protection works like Retaining walls, Breast Walls, W-Beam crash barrier are provided at different locations as per site requirement, the details of protection works with their details are presented below:-

a) Breast walls –

Sl. No	Description	LHS (m)	RHS (m)	Total (m)
1	Breast Wall 1m height	4680	4100	8780
2	Breast Wall 2m height	9220	8560	17780
3	Breast Wall 3m height	5320	5140	10460
4	Breast Wall 4m height	4940	3640	8580

		24160	**21440**	**45600**

b) Retaining Wall - Retaining wall is proposed for length given below

Description	**Length (m)**
Retaining Wall 1.0 m height in Filling sections	16980
Retaining Wall 1.0 m height in Hilly sections	1560
Retaining Wall 2.0 m height in Filling sections	8300
Retaining Wall 2.0 m height in Hilly sections	3080
Retaining Wall 3.0 m height in Filling sections	4340
Retaining Wall 3.0 m height in Hilly sections	1560
Retaining Wall 4.0 m height in Filling sections	1280
Retaining Wall 4.0 m height in Hilly sections	0
Retaining wall 1.0 m height in Pond locations	3965.5

c) W-Beam crash Barrier- W- Beam crash barrier is proposed (Where height of embankment is more than 3.0m),

d) RCC Drain - RCC linear drain of 1m wide is provided (including both sides, as per TCS type 3).

e) PCC Drain - PCC drain is provided

f) Providing PCC on embankment slope at bridge approaches

3.5.10 Miscellaneous Provision for Traffic Guidance and Safety

A high-speed facility is basically aimed at providing safe efficient and economic movement to motorised through traffic with comfort and pleasing environment during the journey. To achieve these objectives in practice, it is essential to make certain miscellaneous provisions for traffic guidance and safety. Accident record shows that there are no critical stretches with respect to accident severity, where ASI exceeds the accident threshold. Repetition of accident at certain locations could be attributed to factors like ribbon development and uncontrolled access along with poor illumination on the stretch. The safety measures and devices as proposed by the Consultants along the highway are described below:

+ Road side Furniture
+ Street Lighting
+ Landscaping and Tree plantation

3.5.11 Roadside Furniture

For notification of road features and also for safety and guidance of the road users, the project road will be provided with all the necessary traffic control and safety devices. These include:

+ Traffic Signs and Pavement Markings

Traffic signs and pavement markings shall include roadside signs, overhead signs, curve mounted signs and road marking along the project highway. The locations for these provisions shall be based as per IRC:35-1997 and IRC:67-2012 respectively.

+ Road Delineators
+ Pedestrian Guard Railing +
Metal Beam Crash Barrier

Metal beam crash barrier shall be provided on both edges of the road where road height is equal to or exceeds 3m and on outer edges of sharp curves. Suitable reflectors have been proposed to be fixed on the beam @ 3 m canter-to-centre for proper delineation of the barrier line.

+ Traffic safety Devices wherever required
+ Boundary Stones
+ Hectometer/Kilometer/ 5th KilometerStones
+ Traffic Blinker Signal (L.E.D) at intersections

3.5.12 Street Lighting

+ Adequate lighting will be provided for bus bays and Truck Lay byes.
+ Street lighting will also be provided for highway alignment passing through potentially hazardous locations such as built-up area, junctions.

3.5.13 Landscaping and Plantation

(i) Landscaping of the highway shall be done at suitable locations. The aim of landscaping will be conservation of existing natural or manmade features e.g. ponds, historical buildings and scenic vistas along the highway.

(ii) Landscaping will address the issue of drainage to ensure minimum disturbance to the natural drainage and at the same time ensure protection of natural surfaces from erosion.

(iii) Proper landscaping will be provided for highway alignment to fit-in with surroundings for pleasing appearance, reducing headlight glare and adverse environmental effects such as air pollution, noise pollution and visual intrusion.

(iv) Landscaping will include stabilization of embankment by pitching and/or turfing / plantation. The treatment of embankment slopes along the highway will be as per recommendations of IRC: 56 - 1974, depending upon soil type involved. Planting of shrubs, hedges and trees on medians and sides for highways of reducing glare effect, reducing visual intrusion, noise pollution and air pollution.

(v) Trees, their spacing and arrangement in different situations will be as per IRC: 21 - 1979 and IRC: SP: 66 — 1976.

3.6 Scoping Analysis of the Anticipated Environmental Impacts

Scoping Analysis of the Anticipated Environmental Impacts has been provided below in Table 3.18.

Table 3.18: Scoping Analysis of the Anticipated Environmental Impacts

Item	Scoping Analysis of the Anticipated Environmental Impacts			
	Pre-construction	Construction Stage	Operation Stage	Rational of the Impact Assessment
Natural Environment				
Climate/ Meteorological Phenomena				*P: No impact is expected.
				*C/O: Impacts on microclimate would occur but to the extent that they are of negligible scale.
Topography		✓		P: No impact is expected.
				C: Changes in topographic conditions over the project area takes place due to the requirement of cutting and filling work.
				O: Topographic conditions should become stable after the completion of construction works, which include slope protection and stabilization.
Geology				P: No impact is expected.
				C: No impact is expected.
				O: No impact is expected.
Soil Erosion		✓	✓	P: No impact is expected.
				C: Soil erosion is expected particularly during the monsoon period.
				O: The Project is expected to improve the conditions and thus reduce the risk of soil erosion as measures of slope protection and stabilization should prevent soil erosion.
Hydrology		✓	✓	P: No impact is expected.
				C: Construction work may cause minor and temporary impacts on hydrology because of cutting and filling.
				O: Cutting and/or filling would result in permanent changes of local hydrology.
Groundwater				P: No impact is expected.
				C: The project does not envision the use of groundwater. There is no tunneling works.
				O: No impact is expected during the operation and maintenance stage.
Ecosystem, Flora, Fauna and Biodiversity		✓	✓	P: No impact is expected.
				C: During the construction period, mountain ecosystem including local flora and fauna as well as forest/wooded areas will be damaged to some extent.

Item	Scoping Analysis of the Anticipated Environmental Impacts			
	Pre-construction	Construction Stage	Operation Stage	Rational of the Impact Assessment
				O: Increase of traffic volume will cause negative impacts on ecosystem including fauna and flora along the road.
Protected Area/ Forest Reserve				P: No impact is expected.
				C: There is no protected area adversely affected. Some area of forest has to be cleared for bypasses.
				O: Increase in emissions due to growing traffic volume will negatively affect the existing forest and surrounding ecosystem. Compensatory afforestation program will be a part of the Project.
Coastal Zone				P/C/O: There is no coastal zone subject to project intervention.
Landscape			✓	P: No impact is expected.
				C: Changes in landscape during the construction work would cause some landscape changes.
				O: The project should explore possibilities to develop scenic viewpoints along the road. The continuity and the harmony with the surrounding landscape made from the original narrow road will be lost.
Natural Disaster		✓	✓	P: No impact is expected.
				C: Many areas of the project area are prone to landslide during the construction period.
				O: Slope protection/stabilization measures and drainage are expected to significantly reduce the risk of natural disaster.
Pollution				
Air Pollution		✓	✓	P: No impact is expected.
				C: Some negative impacts are expected due to operation of construction equipment and vehicles. Dust incidental to earthwork especially during the dry season.
				O:Air pollution is expected to increase due to increase traffic volume on the road.
Offensive Odor		✓		P: No impact is expected. C: It could cause some offensive odor from construction workers' camps. O: No impact is expected.
Water Pollution		✓	✓	P: No impact is expected.
				C: Turbid water due to the earthworks, bridge pier construction work and wastewater effluents from construction workers' camps/yards are expected to pollute the surrounding rivers/canals to some extent.
				O: Some impacts on water quality in surrounding water bodies are expected due to water discharge from road users and wastewater from maintenance activities.

Item	Scoping Analysis of the Anticipated Environmental Impacts			
	Pre-construction	Construction Stage	Operation Stage	Rational of the Impact Assessment
Bottom Sediment Contamination				P: No impact is expected.
				C: Some construction materials such as cement and sand are expected to be washed out mainly by the rain, but the impacts on bottom sediment are expected to be negligible.
				O: Some wastewater will be generated from maintenance activities along the road, the impacts on bottom sediment from the wastewater will be negligible.
Soil Contamination		✓		P: No impact is expected.
				C: Impacts on soil from deposition of pollutants from construction materials in the construction site are expected to be small. Since there is no major industrial activity along the road, it is unlikely that soil along the road is already polluted.
				O: No impact is expected.
Ground Subsidence				P/C/O: No impact is expected.
Noise and Vibration		✓	✓	P: No impact is expected. C: Noise and vibration are generated by operation of construction equipment and vehicles. Construction schedule should take into account the location of schools, hospitals and religious facilities that require silence during the day. O: Noise and vibration levels are likely to increase due to greater traffic volume along the road. Specific measures may be required for quiet places and minimize impacts on schools, hospitals, and religious facilities.
Sunshine Obstruction				P/C/O: No impact is expected.
Wastes/ Hazardous Materials		✓	✓	P: No impact is expected.
				C: Waste from construction workers' camps are expected to be generated. Waste generated from construction and demolition work may include hazardous materials that must be treated before final disposal.
				O: Waste will be generated from road users and workers of maintenance works.
Social Environment				
Involuntary Resettlement	✓			P: The project will result in large-scale involuntary resettlement, particularly in built-up areas where structures exist in both sides of the road. The alternative alignment minimizing the resettlement is discussed in the alternative analysis.
				C/O: There is a high possibility of resettlement to adjacent

Item	Scoping Analysis of the Anticipated Environmental Impacts			
	Pre-construction	Construction Stage	Operation Stage	Rational of the Impact Assessment
				areas, and it is assumed that there will be little impact after resettlement due to compensation and rehabilitation support.
Land Use	✓	✓	✓	P: Land acquisition and involuntary resettlement are likely to cause changes in existing land use pattern.
				C: While changes in land use associated with construction work are relatively minor at expansion section of the existing road, land usage, including cultivation, shifting cultivation and agro-forestry, might be significantly affected at bypass sections.
				O: Land usage will be permanently changed especially at bypass sections. Greater traffic volume may affect the use of road and surrounding area by local residents.
Utilization of Local Resources		✓	✓	P: No impact is expected.
				C: Mass-scale use of local resources such as sand and quarrying for the construction activities may obstruct the utilization by the local people for other purposes.
				O: Improvement in road infrastructure may change the flow of commodity distribution, potentially impacting the use of local resources.
General, Regional /City Plans			✓	P: No impact is expected.
				C: No impact is expected.
				O: Better infrastructure network may trigger influx of outsiders and economic development in the region.
Social Institutions and Local Decision-making Institutions	✓	✓	✓	P: Land acquisition and involuntary resettlement are likely to affect social institutions such as social capital and local decision-making institutions.
				C: Social capital and local decision-making institutions will be affected by the influx of resettling population and construction workers.
				O: Social capital and local decision-making institutions will be affected by the influx of resettling population.
Social Infrastructure and Services	✓	✓	✓	P: Though the area is not densely populated, still the strip land acquisition will affect numerous road side Common Property Resource like Panchayat Office, Police Station, etc..
				C: Access to social infrastructure and services may be temporarily affected due to construction of construction yard and accommodation for workers as well as traffic jams due to the operation of construction vehicles.
				O: The resettlement can result in prolonged disturbance in social infrastructure and services. In the long term,

Item	Scoping Analysis of the Anticipated Environmental Impacts			
	Pre-construction	Construction Stage	Operation Stage	Rational of the Impact Assessment
				however, the project is expected to improve access to social infrastructure and services by providing better road network.
Local Economy and Livelihood	✓	✓	✓	P: Loss of income source and livelihood due to involuntary resettlement and change in land usage are expected to negatively affect the local economic and livelihood.
				C: Loss of income source and livelihood due to involuntary resettlement and change in land usage are expected to negatively affect the local economy and livelihood, especially cultivation and agro-forestry. On the other hand, construction work will have positive impact on local economy by creating employment and business opportunities in the project area.
				O: Over the long term, the project is expected to have positive impact on local economy as improved road network facilitates transport of cash crops, and ensures more stable supply of essential goods. On the other hand, the end of construction work may cause unemployment of construction workers. The project may trigger unintended side effect on local community, e.g. influx of non-local people and more competition in business and pressure on local natural resources.
Unequal Distribution of Benefit and Damage	✓	✓	✓	P: Land acquisition and involuntary resettlement will lead to unequal distribution of benefits and damage between groups who are directly affected by the project and who are not.
				C: While resettling households and households whose livelihood depends on affected lands will bear much of the damage, others may even enjoy benefits from new business opportunities created by construction work, resulting in unequal distribution of benefit and damage
				O: People residing along the road may accrue greater benefits compared with others, potentially increasing rich-poor gap within the community.
Local Conflicts of Interests	✓	✓	✓	P/C/O: Unequal distribution of benefit and damage may trigger and/or intensify local conflicts of interests in the community.
Water Usage, Water Rights and Communal Rights	✓	✓		P: Water usage and water rights of the affected households may be curtailed due to resettlement. However, irrigation is not common in the region and thus, the impact will be minor, if any.
				C: Disturbance to water usage, water rights and communal rights during construction work is expected to be minor and

Item	Scoping Analysis of the Anticipated Environmental Impacts			
	Pre-construction	Construction Stage	Operation Stage	Rational of the Impact Assessment
				short-term in nature. However, communal rights and distribution should be carefully examined to avoid negative impacts.
				O: No impact is expected.
Cultural and Historical Heritage	✓	✓	✓	P: The targeted roads would run near major ruins, cultural heritage and/or sacred forests of the indigenous people. Some heritages along the road would be affected.
				C: Some heritages along the road would be affected.
				O: Some heritages nearby the project road may be indirectly affected.
Religious Facilities	✓	✓	✓	P: Road side religious structures, graveyards, missionaries, etc. have been mostly avoided by adjusting the alignment suitably and/or by eccentric widening. A number of churches, several memorial stones and graves are located along the road. Though realigned route is carefully avoiding them, it may still affect them indirectly.
				C/O: Roadside religious facilities may be affected by noise and vibrations during construction and operation due to construction work and greater traffic volume.
Sensitive Facilities (ex. Hospital, school, precision machine factory)	✓	✓	✓	P: When widening road in a village, it may be necessary to relocate small-scale public facilities (community halls, etc.).
				C: Noise and vibration during construction work may affect schools, public health centers and other medical facilities, but they would remain in small scale.
				O: These facilities can be affected due to noise and vibration resulting from increase in traffic volume. Also, congestion may undermine the utility of such facilities.
Poor People	✓	✓	✓	P: Given the limited coping capacity of the poor, it is necessary to assess their vulnerability and develop appropriate mitigation measures.
				C: The poor may bear disproportionally higher burden due to their limited coping capacity, although they can be benefited from employment opportunities during construction work.
				P: Economic development achieved by the road improvement in the region is expected to benefit the poor.
Ethnic Minorities/ Indigenous People	✓	✓	✓	P/C/O: The alignment of NH208 in Tripura as well would overlap largely with the area under jurisdiction of Tripura Tribal Autonomous Area District Council (TTAADC). Preparation of RAP and livelihood restoration plan, therefore, must take into account this matter.
Gender				P: Project might affect gender-related work division such as

Item	Scoping Analysis of the Anticipated Environmental Impacts			
	Pre-construction	Construction Stage	Operation Stage	Rational of the Impact Assessment
	✓	✓	✓	cultivation, harvest and processing of crops.
				C: The general social and cultural norms need to be carefully studied to avoid gender-related conflicts. The Project can affect gender roles in cultivation, harvesting and processing.
				O: Project might affect gender-related work division such as cultivation, harvesting and processing of crops.
Children's Rights	✓		✓	P: Some children are affected by the relocation. Children in households that have lost land and livelihoods may be forced to drop out of school.
				C: Child labor is unlawful according to article 24 of Indian Constitution. Only adults are eligible for potential employment opportunity created by the project.
				O: Access to social services is expected to improve throughout the year and educational opportunities are expected to improve.
Public Health (sanitation and infectious diseases)		✓	✓	P: No impact is expected.
				C: Influx of construction workers is likely to increase the health risk, particularly that of STD/STI, HIV/AIDS and coronavirus. The risk of malaria should be properly managed for construction work in areas where malaria is prevalent.
				O: An increase in traffic volume and road users may have negative impact on public health.
Occupational Health and Safety (OHS)		✓	✓	P: No impact is expected.
				C: Occupational health and safety of construction work should be properly managed through adequate Environment Management Plan.
				O: Maintenance and repair work should take into account the occupational health and safety of the workers.
Others				
Accidents				P: No impact is expected.
				C: An increase in the risk of accidents caused by the operation of construction machinery and the running of construction vehicles is expected.
				O: Increased traffic volume and increased risk of accidents due to speeding up are expected. On the other hand, it is considered that the accident risk can be reduced by rehabilitating the route and implementing accident prevention measures (such as installing a reflector on the curve).
Climate Change				P: No impact is expected.

Item	Scoping Analysis of the Anticipated Environmental Impacts			
	Pre-construction	Construction Stage	Operation Stage	Rational of the Impact Assessment
		✓		C: Although the impact is temporary and small, greenhouse gases (GHGs) are emitted by the operation of construction machinery and the running of construction vehicles.
				O: GHGs emission is expected to increase due to the increase in traffic volume. In addition, adaptation measures will be implemented by considering the effects of climate change (increase in precipitation, etc.) when considering measures for landslides and soil erosion.

***P is Preconstruction, C is construction stage and O is Operation stage**

4. BASELINE ENVIRONMENTAL STUDIES

Baseline environmental conditions about all facet of environment viz. physical, biological and socio-economic have been established using both primary and secondary sources. Efforts have been made to collect the latest information's both at regional as well as local level especially along the project corridor. This will help to predict likely changes in the environment due to the project and will serve as performance indicators for various components.

4.1 Physical Environment

4.1.1 Meteorology & Climate

The project state, Tripura falls under the sub-tropical to temperate climatic region. The climate of the project districts is characterized by moderate temperature and high humid nature. There are three prominent seasons summer, rainy and winter. The summer season spans from March to May and is followed by SW monsoon lasting till September. Winter season starts from November and lasts till the end of February.

Temperature

The project area falls in the Khowai, Gumati and South Tripura districts. The districts wise temperature profile discussed as per the following.

District Khowai

The state as whole and Khowai district in particular has a monsoon type of climate. There is however, difference of temperature between the hills and plains, which ranges between sub-tropical in the plains to temperate climatic conditions found in the hilly areas. Temperature variation is this region ranges from 9 ℃- 35 ℃. Figure 4.1 shows the graphical representation of the annual trends of temperature in °C from year 2009 to 2020 in Khowai District.

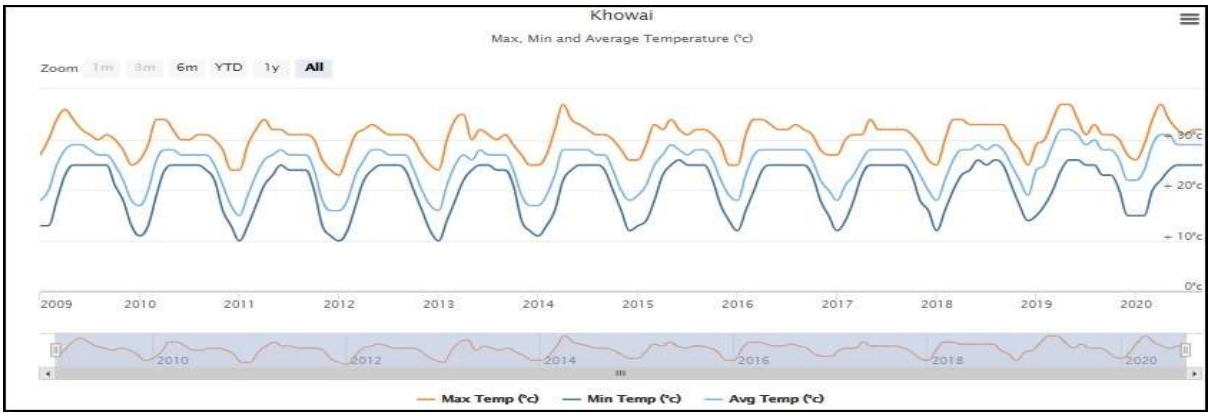


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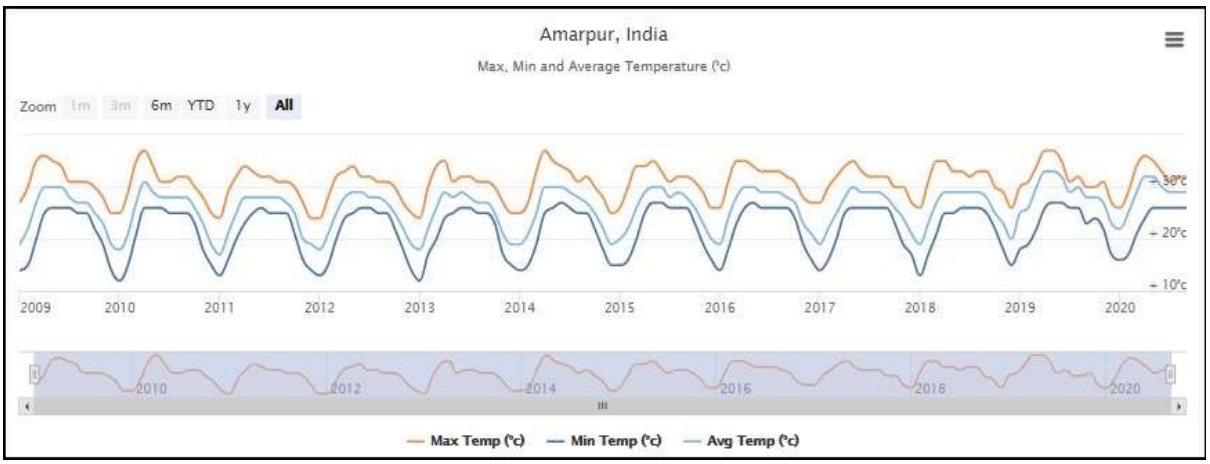
Figure 4.1: Graphical Representation Showing the Annual Trends of Temperature in ° C of from year 2009 to 2020 in Khowai District

District Gumati

The climate of the District is mostly warm and is characterized by a humid summer and a dry cool winter with plenty of rains during July to October. Temperature varies between a maximum of 35.23 and a minimum of 7.43 Celsius. Figure 4.2 shows the graphical representation of the annual trends of Temperature in ° C from year 2009 to 2020 in Gumati District.



https://www.worldweatheronline.com

Figure 4.2: Graphical Representation Showing the Annual Trends of Temperature in ° C from year 2009 to 2020 in Amarpur, Gomati District

District South Tripura

The climate of the District is mostly warm and is characterized by a humid summer and a dry cool winter with plenty of rains during July to October. Temperature varies between a maximum of 36.5 and a minimum of 4.8 Celsius. Figure 4.3 shows the graphical representation of the annual trends of temperature in kmph from year 2009 to 2020 in Sabroom, South Tripura District.

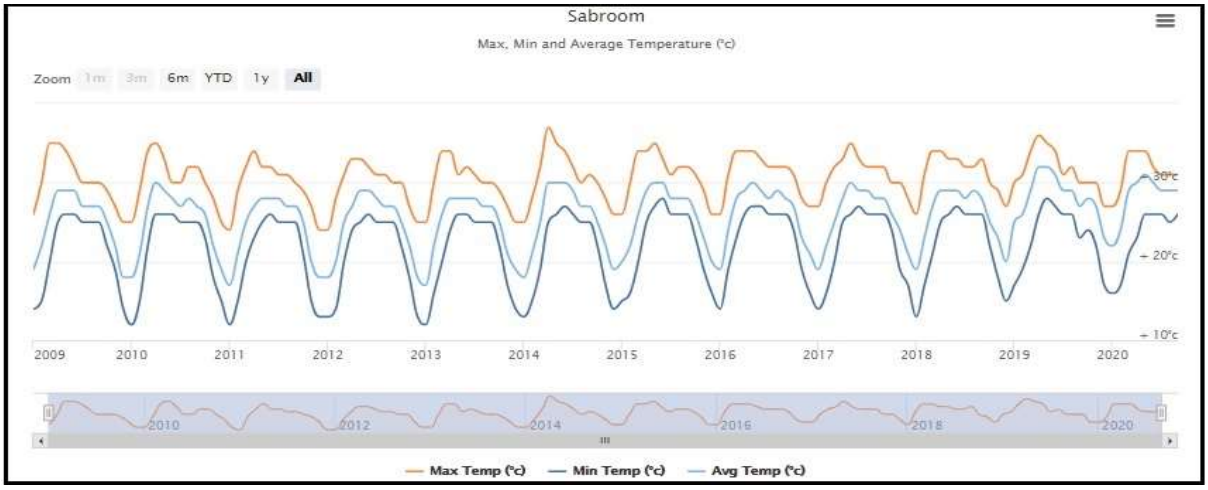


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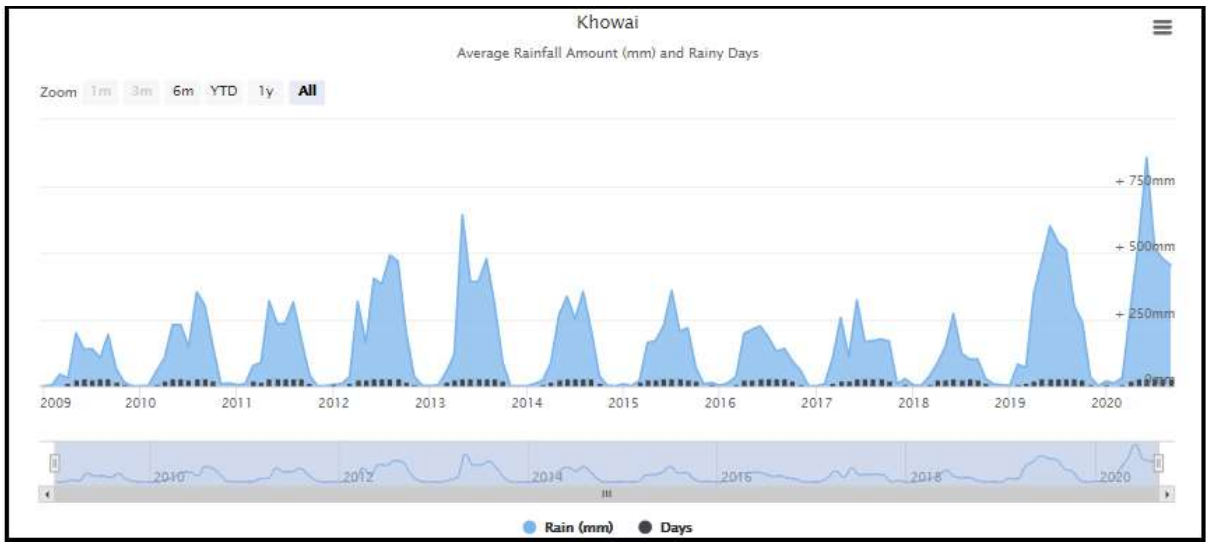
Figure 4.3: Graphical Representation Showing the Annual Trends of Temperature in ° C from year 2009 to 2020 in Sabroom, South Tripura District

Rainfall: The rainfall pattern in Tripura varies not only from place to place but also between seasons. Tripura experiences very heavy rain from June to September/October from the South West Monsoon. The rainfall is at higher side at southern and northern side of the state of Tripura. Winter seasons in Tripura are mostly dry. The annual average rainfall of the State is 2122 mm. The average monsoon rainfall for last 10 years is 1710 mm. The average numbers of rainy days for last 5 years is 95. The co-efficient of variation of rainfall in the area ranges from 6 - 32% suggested a low variability of annual rainfall. The rainfall trends in all the three project districts have been described below.

District Khowai

Khowai has a monsoon influenced humid subtropical climate with large amounts of rain almost all year. Rainfall is high in the range of 1800-2000 mm annually. Figure 4.4 shows the graphical representation of the annual trends of rainfall in mm and rainfall days from year 2009 to 2020 in Khowai District.



https://www.worldweatheronline.com

Figure 4.4: Graphical Representation Showing the Annual Trends of Rainfall in mm and Rainfall Days from year 2009 to 2020 in Khowai District

District Gomati

Rainfall is received from the South - West Monsoon, which normally breaks in the month of May. Hailstorm generally occurs during the month of April & May, occasionally causing damage to the field crops. Autumn and spring are of very short duration. Average annual rainfall in the district is about 2000 mm. Figure 4.5 shows the graphical representation of the annual trends of rainfall in mm and rainfall days from year 2009 to 2020 in Amarpur, Gumati District.

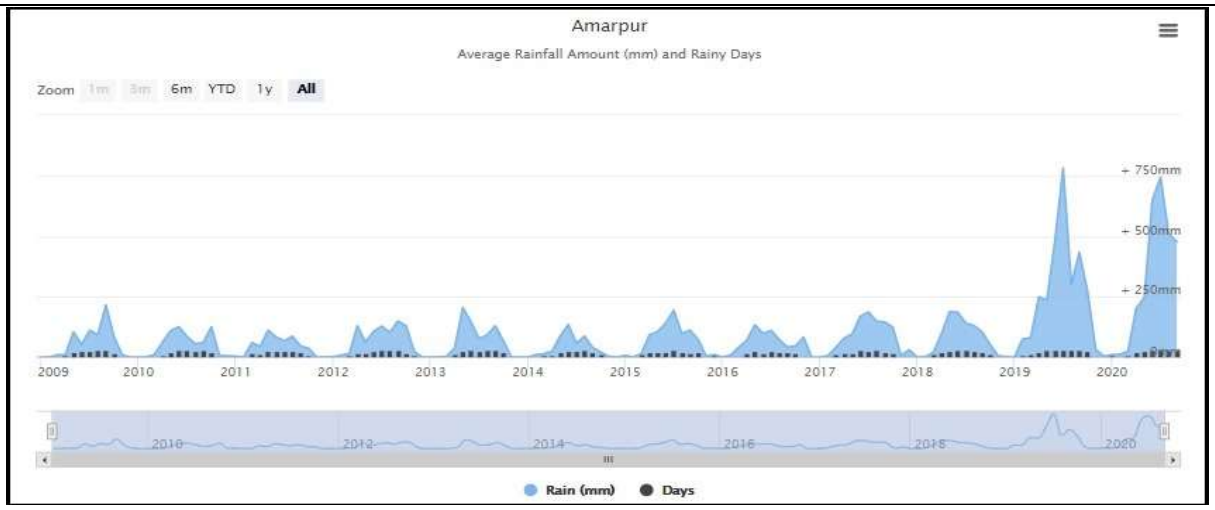


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Figure 4.5: Graphical Representation Showing the Annual Trends of Rainfall in mm and Rainfall Days from year 2009 to 2020 in Amarpur, Gumati District.

District South Tripura

Rainfall is received from the South - West Monsoon, which normally breaks in the month of May. Autumn and spring are of very short duration. The highest mean southwest monsoon rainfall (1549.1 mm) is observed in South Tripura district. Figure 4.6 shows the graphical representation of the annual trends of rainfall in mm and rainfall days from year 2009 to 2020 in Sabroom, South Tripura District

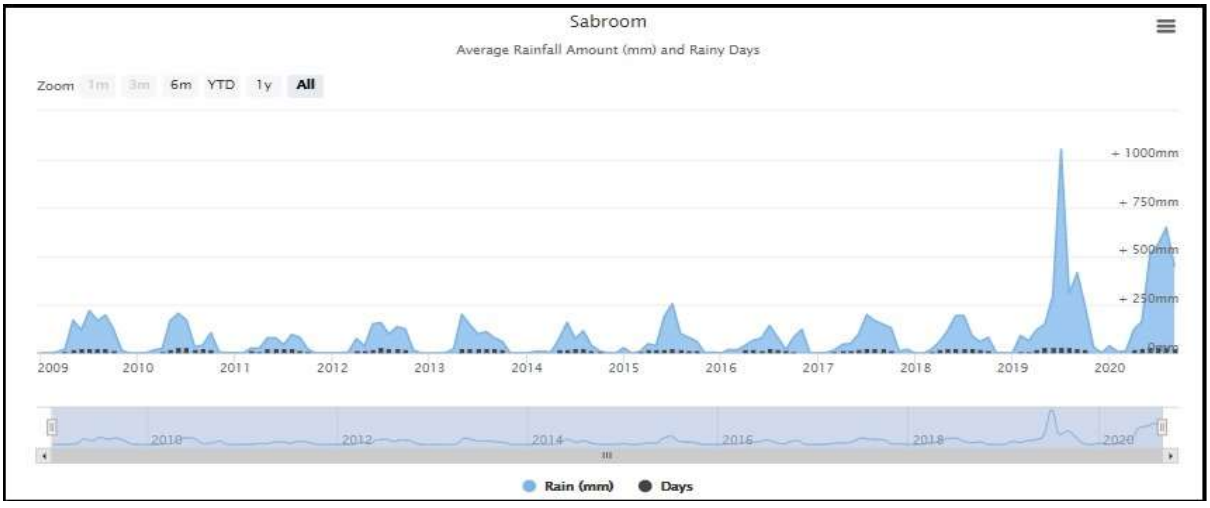

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Figure 4.6: Graphical Representation Showing the Annual Trends of Rainfall in mm and Rainfall Days from year 2009 to 2020 in Sabroom, South Tripura District

Humidity: The relative humidity of the state stays at higher side throughout the year. In summer, the relative humidity lies between 50 to 74 percent whereas during rainy season it goes beyond 85 percent. The maximum and minimum relative humidity is 85 percent and 57 percent in the month of July and January respectively. The humidity variations in all the three project districts have been described below.

District Khowai

The district is highly humid during the summer season from June to October which is when the south west monsoon season starts from June to September and October, November constitute the period of post monsoon. The average humidity remains almost same with variation from 68% in winter period to around 90% in post monsoon period. Figure 4.7 shows the graphical representation of the annual trends of relative humidity in % from year 2009 to 2020 in Khowai District.

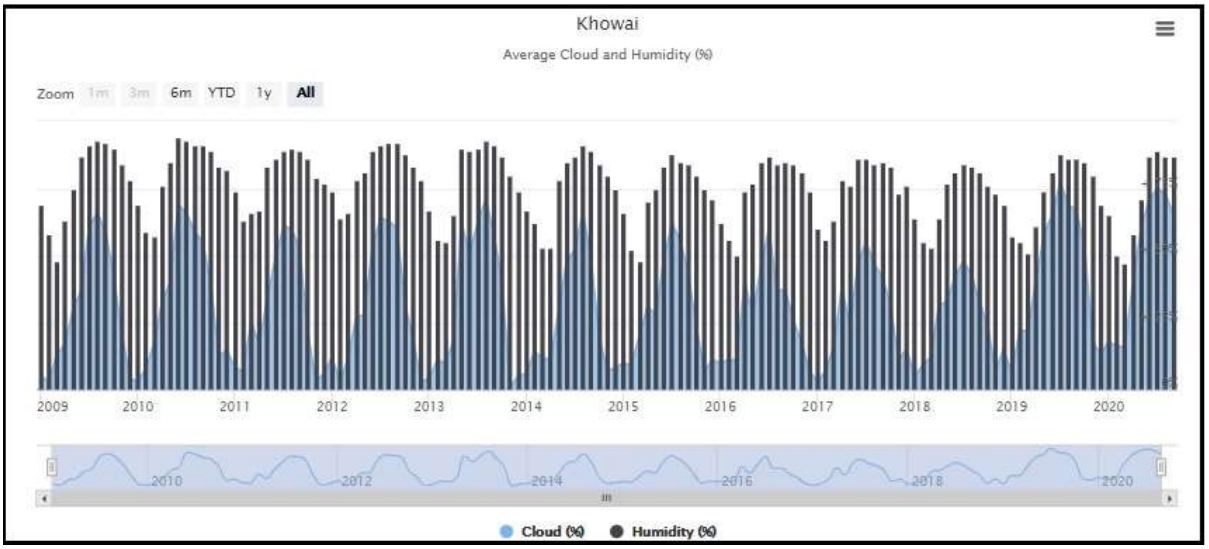

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Figure 4.7: Graphical Representation Showing the Annual Trends of Relative Humidity in % from year 2009 to 2020 in Khowai District

District Gumati

The average humidity remains with variation from 45% to around 85% all over the year. Figure 4.8 shows the graphical representation of the annual trends of relative humidity in % from year 2009 to 2020 in Gomati District.

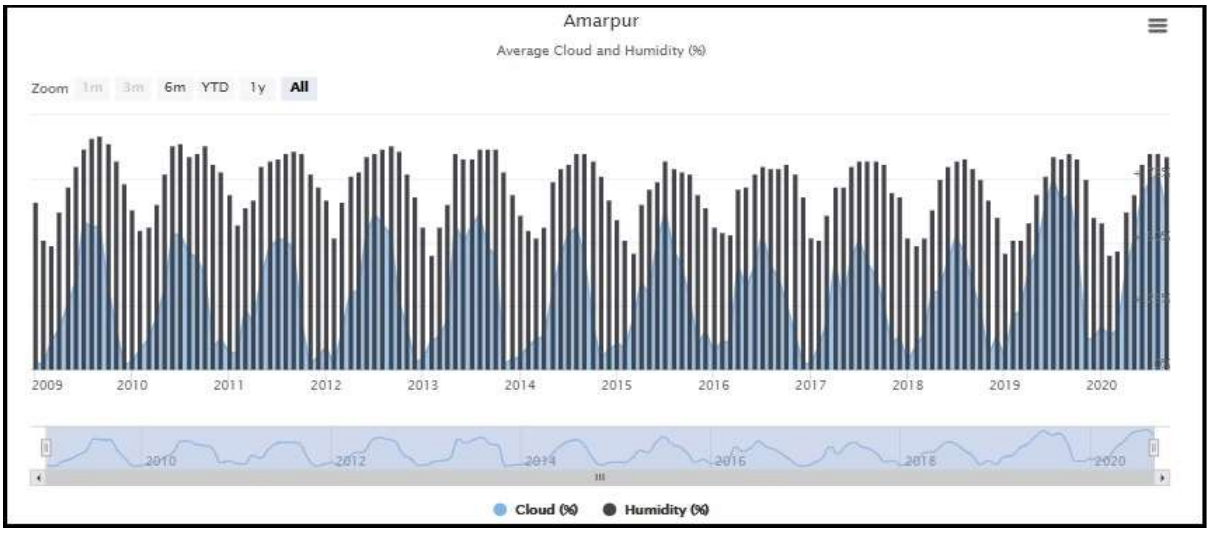

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Figure 4.8: Graphical Representation Showing the Annual Trends of Relative Humidity in % from year 2009 to 2020 in Gomati District

District South Tripura

The average humidity remains with variation from 46% to around 86% all over the year. Figure 4.9 shows the graphical representation of the annual trends of relative humidity in % from year 2009 to 2020 in South Tripura District.

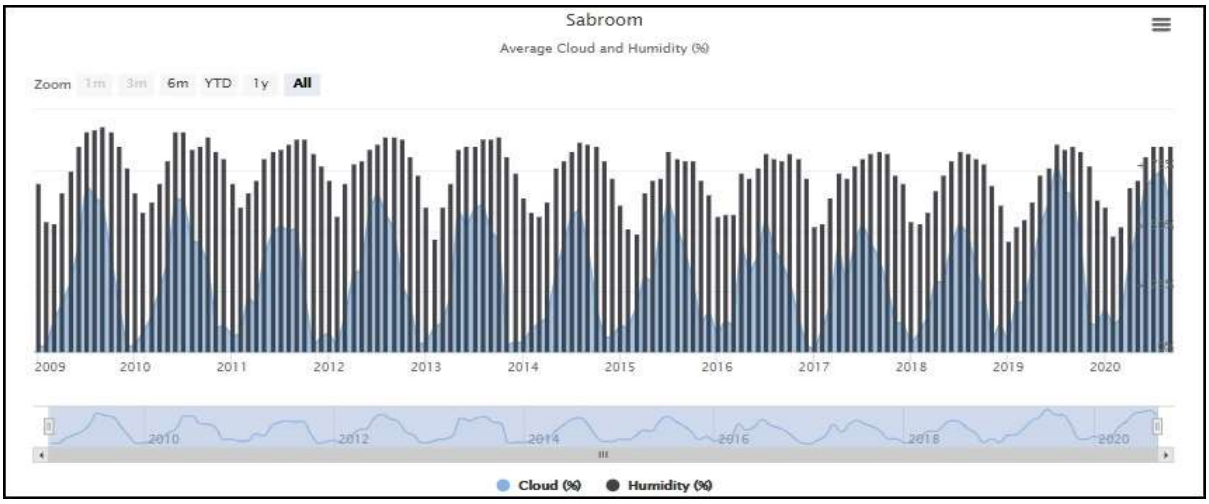

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Figure 4.9: Graphical Representation Showing the Annual Trends of Relative Humidity in % of from year 2009 to 2020 in South Tripura District

Wind Speed: The wind speed of an area influences the dispersal of pollutants from a point and non-point sources. The maximum and average wind speed recorded in the project districts has been graphical presented. The wind speed pattern in all the three project districts have been described below.

District Khowai

The maximum windspeed in the district is 13.5 km/hr. The maximum wind speed in the district is 24.4 km/hr. Figure 4.10 shows the graphical representation of the annual trends of wind speed and gust in kmph from year 2009 to 2020 in Khowai District.

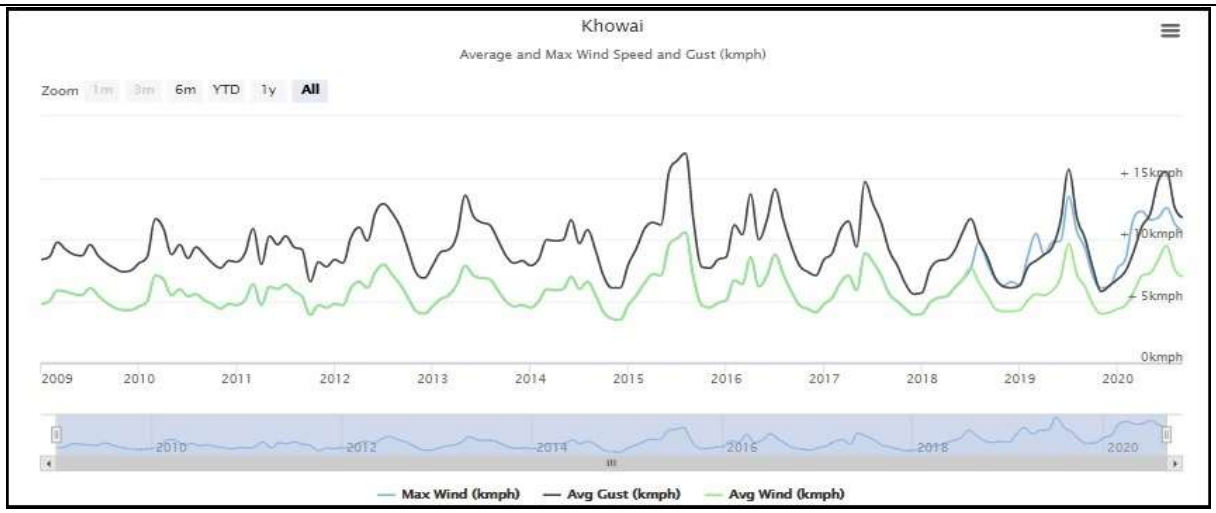

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Figure 4.10: Graphical Representation Showing the Annual Trends of Wind Speed and Gust in kmph from year 2009 to 2020 in Khowai District

District Gumati

The maximum windspeed in the district is 24.1 km/hr. Figure 4.11 shows the graphical representation of the annual trends of wind speed and Gust in kmph from year 2009 to 2020 in Amarpur, Gomati District.

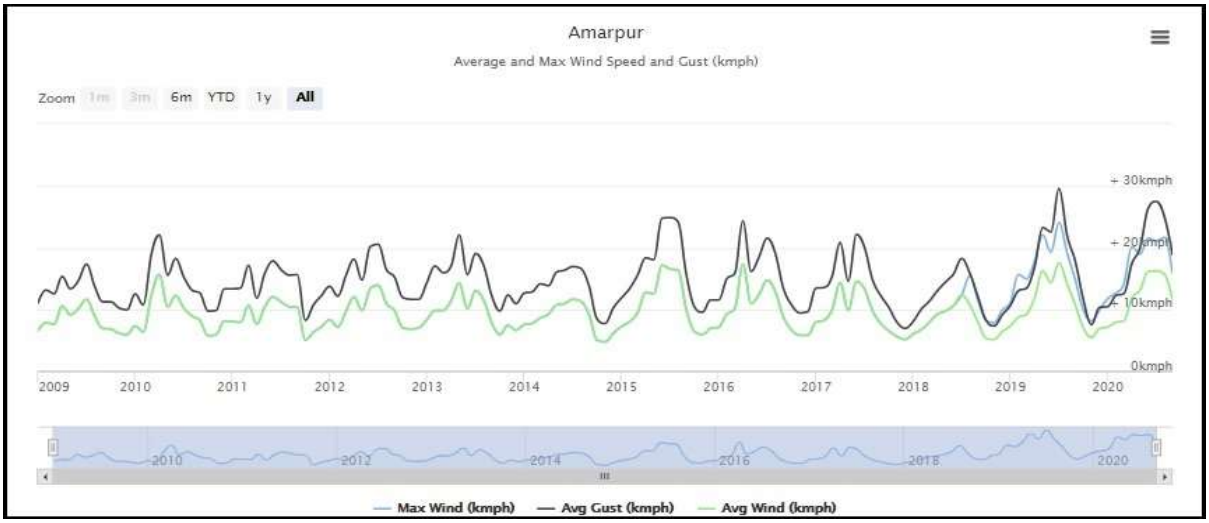

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Figure 4.11: Graphical Representation Showing the Annual Trends of Wind Speed and Gust in kmph from year 2009 to 2020 in Amarpur, Gomati District

District South Tripura

The maximum windspeed in the district is 24.4 km/hr. Figure 4.12 shows the graphical representation of the annual trends of wind speed and gust in kmph from year 2009 to 2020 in Sabroom, South Tripura District.

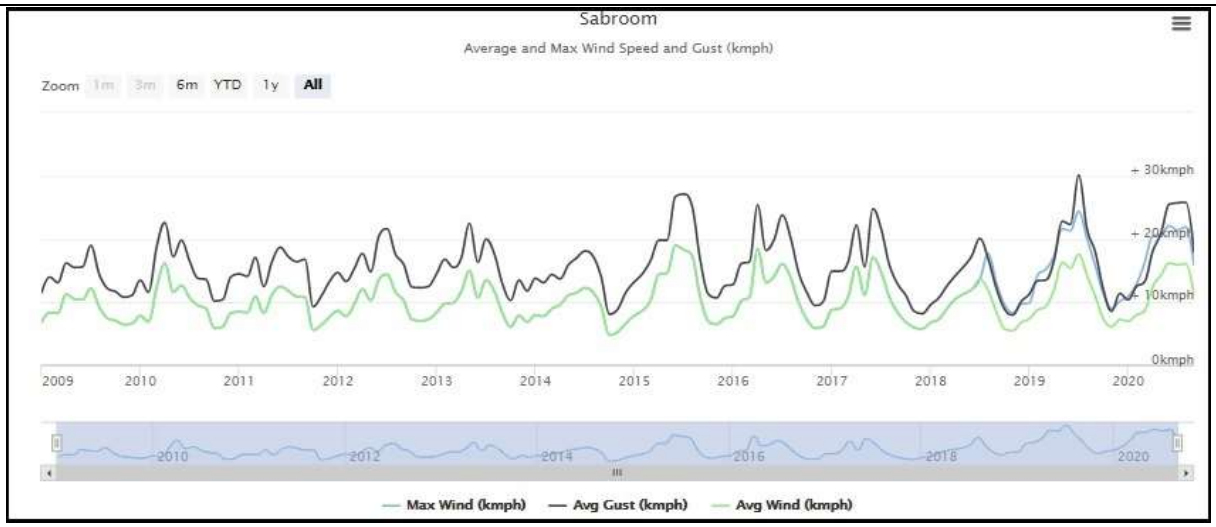

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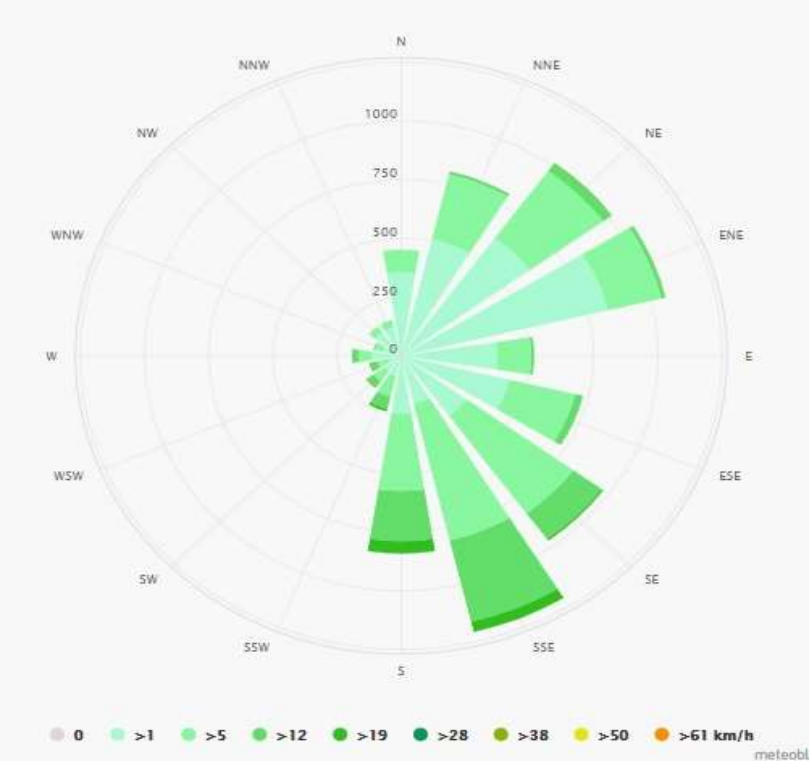
Figure 4.12: Graphical Representation Showing the Annual Trends of Wind Speed and Gust in kmph from year 2009 to 2020 Sabroom, South Tripura District

Wind direction

The windrose diagrams for all the three project districts have been presented in Figure 4.13 to 4.15.

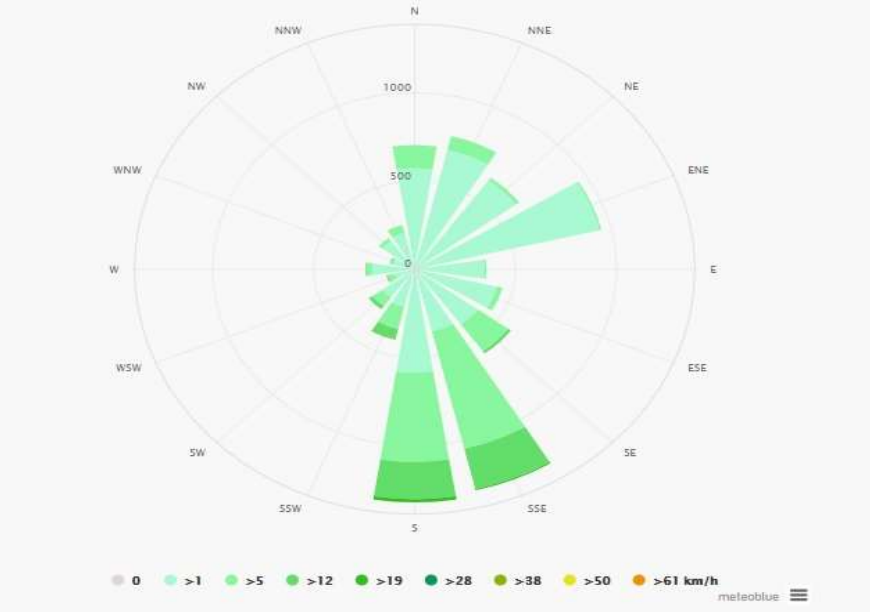
District Khowai: The wind direction of an area influences the dispersal of pollutants from a point and non-point sources. The predominant wind direction in district Khowai is from SSE direction (South South East). Figure 4.13 shows the windrose diagram showing the wind direction in Khowai District.



https://www.meteoblue.com/en/weather/historyclimate

Figure 4.13: Windrose Diagram Showing the Wind Direction in Khowai District

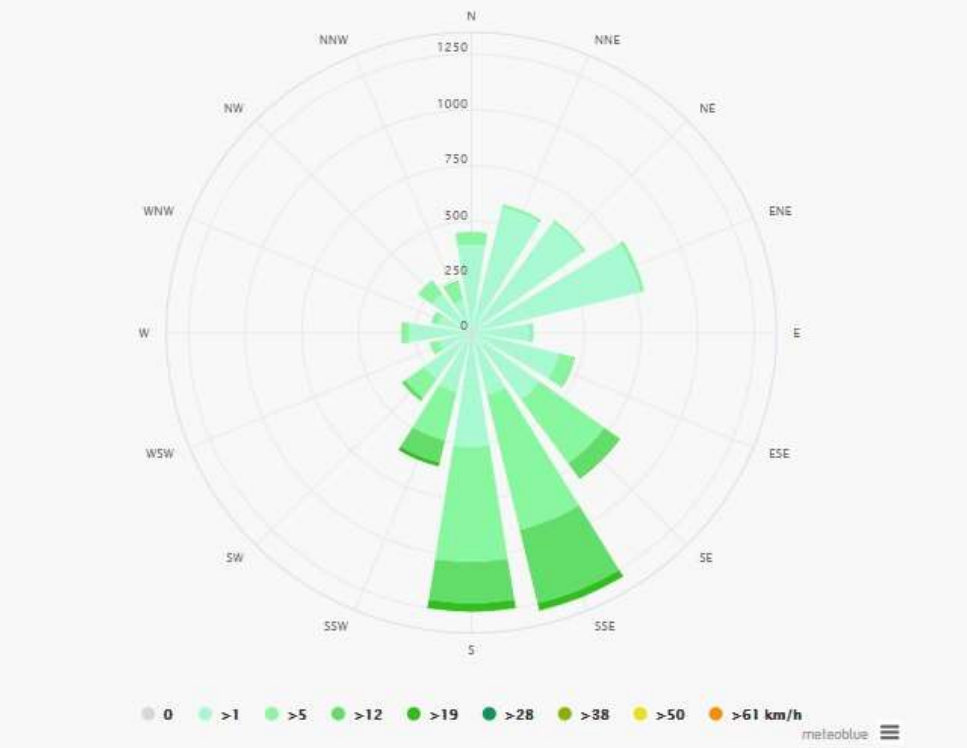
District Gumati: The predominant wind direction in district Gomati is from South direction. Figure 4.14 shows the windrose diagram for Gumati District.



https://www.meteoblue.com/en/weather/historyclimate

Figure 4.14: Windrose Diagram Showing the Wind Direction in Amarpur, Gomati District

District South Tripra: The predominant wind direction in district South Tripura is from South direction. Figure 4.15 shows the windrose diagram for South Tripura District.



https://www.meteoblue.com/en/weather/historyclimate

Figure 4.15: Windrose Diagram Showing the Wind Direction in Sabroom, South Tripura District

4.1.2 Hazards/ Disasters

Natural hazards such as earth quake, flood, drought, cyclone etc. cause destruction of human life and properties. A natural calamity and disaster during the life cycle of the project may exert significant effects on the project activity, project function and also inhibits the availability of resources for the project. The access to the project site may also get disturbed through disruption of transportation links. Major natural calamities pertaining to the state of Tripura are furnished below:

Seismicity & Earthquakes

The State of Tripura comes under the very high risk seismic zone in the country, namely, Zone V of seismic Zoning Map of India. A large number of moderate to large magnitude earthquakes have occurred within the State boundary as well as within 100 km distance around it. Major and significant earth quakes have been furnished in table 4.1 below.

Table 4.1: Significant Earthquake of Tripura

Date/ Year of Earthquake	Location of Epicentre	Remarks
1869	Within 18 km of the district town of Dharmanagar.	An earth quake of M 7.5 occurred, caused massive destruction in permanent infrastructures and lives. The old royal palace at Udaypur got destroyed form this earth quake.
12th June 1897	In Shillong Plateau, near Rangjuli, Assam	An earthquake took place in the state and adjacent areas of which magnitude M 8.7. This was one of the most powerful earthquakes in theIndian sub-continent. The quake wreaked havoc across the present states of Tripura, Assamand Meghalaya.
1918	N.A.	Srimangal area experienced an earth quake with a magnitude of M 7.6 1930 Dubri An earth quake took place with a magnitude of M 7.1
15th Aug,1950	Indo-China Border Region	An earth quake hit mainly the northern part of Tripura and it was originated from Indo-China boarder region. The magnitude of this earthquake was 8.5 Richter. It was the 6th largest earth quake of 20th century.
1950	N.A.	An Earthquake of magnitude 6.3 Richter occurred within North Tripura district caused damage to the buildings and other infrastructures
1970 to 2000	N.A.	According to the records of the Indian Meteorological Department, 41 earthquakes of 5.6 or lower magnitude have occurred within thecoordinates 23.00°- 25.00°N and 91.00°-93.00°E

Source: Tripura Disaster Management Authority

Flood

750 km^2 of land area of Tripura is considered to be flood prone. Nearly all the rivers are rainfed and are prone to flood. The State is bestowed with a relatively high average annual rainfall of with average number of rainy days at 92. Normally rain arrives in the State in late April and continues up to October. However, the intensity of rainfall increases during the months of June to September. Higher rainfall, that occurs during this period causing floods in low lying areas and erosion of land. Tripura, in the past witnessed worst form of disasters by disruption of means of communications caused due to damage of roads and bridges and also blockage of roads due to landslides. Flash flood is also a common phenomenon during rainy season. In last twenty years two major flood events occurred in the state of Tripura - One in 1999 and another in 2004 causing huge economic loss. Drought is an infrequent calamity in the state. However, it normally occurs in the State of Tripura due to delayed rainfall in the months of April-May. Deficient rainfall in those months results scarcity of drinking water as ground water level go down. The impact of dry spell hampers most on agricultural activities. It also adversely affects the Pisciculture, Sericulture and Tea plantations resulting to production loss in these sectors. Induced 27 by extremely low rainfall, drought occurred in the year 1988 and in the year 1999. Summer vegetables, paddy, sesamum, maize, etc were

the crops that had been damaged. Most affected districts were West Tripura, South Tripura and Gomati District. Figure 4.16 shows Seismic Zone Map of India.

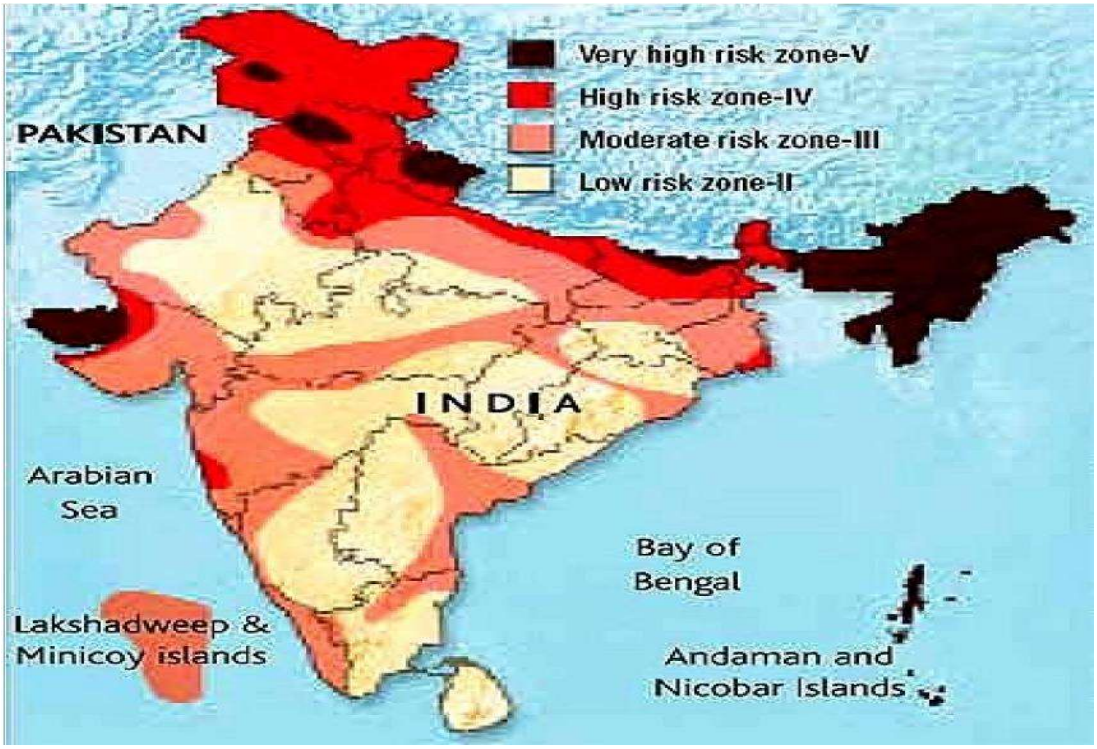


Figure 4.16: Seismic Zone Map of India

Source: moes.gov.in

4.1.3 Ambient Air & Noise Environment

The air environment is most sensitive to any developmental work leading to various type of air pollution. As per present norms, guidelines and practices the air quality monitoring within 10 km radius of the core zone is essential. Air environment is one of the most important components of the ecosystem. The prime objective of ambient air quality monitoring of project area is to assess existing air environment. Air pollution forms an important and critical factor to study the environmental issues in the linear project. Air quality has to be frequently monitored to know the extent of pollution due to road traffic and allied activities. This will be useful for assessing the conformity to standards of the ambient air quality during implementation of the proposed project road construction activities.

The following criteria were taken into account during selection of the sampling locations for collection of representative samples:

- Topography of the area
- Human settlements within the study area
- Meteorological condition in the region
- Representation of the area
- Safety, accessibility and non-interference with general routine of the people residing near the sampling location

In absence of any existing data on ambient air quality and noise levels of the project area, onsite monitoring was conducted at select locations. Major part of the project road passes through built-up areas and agriculture land. The project road is a major connectivity to Agartala. It is very important to measures air quality in the project road stretch since there are numbers of schools, health centres and public utility services along the project road.

Air Quality: SPM, PM10 and PM2.5 have been estimated by gravimetric method. Modified West and Gaeke Method have been adopted for estimation of SO2. Jacobs - Hochheiser Method has been adopted for the estimation of NOx.

Particulate matter (PM10) ranges from 23 µg/m^3 to 48 µg/m^3 and Particulate matter (PM2.5) ranges from 10 µg/m^3 to 18 µg/m^3 in the project area. While SO2 & NOx are also within the prescribed limit in the project area in all the thirteen monitored locations for ambient air quality. Hence ambient air quality levels conform to the prescribed National Ambient Air Quality Standards (NAAQS) appended as **Annexure -*4*** at all the thirteen monitoring sites. Particulate matter found after analysis mostly due to dust flying in the air. Ambient Air Quality monitoring locations and results in the Project Road have been given in table 4.2 & 4.3 below. Ambient air quality monitoring locations and photographs have been presented in figure 4.17 and 4.18 respectively.

Table 4.2: Ambient air quality monitoring locations

S. No.	Locations	Latitude	Longitude
AAQ1	Mahadevtila/Chebri village	24° 1’9.24”N	91°37’49.04”E
AAQ2	Dwarikapur	23°57’32.34”N	91°36’45.78”E
AAQ3	Kalyanpur	23°55’48.00”N	91°36’24.71”E
AAQ4	Teliamura (NH44)	23°50’24.46”N	91°37’40.05”E
AAQ5	BSF camp area	23°46’15.45”N	91°39’06.88”E
AAQ6	Taidu	23°43’40.73”N	91°38’38.50”E
AAQ7	Jantana Pada	23°41’11.55”N	91°38’08.14”E
AAQ8	Tingharia	23°35’24.57”N	91°38’07.26”E
AAQ9	Rangamati	23°32’14.75”N	91°39’29.69”E
AAQ10	Chelagangmung	23°26’59.14”N	91°43’15.00”E
AAQ11	Suknachari	23°12’41.96”N	91°47’1.61”E
AAQ12	Rupachari	23° 6’40.35”N	91°42’18.67”E
AAQ13	Harina	23°02’25.68”N	91°40’13.09”E

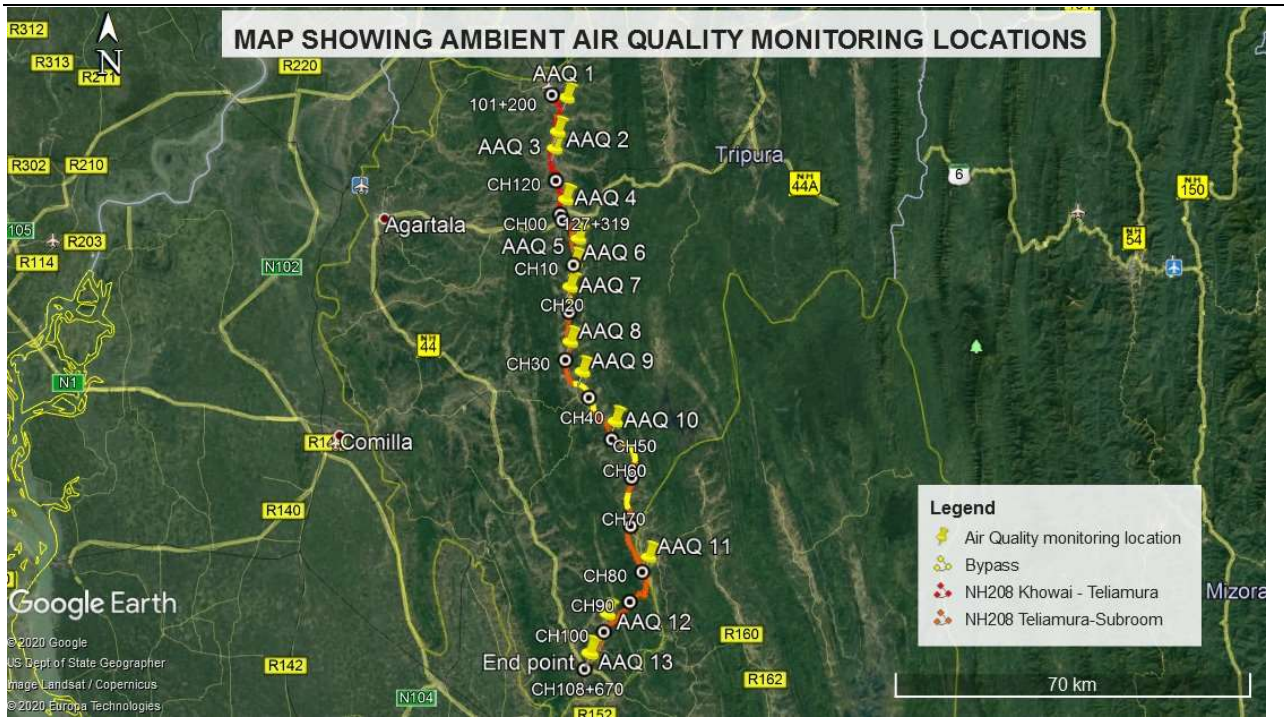


Figure 4.17: Ambient air quality monitoring locations

Table 4.3: Ambient Air Quality in the Project Road

S. No.	Locations	Parameters (ug/m^3)				Category
		PM10	PM2.5	SO2	Nox	
1	Mahadevtila	23	10	7.4	12.2	Sensitive
2	Dwarikapur	25	10	7.2	12.1	Residential
3	Kalyanpur	30	14	7.1	11.7	Residential
4	Teliamura	32	14	7.1	11.3	Commercial
5	BSF camp area	31	13	6.8	11.0	Sensitive
6	Taidu	45	17	7.9	13.7	Commercial
7	Jantana Pada	37	15	7.4	13.2	Residential
8	Tingharia	32	13	6.9	11.1	Sensitive
9	Rangamati	46	18	8.3	14.2	Commercial
10	Chelagangmun	36	14	7.2	12.7	Residential
11	Suknachari	37	15	6.6	12.4	Residential
12	Rupachari	47	17	8.1	13.9	Commercial
13	Harina	48	18	8.5	14.4	Commercial
CBCP Central Pollution Control Board Standard for industrial, resi-dential, and other rural areas		100	60	80	80	Standards
International Standards (WHO)24hr average		50	25	20	40	Standards

Source: DPR

Figure 4.18: Photographs showing ambient air quality monitoring

Noise:

The physical description of sound concerns its loudness as a function of frequency. Noise in general is unwanted/un-desired sound, which is composed of frequencies of different loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common and universally accepted scale is the A weighted scale which is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear. Ambient noise quality monitoring locations, map and photographs have been presented in Table 4.4, figure 4.19 and 4.20 respectively.

Table 4.4: Ambient noise quality monitoring locations

S. No.	Locations	Latitude	Longitude
NQ1	Mahadevtila/Chebri village	24° 1'9.24"N	91°37'49.04"E
NQ 2	Dwarikapur	23°57’32.34”N	91°36’45.78”E
NQ 3	Kalyanpur	23°55’48.00”N	91°36’24.71”E
NQ 4	Teliamura (NH44)	23°50’24.46”N	91°37’40.05”E

NQ 5	BSF camp area	23°46’15.45”N	91°39’06.88”E
NQ 6	Taidu	23°43’40.73”N	91°38’38.50”E
NQ 7	Jantana Pada	23°41’11.55”N	91°38’08.14”E
NQ 8	Tingharia	23°35’24.57”N	91°38’07.26”E
NQ 9	Rangamati	23°32’14.75”N	91°39’29.69”E
NQ 10	Chelagangmung	23°26’59.14”N	91°43’15.00”E
NQ11	Suknachari	23°21’21.42”N	91°47’11.73”E
NQ12	Rupachari	23° 6’40.35”N	91°42’18.67”E
NQ 13	Harina	23°02’25.68”N	91°40’13.09”E

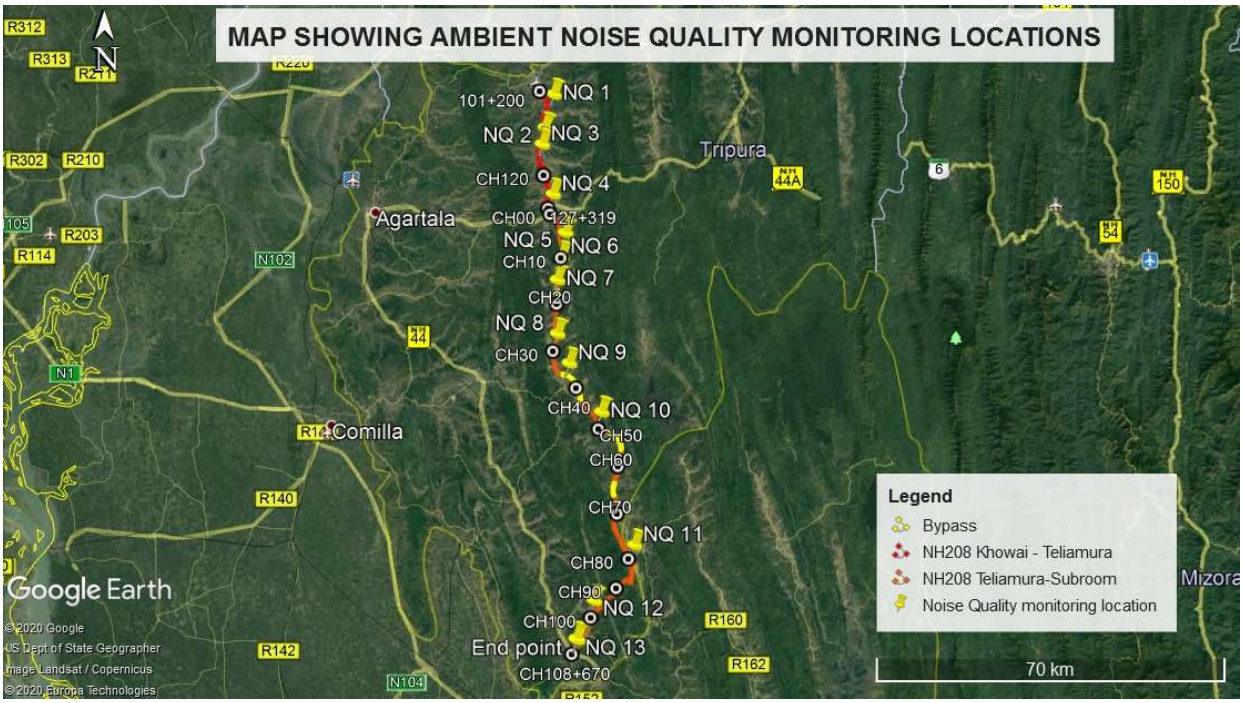


Figure 4.19: Map showing ambient noise quality monitoring locations

Figure 4.20: Photographs showing ambient noise quality monitoring locations

These ambient noise levels conform to the prescribed limit for all landuse categories monitored ***(*Annexure *-7)***. Noise level is comparatively high at Teliamura due to higher traffic load of NH-44. Comparatively high noise level recorded in Teliamura, Kalyanpur & Harina due to heavy vehicular load in the existing road junction. The noise levels during both day and night time are within the prescribed limits. Below table 4.5 presents noise level in dB(A) along the Project Road.

Table 4.5: Noise Level in dB(A) along the Project Road

Location	Results		CPCB Limits Leq dB(A)	
	Leq Day dB(A)	Leq Night dB(A)	Day*	Night*
Mahadevtila	53	42	**50**	**40**
Dwarikapur	50	40	**55**	**45**
Kalyanpur	54	45	**55**	**45**
Teliamura (NH44)	56	44	**65**	**55**
BSF camp area	41.2	37.8	**50**	**40**
Taidu	54.8	42.5	**65**	**55**
Jantana Pada	51.3	41.8	**55**	**45**
Tingharia	45.2	38.3	**50**	**40**

Rangamati	53.9	42.3	**65**	**55**
Chelagangmung	52	41	**55**	**45**
Suknachari	51.8	39	**55**	**45**
Rupachari	52.5	41.7	**65**	**55**
Harina	54.3	43.9	**65**	**55**

Source: DPR

4.1.4 Landforms/Physiography and Topography

The state of Tripura resides in the North-East corner of India and lying between the latitude of 22˚56'N to 24˚32'N and longitude 91˚09'E to 92˚20'E. The state shares state boundary with Assam and Mizoram in the east (53 and 109 km respectively) and international boundary - with Bangladesh (839 km.) General altitude of the state differs between 15m to 750m from MSL. The physiography of Tripura tends to flatten towards west. The longitudinal valleys are juxtaposed in between the numerous hillocks and undulating surfaces. Agricultural activities occur in the fertile soil of these valleys. Series of parallel hill-ranges running north to south divide the state into broad parallel valleys, consisting of undulating hillocks covered with jungle & meandering streams. The range of hills rises from the plains of Sylhet in Bangladesh at the north and proceeds southwards until they join the Chittagong hill tracts in the east. Principal ranges of western part of the state are Baramura - Deotamura and Atharamura ranges. Structurally, the State of Tripura represents the western fringe of the typical 'ridge and valley' structural province of the late tertiary fold mountain belt, commonly known as the Indo-Burma Ranges (Purbachal Range).

4.1.5 Drainage Pattern

The state of Tripura is gifted with surface water resources. Entire drainage system in the state of Tripura is rain-fed and ephemeral in nature. Surface run off during rainy season introduces water into dry or almost dry narrow streams from elevated land. Governed by the topographic gradient and soil types, these streams meet with other streams to form a canal or larger stream. Subsequently all such streams fall in a large river. All major rivers originate from hill ranges and show a typical drainage pattern called trellis drainage, except a few instances of dendrite pattern. Khowai is main River in the project road area.

4.1.6 Geology & Hydrogeology

The major geomorphic element observed in Tripura is north-south running parallel hill regions and intervening valleys. The hills are tightly folded anticlines with broad synclinal valleys. Geologically, the area is occupied by the folded sedimentary formations ranging in age from lower Tertiary to Recent. In Tripura, the loamy soil type facilitates the percolation and infiltration of water from the surface into the ground water regime. Moreover, presence of sand stone facilitates the movement of water under the ground as well and acts as storage of water. It indicates that soil profile and nature of the bedrock helps runoff water to move into the ground water regime from recharge zone.

In the state of Tripura, the ground water occurs in shallow aquifers under unconfined and semi - confined to confined conditions. Fine to medium grained sand stones form the principal aquifer. In major part of the state, ground water occurs under unconfined condition in shallow depth. Ground water occurs under confined condition within shallow depths in small isolated zones. Aquifer system of the area is divided into two types, viz, shallow aquifer within 50 m bgl and deep aquifer between 50 to 300 m bgl. As per CGWB Report, 2008, the wells are constructed within a depth range of 6 to 171 m bgl. Discharge of the wells varies from 0.01 to 2.00 lit/sec during pre-monsoon period and from 0.02 to 2.5 lit/sec during post-monsoon period.

Three types of hydro-geological formations identified in the state of Tripura and they are as follows: Alluvial formation with thickness varies between 10-15 m and occurs along the bank of rivers and water can be extracted through dug well and ordinary hand pumps; Dupitila formation with thickness from 10-15m and nearly horizontal in disposition and it has low permeability and low storage capacity due to high clay content. It indicates that the water yielding capacity from this type of formation is very low; Sand stone of Tipam formation constituted the principle aquifer of this area and it consists of sub rounded fine to medium grained, friable sandstone with intercalated clay. Tipam formation is found in valleys of Tripura. The permeability of this formation is much higher than Dupitila and Surma sandstone.

4.1.7 Soil (Types and Chemical Characteristics)

The soil type of the state of Tripura can be classified in five major groups. They are reddish yellow brown sandy soils, red loam and sandy loam soils, older alluvial soils, younger alluvial soils and lateritic soils. Among these soil categories, reddish yellow brown sandy soil covers approximately 33 percent of the total geographic area and distributed along north-south axis of Tripura. Red loam and sandy loam soil covers 43.07 percent of total soil cover in state of Tripura. This soil type is associated with forest ecosystem and rich in nutrients. Older alluvial soil type covers 10 percent of total soil cover in Tripura and found mainly in river terraces and in high plains. Approximately 9 percent of the state's soil cover is constituted by younger alluvial soil. This type of soil is confined to the flood plains of river such as Khowai, Gumti etc. This nutrient rich soil type is composed of clay loam and loam.

Approximately 5 percent of the state's total soil cover comes under "lateritic soil" which is very poor in nutrient content. This can be recognized along the western boundary of the state of Tripura. Soils of Tripura have been grouped into five soil reaction classes viz. extremely acidic (<4.5 pH)-10%, very strongly acidic (4.6-5.0)-26%, strongly acidic (5.1-5.5) - 54% and medium (5.6-6.0)-8% and slightly acidic (6.1-6.5)-2%.The results is given in table below. It is observed from the soil analysis result that the soil quality of project road meet the requirement of ICAR for agriculture purposes. Below table 4.6 presents soil quality sampling locations. Physical-Chemical Characteristics of Soil at various locations have been provided in table 4.7. Photographs and map showing soil sampling have been presented in figure 4.21 and 4.22 respectively.

Table 4.6: Soil quality sampling locations

S. No.	Locations	**Latitude**	**Longitude**
SQ1	Dwarikapur	23°57'32.34"N	91°36'45.78"E
SQ 2	Kalyanpur	23°55'48.00"N	91°36'24.71"E
SQ 3	Teliamura (NH44)	23°50'24.46"N	91°37'40.05"E
SQ 4	BSF camp area	23°46'15.45"N	91°39'06.88"E
SQ 5	Taidu	23°43'40.73"N	91°38'38.50"E
SQ 6	Jantana Pada	23°41'11.55"N	91°38'08.14"E
SQ 7	Tingharia	23°35'24.57"N	91°38'07.26"E
SQ 8	Rangamati	23°32'14.75"N	91°39'29.69"E
SQ 9	Chelagangmung	23°26'59.14"N	91°43'15.00"E
SQ 10	Suknachari	23°21'21.42"N	91°47'11.73"E
SQ 11	Rupachari	23° 6'40.35"N	91°42'18.67"E
SQ 12	Harina	23°02'25.68"N	91°40'13.09"E

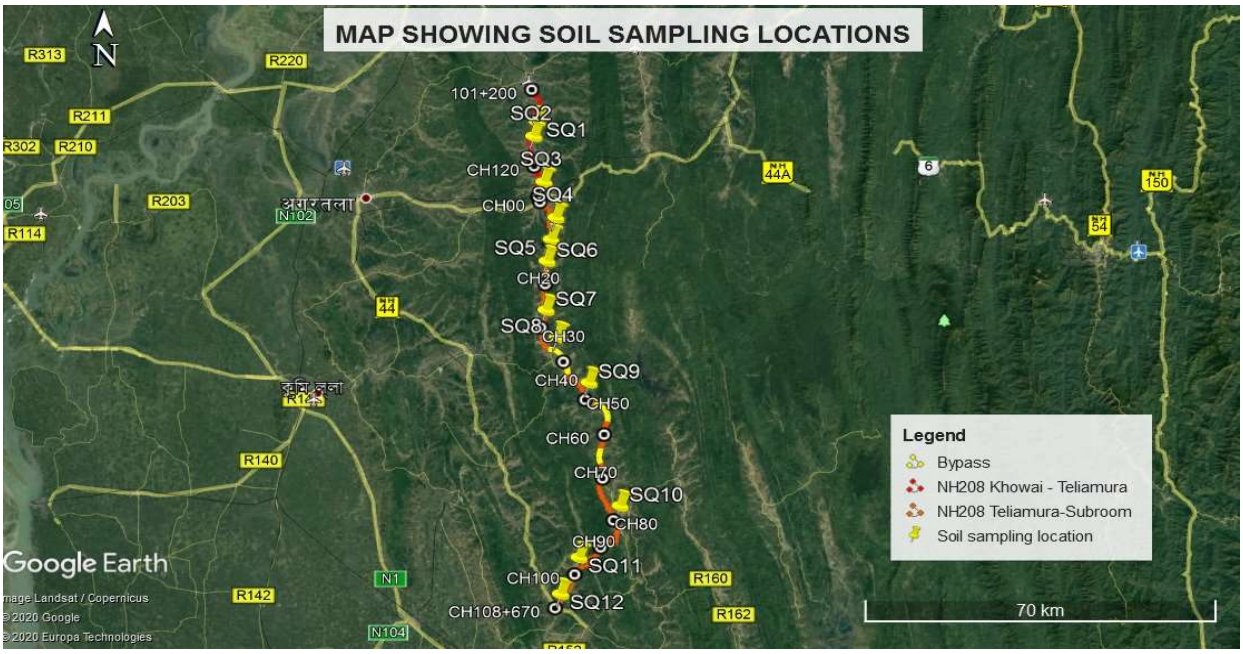


Figure 4.21: Soil quality sampling locations

Figure 4.22: Photographs showing soil sampling

Table 4.7: Physical-Chemical Characteristics of Soil

Sl.	**Parameters**	Dwarikapur	Kalyanpur	Teliamura	BSF	Taidu	Jantana	Tingharia	Rangamati	Chelagangmung	Suknachari	Rupachari	Hrina
1	Soil Texture	Sandy Loam	Sandy	Sandy	Sandy	Sandy	Sandy	Sandy	Sandy	Sandy Loam	Sandy	Sandy	Sandy
	Grain Size	100	100	100									
	a) Sand	41	44	46	40	48	40	41	47	44	45	42	43
	b) Silt	40	35	36	36	32	33	35	33	35	35	34	36
2	c) Clay	19	21	18	24	20	27	24	20	21	20	24	21
3	Porosity (%)	20	21	26	22	23	20	22	24	21	22	23	21
4	Bulk Density	1.49	1.5	1.48	1.42	1.36	1.44	1.36	1.38	1.32	1.45	1.42	1.48
5	pH	5.5	4.7	5.8	5.8	6.0	5.9	5.8	6.2	5.8	5.6	5.8	6.7
6	Elect.	0.34	0.35	0.35	0.36	0.38	0.35	0.36	0.37	0.38	0.35	0.36	0.38
7	Water	39	42	39	42	38	40	41	35	40	42	39	41
8	Liquid Limit	25.6	24.6	21.6	21.2	21.4	20.3	21.5	21.4	20.6	21.2	21.8	21.4
9	Plastic Limit	13.2	13.1	13.5	13.0	11.8	14.6	13.0	12.7	13.0	12.8	12.0	11.8
10	Infiltration	2.7	2.7	2.8	2.6	2.9	2.8	2.6	2.4	2.5	2.8	2.7	2.6
11	Field	8.2	8.2	8.3	8.2	8.4	8.2	8.0	8.2	8.3	7.4	8.5	8.6
12	Wilting Co-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
13	Available	16	15	17	20	18	17	20	22	19	20	22	17
14	Organic	0.39	0.49	0.38	0.38	0.26	0.44	0.39	0.27	0.42	0.45	0.44	0.42
15	Sodium	0.33	0.34	0.38	0.34	0.35	0.32	0.33	0.32	0.36	0.35	0.34	0.38
16	Carbon	6.7	6.5	7.2	7.0	7.5	7.4	7.0	7.2	7.0	7.6	7.5	7.8
17	Nitrogen as	219	221	245	230	232	236	237	234	235	238	235	238
18	Phosphorous	7.1	6.7	7.1	7.4	7.8	7.5	7.5	7.6	7.4	7.8	7.5	7.6
19	Potash as	109.5	122.5	125.5	102.8	105.2	106.7	103.4	102.3	105.5	103.4	104.2	105.6

Source: DPR

4.1.8 Land Use of Project Influence Area

A detailed land use map in 10 km radius from the proposed project road corridor has been prepared with the help of latest satellite imageries and based on the primary field observation. Dominant land use in the 10km radius of the project road is forest land with an area covering 62.51%. It is followed by crop land land which covers an area of 27.14% in 10km radius of the project road. Land Use Map is given below as Figure 4.23. Table 4.8 shows Land Use of the Project Road Corridor (10km radius)

Table 4.8: Land Use of the Project Road Corridor (10km radius)

Class	**Area in Hectares**	**Area in Km**	**Percentage**
Class 1 Forest	176662.1	1766.621	62.51220789
Class 2 Built-up	8412.66	84.1266	2.976835161
Class 3 Wastelands /Unculturable	7973.1	79.731	2.821296049
Class 4 Crop Land	76708.3	767.083	27.14337255
Class 5 Water	12848	128.48	4.546288349
Total	**282604.16**	**2826.0416**	**100**

Figure 4.23: Land Use Map of the Project Road Corridor (10km radius)

Source: DPR and EIS

4.1.9 Ground Water (Occurrence and Quality)

In shallow aquifer ground water occurs under unconfined and semi-confined to confined conditions. In major part of the area ground water occurs under unconfined condition in shallow depth. Ground water occurs under confined condition within shallow depths in small isolated zones, e.g., in central and eastern part of Matabari block, in central part of Kakraban block, in northern part (Rajapur - Kanchannagar area) of Bagafa block, in Srirampur area of Rajnagar block, in the southern part (Jalefa - Harina area) of Satchand block. In deeper aquifers ground water occurs under semi-confined to confined conditions. Ground water occurs under artesian condition in Teliamura, Dhuptali, Rajnagar, Muhuripur, Charakbai, East Pipariakhola, Fulkumari and Satchand area.

In the study area hand pump and bore well have been made to trap underground water. Ground water samples have been collected from thirteen locations to assess drinking water quality of the project area. All the thirteen samples confirm (Table 4.9) suitability of the ground water for drinking purpose. Figure 4.24 presents groundwater quality sampling locations and photographs have been presented in figure 4.25.

Table 4.9: Groundwater quality sampling locations

Sl. No.	Location	Latitude	Longitude
GW1	Mahadevtila/Chebri village	24° 1'9.24"N	91°37'49.04"E
GW 2	Dwarikapur	23°57'49.93"N	91°36'46.77"E
GW 3	Kalyanpur	23°55'55.46"N	91°36'26.43"E
GW 4	Teliamura	23°50'19.71"N	91°37'38.26"E
GW 5	BSF camp area	23°46'15.45"N	91°39'06.88"E
GW 6	Taidu	23°43'40.73"N	91°38'38.50"E
GW 7	Jantana Pada	23°41'11.55"N	91°38'08.14"E
GW 8	Tingharia	23°35'24.57"N	91°38'07.26"E
GW 9	Rangamati	23°32'14.75"N	91°39'29.69"E
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GW 12	Rupachari	23° 6'40.35"N	91°42'18.67"E
GW 13	Harina	23°02'25.68"N	91°40'13.09"E

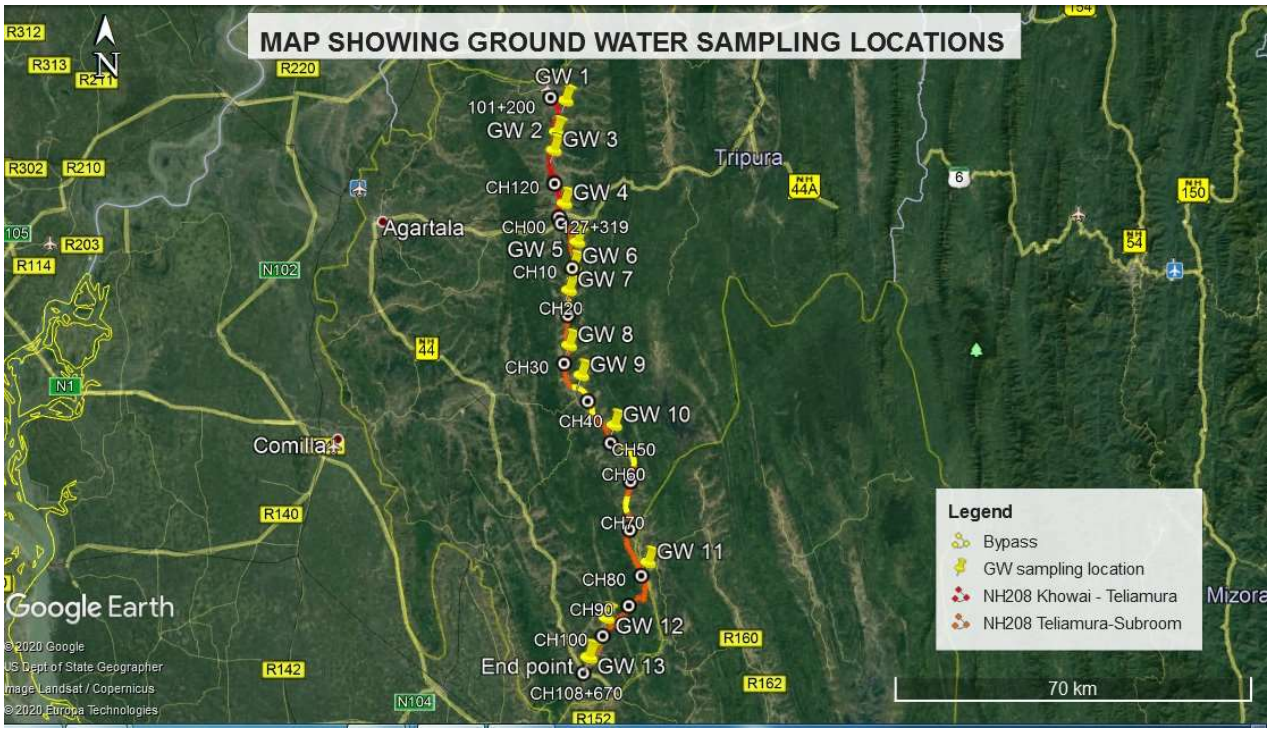


Figure 4.24: Groundwater quality sampling locations

Figure 4.25: Photographs showing ground water sampling

The ground water quality of the project area has been shown in **Table 4.10** below**.**

Table 4.10: Ground Water Quality of the Project Area

Sl. No.	Location	Source	EC	HCO 3	Cl	Ca	Mg	TH as CaCO3	Na	K
	Unit		¼S/cm 25ÚC	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	Mahadevtila	Hand pump	222	59	17	43	28	71	37	4.6
2	Dwarikapur	Hand pump	204	57	19	46	27	73	34	4.2
3	Kalyanpur	Hand pump	240	58	20	45	29	74	40	4.4
4	Teliamura	Hand pump	234	60	17	42	28	70	39	4.6
5	BSF camp area	Bore well	308	44	42	28	16	168	14	2.1
6	Taidu	Bore well	312	48	38	32	17	145	16	3.2
7	Jantana Pada	Hand pump	309	46	40	30	18	155	17	2.5
8	Tingharia	Bore well	318	42	36	34	16	147	18	3.0
9	Rangamati	Bore well	308	45	39	36	17	156	16	2.6
10	Chelagangmung	Bore well	312	40	35	32	15	142	17	2.4
11	Suknachari	Bore well	316	44	38	35	14	166	15	2.8
12	Rupachari	Hand pump	310	40	16	38	22	167	18	2.6
13	Harina	Hand pump	306	41	15	40	18	158	16	3.2

Source: DPR

4.1.10 Surface Water Quality

Surface water samples taken from the Khowai and Gumti River and also from ponds adjacent to project road located & have been compared with the standards prescribed by Central Pollution Control Board (CPCB) for Irrigation- Class D and propagation of wildlife and fisheries -Class-E (**Annexure *-5 & 6***). The results of the samples confirm their suitability for both these purposes. Surface water quality sampling locations and map have been presented in table 4.11 and figure 4.26 below.

Table 4.11: Surface water quality sampling locations

SI No.	Source	Location	Latitude	Longitude
SW1	Khowai River	Khowai	24° 3'44.84"N	91°35'55.40"E
SW 2	Pond	Mahadevtila/ Chebri village	24° 1'6.61"N	91°37'55.13"E
SW 3	Pond	Dwarikapur	23°58'6.02"N	91°37'4.10"E
SW 4	Pond	Kalyanpur	23°55'53.12"N	91°36'28.12"E
SW 5	Pond	Teliamura	23°50'23.98"N	91°37'35.18"E
SW 6	River	Near Tingharia	23.677856°	91.635847°
SW 7	Gumti river	Near Rangamati bridge	23.528601°	91.652791°
SW 8	Pond	Near Sukhnachari	23.197497°	91.792533°

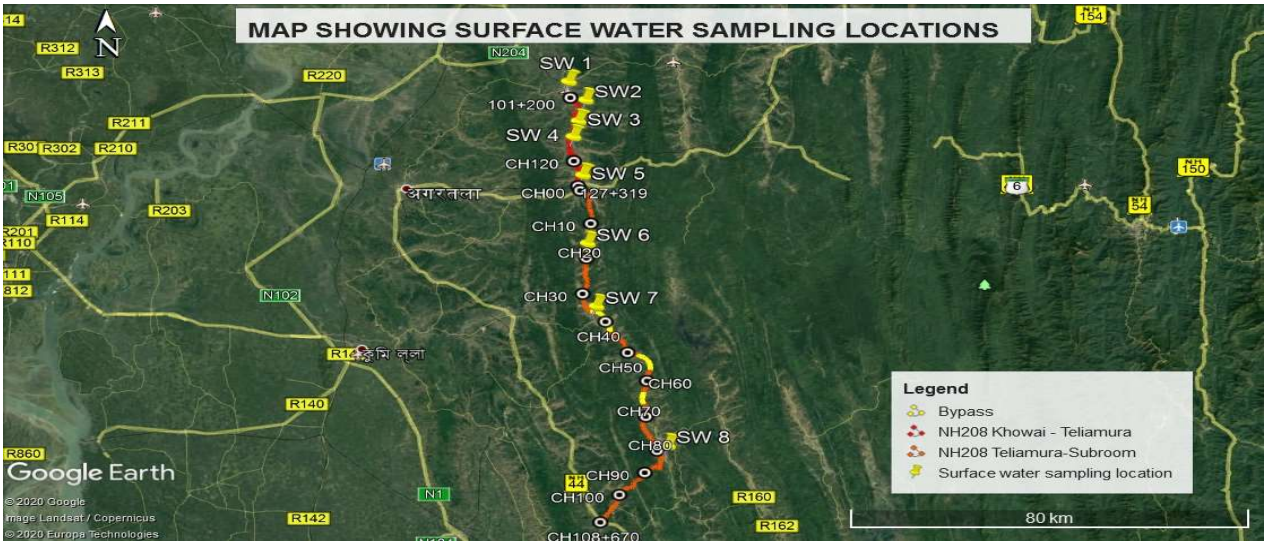


Figure 4.26: Surface water quality sampling locations

Photographs showing surface water sampling have been presented in figure 4.17.

Figure 4.27: Photographs showing surface water sampling

Results of the surface water quality in the project area have been summarized in table 4.12 below.

Table 4.12: Surface Water Quality of the Project Area

Parameters	Locations					Limit as per IS:2296 Class 'C'
	Pond at Teliamura	Pond at Kalyanpur	Pond at Dwarikapur	Pond at Mahadevtila	Khowai River	
Physical						
pH	6.9	6.8	6.9	6.8	6.7	6.5-8.5
Temperature	24.5	25.5	25	24.5	25.5	*
Colour, HU	3	3	3	3	4	300
Turbidity (NTU)	26	24	24	22	32	*
Total Suspended Solids	28	33	32	30	42	
Total Dissolved Solids	431	396	414	412	467	1500
Chemical						
P- Alkalinity as CaCO3	Nil	Nil	Nil	Nil	Nil	*
Total Alkalinity as CaCO3	152	142	147	157	182	*
Chloride as Cl	18	21	19	24	12	600
Sulphate as SO4	197	186	191	182	168	400
Nitrate as NO3	0.8	0.9	1.1	0.9	0.2	50
Fluride as F	<0.4	<0.5	<0.5	<0.4	<0.3	1.5
Total Hardness as CaCO3	98	90	94	94	106	*
Calcium Hardness as CaCO3	54	50	52	56	66	*
Magnesium Hardness as CaCO3	44	40	42	38	40	*

Dissolve Oxygen	5.4	5.8	5.6	5.6	6.8	4
COD	18	20	16	18	14	*
BOD (3days at 27^{Ú}C)	4.2	4.8	4.6	4.8	5.8	3
Total Kjeldahl Nitrogen as N	2.3	2.8	1.9	2.1	1.7	*
Sodium as Na	15	12	13	13	24	*
Potassium as K	2	2	2	2	3	*
Silica as SiO2	12	12	11	12	16	*
Heavy Metals						
Iron as Fe	0.9	0.8	0.8	0.8	1.1	5
Manganese as Mn	<0.07	<0.07	<0.08	<0.07	<0.05	*
Total Chromium as Cr	NT	NT	NT	NT	NT	0.05
Lead as Pb	NT	NT	NT	NT	NT	0.1
Zinc as Zn	0.1	0.1	0.1	0.1	0.2	15
Cadmium as Cd	NT	NT	NT	NT	NT	
Copper as Cu	NT	NT	NT	NT	NT	
Nickel as Ni	NT	NT	NT	NT	NT	
Arsenic as As	NT	NT	NT	NT	NT	0.2
Selenium as Se	NT	NT	NT	NT	NT	0.05
Cyanide as CN	NT	NT	NT	NT	NT	0.05
Mercury as Hg	NT	NT	NT	NT	NT	
Others						
Oil & Grease	BDL	BDL	BDL	BDL	BDL	0.1
Phenolic Compound as C6H6OH	NT	NT	NT	NT	NT	0.005
Coliform Organisms (MPL/100ml)	2.2X90	2.2X90	2.2X90	2.2X90	2.2X120	5000

Parameters	**Location**			
	Local River Near Tingharia Village	**Pond water Near Sukhnachari**	**Gomti river near Rangamati bridge**	**Limit as per IS:2296 Class 'C'**
Physical				
pH	7.58	7.42	7.55	6.5-8.5
Temperature	25.2	26.4	25.5	*
Colour, HU	4.2	5.0	2.2	300
Odour				
Turbidity (NTU)	5	6	4	*
Total Suspended Solids	18	20	17	
Total Dissolved Solids	381	384	375	1500
Chemical				
P-Alkalinity as CaCO3	Nil	Nil	Nil	*
Total Alkalinity as CaCO3	118	120	117	*

Chloride as Cl	16.2	18.5	14.6	600
Sulphate as SO4	186	188	184	400
Nitrate as NO3	0.02	0.03	0.02	50
Fluoride as F	<0.6	<0.8	<0.5	1.5
Total Hardness as CaCO3	289	282	266	*
Calcium Hardness as CaCO3	50	55	48	*
Magnesium Hardness as CaCO3	40	42	36	*
Dissolve Oxygen	6.0	5.5	6.45	4
COD	12	15	14	*
BOD (3days at 27^{Ú}C)	3.2	4.5	3.0	3
Total Kjeldahl Nitrogen as N	2.8	3.0	2.5	*
Sodium as Na	16	18	15	*
Potassium as K	2.8	3.0	2.4	*
Silica as SiO2	10	12	9.8	*
Heavy Metals				
Iron as Fe	0.8	0.9	0.6	5
Manganese as Mn	<0.06	<0.07	<0.05	*
Total Chromium as Cr	BDL	BDL	BDL	0.05
Lead as Pb	BDL	BDL	BDL	0.1
Zinc as Zn	0.2	0.3	0.2	15
Cadmium as Cd	BDL	BDL	BDL	
Copper as Cu	BDL	BDL	BDL	
Nickel as Ni	BDL	BDL	BDL	
Arsenic as As	BDL	BDL	BDL	0.2
Selenium as Se	BDL	BDL	BDL	0.05
Cyanide as CN	BDL	BDL	BDL	0.05
Mercury as Hg	BDL	BDL	BDL	
Others				
Oil & Grease	BDL	BDL	BDL	0.1
Phenolic Compound as C6H6OH	BDL	BDL	BDL	0.005
Total Coliform (MPL/100ml)	234	345	228	5000

NIL means zero, NT: Not traceable, BDL: Below detectable limit, NT is less than the detectible limit and called NT i.e. non traceable as per NABL (National Accreditation Board for Testing and Calibration Laboratories)

Source: DPR

4.2 Biological Environment and Biodiversity

The state of Tripura is characterized by diverse natural resources and agronomically – potential tropical areas. The recorded forest area of the state is merely 6,294 sq. km which contributes forest cover to the tune of 60.02 per cent of the geographical area at the state level. Legally, the forest area in the State has been classified into three categories, viz., Reserved Forest, Protected Forest and Unclassified Forest, which constitute 66.33 per cent, 0.03 per cent and 33.64 per cent of the total recorded forest area, respectively (**FSI, 2017**). In term of forest canopy density classes, the state has very dense forest 1.04 per cent, 100 moderate dense forest 44.67 per cent, open forest 30.33 per cent, scrub 0.69 per cent, and non-forest 23.27 per cent. Figure 4.28 shows forest cover map of Tripura and Figure 4.29 is geo-reference map showing forest area proposed to be diverted for widening of NH- 208 under the Teliamura to Sabroom (sectin II).

Forest land is required for project. The stage-1 clearance has already been obtained in section 1 and in section 2, forest diversion of 126.2014 ha of land is under process. A total of approx. 36744 nos of trees expected to fell due to project road construction activities.

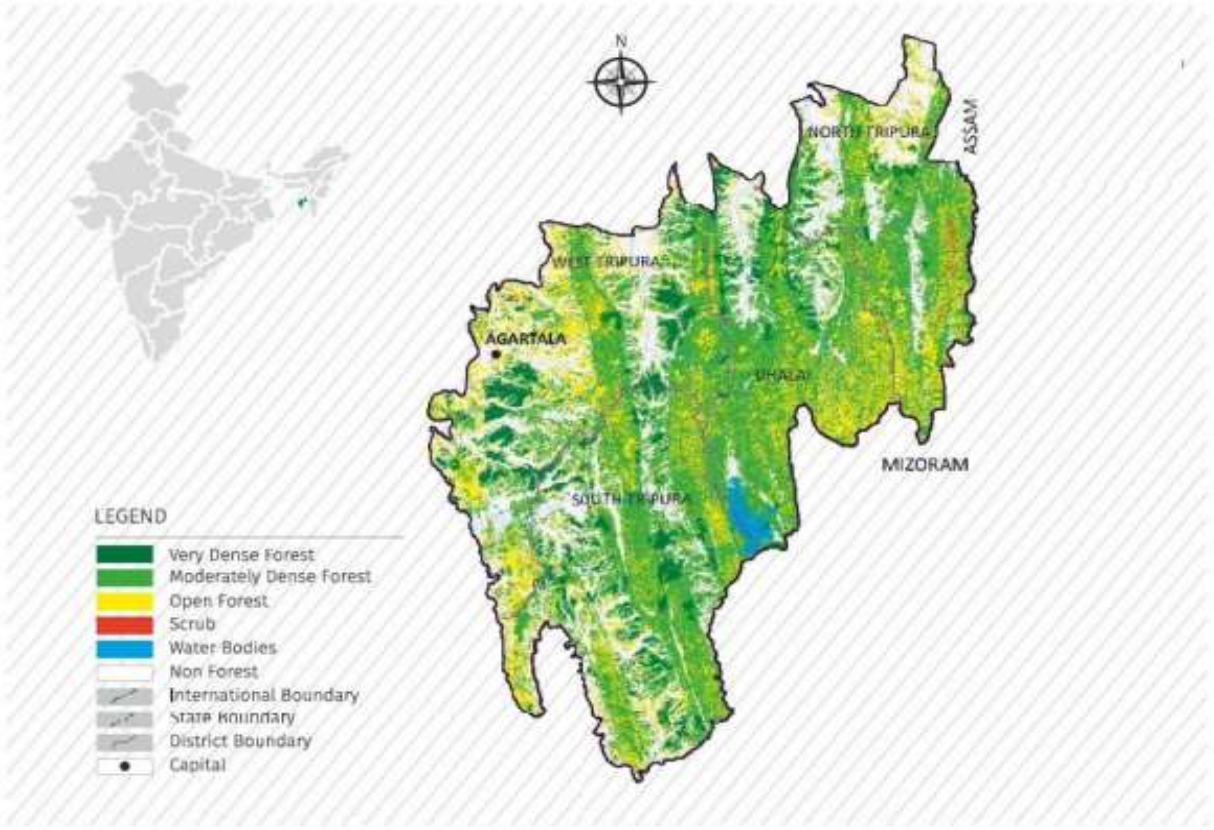
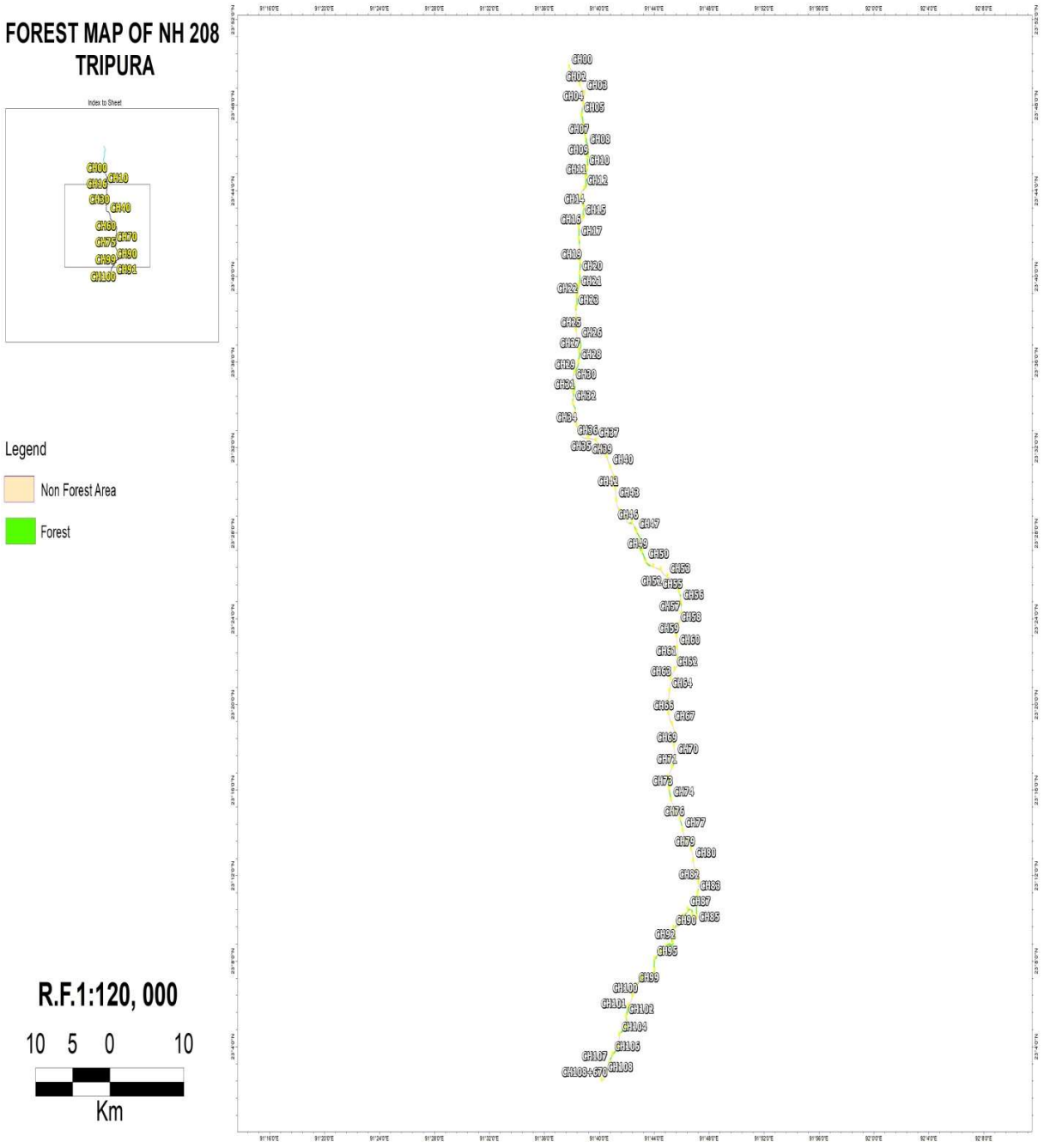


Figure 4.28: Forest cover map of Tripura

Source: fsi.nic.in



Source: EIS

Figure4.29: Geo-Reference Map Showing Forest Area Proposed to be diverted for Widening of NH- 208 (Selected from Teliamura to Sabroom section II)

4.2.1 Methodology for Ecological and Biodiversity Analysis

A phased and consultative approach was followed to carry out the ecological and biodiversity assessment during monsoon season in August-September, 2020. The successive phases include: (i) reconnaissance

survey, (ii) on-site primary data collection for flora and fauna using standardised ecological methods, and (iii) secondary data collection through review of available literature (published and memiographic, and electronic media). Wherever necessary, the desired information was collected/substantiated through formal and informal interactions/discussions with the field staff of the line department, revenue authorities at village level, local inhabitants and natural resource users.

The vegetation of terrestrial ecosystem was classified following Champion and Seth (1968) for forest types and Dabadghao and Shankarnarayana (1973) for grassland types.
The floristic composition (floral biodiversity) of terrestrial ecosystem was studied through field visits and using quadrat method as per need. Both the angiospermic and non-angiospermic flora were recorded using random sampling and identified following published taxonomic literature and by consulting the professionals of relevant study area. The phytosociological attributes could not be studied on account of very dense growth of vegetation with complete cover of the ground. For aquatic ecosystems, the phytoplanktons, zooplanktons and macrophytes were studied upto species level.

For biodiversity analysis of fauna, transect method was followed. The timing is during August-September, 2020, which is the wet and humid season. The dry season data were based on the additional information for fish species, avifauna and mammals which was collected from local people, local market and working plan of the Forest Department. The status of the plant and animal species, such as, endemic, rare, endangered and threatened, etc., is reported following IUCN Red list of RET species, Red Data Book of BSI, Wildlife (Protection) Act, 1972 and as per local availability.

In order to understand the composition of vegetation, most of the plant species were identified in the field itself whereas in case of the species that could not be identified at the site, a herbarium specimen of the same was collected without uprooting the plant, and additionally their photographs were also taken wherever necessary for identification later with the help of available published literature and flora of the region.

Analysis of existing flora and fauna (as described hereunder) indicates almost negligible presence of threatened and endangered species of plants and animals. Local availability (based on field visits and interactions with the inhabitants) for each species of plant and animal has been indicated in each checklist which is an indicative of abundance and dominance of the existing species.

Sampling locations are as below in table 4.13 and map showing ecology and biodiversity sampling locations Figure 4.30.

Table 4.13: Ecology and Biodiversity sampling locations

S.No.	Names	Latitude	Longitude
EBA1	Near Khowai	24° 3'16.11"N	91°37'4.22"E
EBA2	Durgapur	23°57'34.47"N	91°38'24.07"E
EBA3	Jambuk Chhara	23°45'47.41"N	91°39'54.90"E
EBA4	Dalak	23°30'2.19"N	91°43'24.95"E
EBA5	Bishnupur	23° 8'8.70"N	91°45'26.54"E

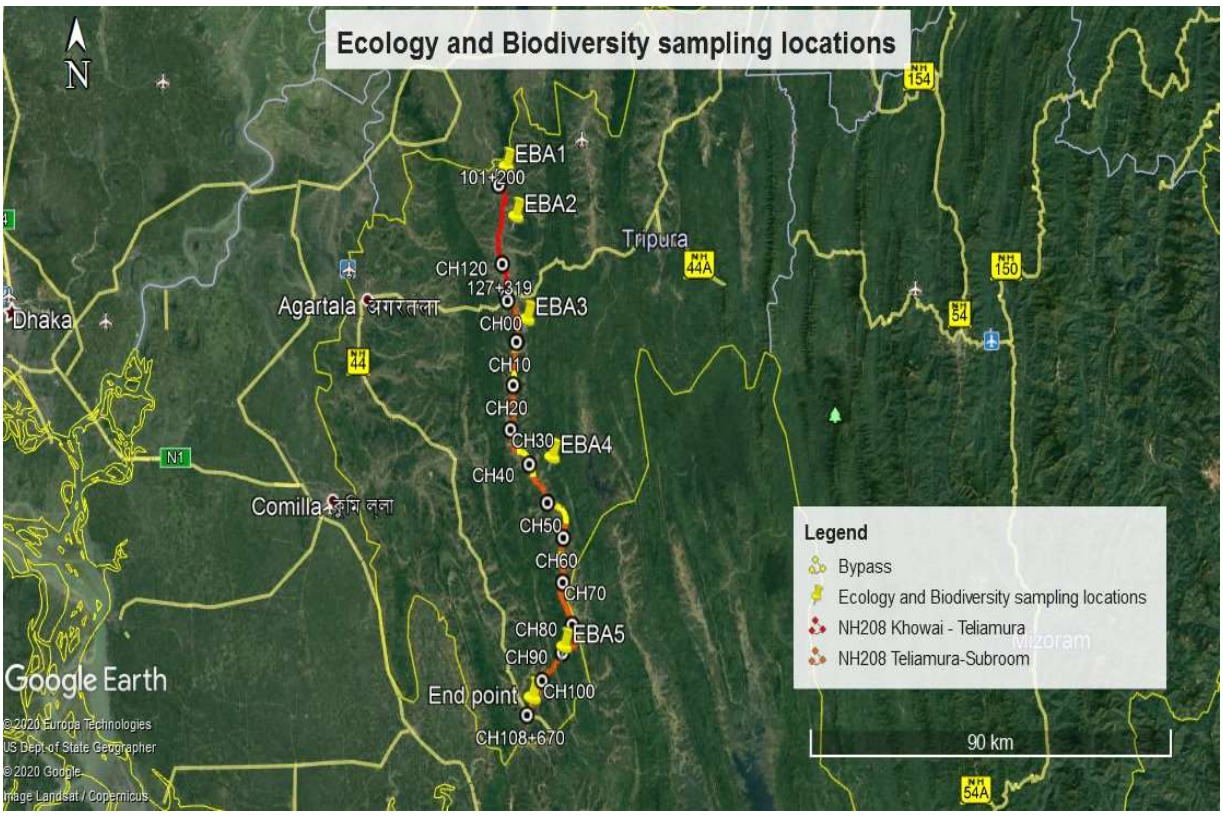


Figure 4.30: Map showing ecology and biodiversity sampling locations

4.2.1.1 Forest and Grassland Types

Following the classification of forest types given by **Champion and Seth (1968),** the project site includes Moist Deciduous Forest and Semi-Evergreen Forest based on different bio-edaphic conditions.
The grass cover in the project site belongs to *Phragmites-Saccharum-Imperate* type mainly and *Themeda-Arudinella* type particularly in upland conditions, as described by Debadghao and Shankarnarayana (1973).

4.2.1.2 Biological Diversity

Representative examples of usages of biodiversity by the inhabitants in the project area are illustrated in Figures 4.31 to 4.32. The taxonomic details of floral and faunal biodiversity in land-based and water-based ecosystems in the project site are enumerated in Tables 4.14 to 4.29. The economic importance of major species is detailed in Table 4.21.

Fig. 4.31 Biodiversity usages for human consumption in the project site

Fig. 4.32 Biodiversity in wild landscape (from top to bottom-wild flora along the rural road, interaction about local use of wild biodiversity with the local person, biodiversity along NH208)

Source: EIS

(A) TERRESTRIAL FLORAL DIVERSITY

During the site visit, the type and details of major non-flowering plant species present in the project area has been provided in table 4.14.

Table 4.14: Major non-flowering plant species in the project area

S. NO.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN CATEGORY
(A) BRYOPHYTES					
1	*Funaria spp.*	?	Funariaceae	Common	-
2	*Marchantia spp.*	?	Marchantiaceae	Rare	-
3	*Plagiochasma spp.*	?	Plagiochasmaceae	Common	-
4	*Riccia spp.*	?	Ricciaceae	Common	-
(B) PTERIDOPHYTES					
1	*Adiantum sp.*	?	Adiantaceae	Common	-
2	*Pleopeltis sp.*	?	Pleopeltae	Common	-
3	*Pteris sp.*	?	Pteridae	Common	-
4	*Pteridium spp.*	?	Pteridiae	Very common	-
(C) GYMNOSPERMS					
Not recorded					

** Source: EIS*

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

The non-flowering plant species found in the study area are having availability common and very common in nature except *Marchantia spp.* which has a rare availability in the study area. However project activities have no significant impact on this specie.

During the site visit, the type and details of Tree species (angiospermic) present in the project area has been provided in table 4.15.

Table 4.15: Tree species (angiospermic) recorded in the project area

S.No.	SCIENTIFIC NAME	LOCAL / ENGLISH NAME	FAMILY	LOCAL AVAILABLITY	IUCN CATEGORY
1.	Acacia auriculiformis	?	Mimosaceae	Common	NA
2.	*Acacia leucophloea*	Reonjha	Mimosaceae	Abundant	NA
3.	*Acacia nilotica*	Babul	Mimosaceae	Abundant	NA
4.	*Adina cordifolia*	Haldu	Rubiaceae	Common	NA
5.	*Aegle marmelos*	Bel	Rutaceae	Very common	NA
6.	*Ailanthus excelsa*	Maharukh	Simarubiaceae	Abundant	NA
7.	*Albizia lebbeck*	Shirish	Mimosaceae	Common	NA
8.	*Albizia lucida*	Sikaria	Mimosaceae	Common	NA
9.	*Albizia procera*	Karai	Mimosaceae	Common	NA
10.	*Albizia stipulata*	Harish	Mimosaceae	Common	NA
11.	*Alstonia scholaris*	Chaitwan /Chhatni	Apocynaceae	Common	NA
12.	*Anthocephalus chinensis*	Kadam	Rubiaceae	Common	NA
13.	*Anogeissus pendula*	Kardhai	Combretaceae	Abundant	NA
14.	*Artocarpus heterophyllus*	Dehua Chamal	Moraceae	Common	
15.	*Artocarpus lacucha*	Kathal	Moraceae	Common	NA
16.	*Azadirachta indica*	Neem	Meliaceae	Very common	NA
17.	*Barringtonia acutangula*	Hijal	Lecythidaceae	Common	NA
18.	*Bauhinia purpurea*	Kanchan	Caesalpiniaceae	Common	NA
19.	*Bauhinia racemosa*	Asto	Caesalpiniaceae	Common	NA
20.	*Bombax ceiba*	Simul	Malvaceae	Common	NA
21.	*Butea monosperma*	Dhak; palas	Papilionaceae	Very common	NA
22.	*Calamus tenuis*	Jalibet/Chachi bet	Arecaceae	Common	NA
23.	*Canarium strictum*	Dhup	Burseraceae	Common	NA

24.	*Careya arborea*	Kumbhi	Lecythidaceae	Common	NA
25.	*Caryota urens*	Tad	Arecaceae	Common	NA
26.	*Cassia fistula*	Sonal/Shonalu	Caesalpiniaceae	Common	NA
27.	*Callicarpa arborea*	Banmala	Verbenaceae	Common	NA
28.	*Cinnamomum tamala*	Tejpata	Lauraceae	Common	NA
29.	*Dalbergia sissoo*	Shisham	Papilionaceae	Very common	NA
30.	*Dillenia indica*	Chalta	Dilleniaceae	Common	NA
31.	*Dillenia pentagyna*	Hargaja	Dilleniaceae	Common	NA
32.	*Diospyros peregrina*	Kendu	Ebenaceae	Common	NA
33.	*Dipterocarpus turbinatus*	Garjan	Dipterocarpaceae	Common	NA
34.	*Duabanga grandiflora*	Ramdala	Sonneratiaceae	Common	NA
35.	*Emblica officinalis*	Amla	Euphorbiaceae	Abundant	NA
36.	*Erythrina suberosa*	Pangra	Papilionaceae	Very common	NA
37.	*Eucalyptus tereticornis*	Neelgiri	Myrtaceae	Common	NA
38.	*Ficus bengalensis*	Bar	Moraceae	Rare	NA
39.	*Ficus glomerata*	Gular	Moraceae	Common	NA
40.	*Ficus hispida*	Dumur	Moraceae	Rare	NA
41.	*Ficus religiosa*	Aswatwa	Moraceae	Common	NA
42.	*Ficus tomentosa*	Son pakar	Moraceae	Common	NA
43.	*Flacourtia indica*	Kakai	Salicaceae	Common	NA
44.	*Garuga pinnata*	Kekar	Burseraceae	Rare	NA
45.	*Gmelina arborea*	Gamar	Verbenaceae	Common	NA
46.	*Grewia microcos*	Pichla	Tiliaceae	Common	NA
47.	*Gossypium arboreum*	Karpash	Malvaceae	Common	NA
48.	*Holarrhena antidysenterica*	Sarpa Gandha	Apocynaceae	Common	NA
49.	*Hydnocarpus kurzii*	Chalmugra	Achariaceae	Common	NA
50.	*Lagerstroemia parviflora*	Ledi	Lythraceae	Abundant	NA
51.	*Lawsonia inermis*	Mehandi	Lythraceae	Common	NA
52.	*Leucaena leucocephala*	Babul	Fabeaceae	Common	NA

53.	*Licuala peltata*	Kuruj Pat	Arecaceae	Common	NA
54.	*Litsea glutinosa*	Garpur	Lauraceae	Common	NA
55.	*Mangifera indica*	Aam	Anacardiaceae	Common	NA
56.	*Mesua ferrea*	Nageswar	Guttiferae	Common	NA
57.	*Michelia champaca*	Champa	Magnoliaceae	Common	NA
58.	*Machilus gamblei*	Shum	Magnoliaceae	Common	NA
59.	*Parkia javonica*	Pukya tetui	Mimosaceae	Common	NA
60.	*Polyalthia longifolia*	Debdaru	Annonaceae	Common	NA
61.	*Samanea saman*	Raintree	Mimosaceae	Common	NA
62.	*Schima wallichii*	Kanak	Theaceae	Common	NA
63.	*Schleichera trijuga*	Kusum	Sapindaceae	Very common	NA
64.	*Schumannianthus dichotomus*	Mukta	marantaceae	Common	NA
65.	*Shorea robusta*	Shal (Sal)	Dipterocarpaceae	Common	NA
66.	*Spondias pinnata*	Amra	Anacardiaceae	Common	NA
67.	*Sterculia alata*	Gorak Nerical	Sterculiaceae	Common	NA
68.	*Sterculia villosa*	Udal	Sterculiaceae	Common	NA
69.	*Stereospermum personatum*	Chari awal/Dharmara	Bignoniaceae	Common	NA
70.	*Syzygium cumini*	Kalajam	Myrtaceae	Very common	NA
71.	*Syzygium fruticosum*	Banjam	Myrtaceae	Very common	NA
72.	*Tectona grandis*	Sagaun	Verbenaceae	Very Common	NA
73.	*Terminalia arjuna*	Koha	Combetaceae	Very common	NA
74.	*Terminalia belerica*	Bahera	Combretaceae	Common	NA
75.	*Terminalia chebula*	Harra	Combretaceae	Very common	NA
76.	*Terminalia myriocarpa*	?	Combretaceae	Common	NA
77.	*Terminalia tomentosa*	Saja	Combretaceae	Common	NA
78.	*Tetrameles nudiflora*	Chandul	Passifloraceae	Common	NA
79.	*Ziziphus mauritiana*	Kulbarai	Rhamnaceae	Common	NA
80.	*Ziziphus oenoplia*	Bambarai	Rhamnaceae	Common	NA

** Source: EIS and Forest working plan*

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

During the site visit, the survey team found that there were no Trees which is of serious concern in terms of scarcity in the project area. There are 60 nos. of common, 11 nos. of very common, 3 nos. of rare and 6 nos. of abundant species of Trees in the project area.

During the site visit, the type and details of Shrubs species present in the project area has been provided in table 4.16.

Table 4.16: Shrub species (Angiosperms) recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Acacia concinna*	Banritha	Mimosaceae	Common	NA
2.	*Adhatoda vasica*	Adusa	Acanthaceae	Abundant	NA
3.	*Calotropis procera*	Madar	Apocynaceae	Very common	NA
4.	*Cassia fistula*	Sonal/Shonalu	Caesalpiniaceae	Common	NA
5.	*Cassia tora*	Banar	Caesalpiniaceae	Abundant	NA
6.	*Cissampelos pareira*	Akandi	Menispermaceae	Common	NA
7.	*Clerodendron glandulosum*	Banabhait	Verbenaceae	Common	NA
8.	*Clerodendron viscosum*	Bhait	Verbenaceae	Common	NA
9.	*Colebrookea oppositifolia*	Ameda	Apocynaceae	Very common	NA
10.	*Glycosmis arborea*	Kawathuti	Rutaceae	Common	NA
11.	*Jatropha curcas*	Ratan jyoti	Euphorbiaceae	Common	NA
12.	*Lagerstroemia speciosa*	Jarul/Gang	Lythraceae	Common	NA
13.	*Lantana camara*	Kuri	Verbenaceae	Abundant	NA
14.	*Melastoma malabathricum*	Phutki	Melastomataceae	Common	NA
15.	*Murraya paniculata*	Madhukamani	Rutaceae	Common	NA
16.	*Nyctanthes arbor-tristis*	Parijat	Nyctaginaceae	Very common	NA
17.	*Prosopis juliflora*	Kikar	Mimosaceae	Common	NA
18.	*Premna latifolia*	Jinary/Gandhapatra	Verbenaceae	Common	NA
19.	*Tamarix dioica*	Bhayo	Tamaricaceae	Very common	NA
20.	*Tinospora cordifolia*	Gulancha	Menispermaceae	Common	NA
21.	*Vitex negundo*	Nirgudi	Verbenaceae	Common	NA
22.	*Zanthoxylum limonella*	Bazna/Bajrang	Rutaceae	Common	NA
23.	*Zizyphus jujuba*	Ber	Rhamanaceae	Common	NA

** Source: EIS and Forest working plan*
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

During the site visit, the survey team found that there was no shrub species which is of serious concern in terms of scarcity in the project area. There are 16 nos. of common, 04 nos. of very common and 03 nos. of abundant species in the study area.

During the site visit, the type and details of Herb species present in the project area has been provided in table 4.17.

Table 4.17: Herb species (angiosperms) recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Achyranthus aspera*	Latjeera	Amaranthaceae	Abundant	NA
2.	*Acorus calamus*	Bach	Acoraceae	Very common	NA
3.	*Ageratum conyzoides*	?	Asteraceae	Very common	NA
4.	*Ageratum houstonianum*	?	Asteraceae	Abundant	NA
5.	*Aquilaria agallocha*	Agar	Thymelaeaceae	Common	NA
6.	*Argemon mexicana*	Siparkata	Papaveraceae	Common	NA
7.	*Asparagus filicinis*	Satavar	Liliaceae	Rare	NA
8.	*Astragalus sp.*	?	Caesalpiniaceae	Common	-
9.	*Centlla asiatica*	Brahmi	Apiaceae	Rare	NA
10.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Common	NA
11.	*Cyprus rotundus*	Motha	Cyperaceae	Very common	NA
12.	*Datura metel*	Datura	Solanaceae	Rare	NA
13.	*Datura stramonium*	Datura	Solanaceae	Rare	NA
14.	*Desmodium pulchellum*	Chipati	Papilionaceae	Abundant	NA
15.	*Dicliptera bupleuroides*	?	Acanthaceae	Very common	NA
16.	*Euphorbia emodi*	?	Euphorbiaceae	Common	NA
17.	*Euphorbia hirta*	?	Euphorbiaceae	Common	NA
18. .	*Fimbristylis dichotoma*	?	Cyperaceae	Very common	NA
19.	*Gloriosa superba*	Karihari	Liliaceae	Rare	NA
20.	*Medicago spp.*	?	Papilionaceae	Common	-
21.	*Memosa pudica*	Chhui mui	Mimosaceae	Common	LC
22.	*Musa spt.*	Kela	Musaceae	Very common	-
23.	*Nyctanthes arbor-tristis*	Parijati	Oleaceae	Rare	NA
24.	*Ocimum sanctum*	Bantulsi	Lamiaceae	Common	NA
25.	*Oxalis corniculata*	?	Oxalidaceae	Very common	NA
26.	*Parthenium hysterophorus*	Gajar ghas	Asteraceae	Abundant	NA
27.	*Picrius spp.*	?	Cyperaceae	Common	-
28.	*Plumbago zeylanica*	Chitawar	Plumbaginaceae	Very common	NA
29.	*Sida acuta*	Kareta	Malvaceae	Comoon	NA
30.	*Solanum nigrum*	Bhatkatya	Solanaceae	Very common	NA
31.	*Sonchus asper*	?	Asteraceae	Very common	NA
32.	*Thespesia lampas*	Ban kapas	Malvaceae	Common	NA
33.	*Tournefortia roxburghii*	?	Scrophulariaceae	Rare	NA
34.	*Vanda parviflora*	Arkind	Orchidaceae	Rare	NA

35.	*Xanthium strumarium*	Godhru	Asteraceae	Abundant	NA

Source: EIS and Forest working plan
NA=Not Assessed; NF=Not Found in the IUCN catalogue; LC= Least Concern;
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972

During the site visit, the survey team found that there was no Herb species which is of serious concern in terms of scarcity in the project area. There are 12 nos. of common, 10 nos. of very common, 08 nos. of rare and 05 nos. of abundant species in the study area. However project activities do not have any significant impacts on these species as these are not found in ROW along the project alignment.

During the site visit, the type and details of Climber species present in the project area has been provided in table 4.18.

Table 4.18: Climber species (angiosperms) recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Abrus precatorius*	Ratti	Papilionaceae	Common	NA NF
2.	*Asparagus racemosus*	Satwar	Liliaceae	Common	NA
3.	*Cocculus hirsutus*	Huyer	Menispermaceae	Common	NA
4.	*Clematis triloba*	Morbel	Ranunculaceae	Common	NA
5.	*Cryptolepis buchnania*	Nagbel	Combretaceae	Rare	NA NF
6.	*Dioscorea bulbifera*	Kand	Papilionaceae	Common	NA NF
7.	*Dioscorea danoda*	Bechaadi	Papilionaceae	Common	NA NF
8.	*Jasminum arborescens*	Chameli	Oleaceae	Very Common	NA
9.	*Pueraria tuberosa*	?	Leguminosae	Common	NA
10.	*Smilax zeylanica*	Ramdaton	Vitaceae	Common	NA NF
11.	*Smilax aspera*	?	Vitaceae	Common	NA NF
12.	*Tinospora cordifolia*	Giloi	Menispermaceae	Common	NA
13.	*Ventilago aciculata*	Qyuti	Rhamnaceae	Rare	NA NF
14.	*Vitex negundo*	?	Lamiaceae	Common	NA

Source: EIS and Forest working plan
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

During the site visit, the survey team found that there was no Climber species which is of serious concern in terms of scarcity in the project area. There are 11 nos. of common, 01 very common and 02 nos. of rare species in the study area. However project activities do not have any significant impacts on rare species. During the site visit, the type and details of Grass species present in the project area has been provided in table 4.19.

Table 4.19: Grass species (angiosperms) recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Agrostis spp.*	?	Poaceae	Very common	-

2.	*Apluda mutica*	Phuli	Poaceae	Common	NA
3.	*Aristida setacea*	Thani	Poaceae	Rare	NA
4.	*Arundinella bengalensis*	?	Poaceae	Common	NA
5.	*Arundinella setosa*	Fulbahari	Poaceae	Common	NA
6.	*Bambusa Balcoa*	Bans	Poceae	Common	NA
7.	*Bambusa nutans*	Kali Bans	Poceae	Common	NA
8.	*Bambusa affinis*	Kanak-Kaich	Poceae	Common	NA
9.	*Bambusa pallida*	Makal	Poceae	Common	NA
10.	*Bambusa teres*	Powra	Poceae	Common	NA
11.	*Bothriochloa intermedia*	?	Poaceae	Abundant	NA
12.	*Bothriochloa pertusa*	?	Poaceae	Common	NA
13.	*Calamus garbna*	Sundibet	Poaceae	Common	NA
14.	*Calamus viminalis*	Pannabet	Poaceae	Common	NA
15.	*Calamus tenuis*	Chachibet	Poaceae	Common	NA
16.	*Chrysopogon fulvus*	Ghoriya	Poaceae	Common	NA
17.	*Cynodon dactylon*	Dub	Poaceae	Abundant	NA
18.	*Dactyloctenium aegyptium*	?	Poaceae	Very common	NA
19.	*Dendrocalamus hamiltonii*	Ponch bans	Poceae	Common	NA
20.	*Dendrocalamus strictus*	Baans	Poaceae	Very common	NA
21.	*Dichanthium annulatum*	Kel	Poaceae	Very common	NA
22.	*Digitaria spp.*	?	Poaceae	Very common	-
23.	*Elusine indica*	?	Poaceae	Common	NA
24.	*Eregrostis interrupta*	?	Poaceae	Very common	NA
25.	*Eregrostis tenella*	Bhurbhuli	Poaceae	Very common	NA
26.	*Eulaliopsis binata*	Sabai/Bhabar	Poaceae	Common	NA
27.	*Heteropogon contortus*	Kumariya	Poaceae	Abundant	NA
28.	*Imperata cylindrica*	Chhir	Poaceae	Very common	NA
29.	*Iseilema laxum*	Mushan	Poaceae	Common	NA
30.	*Melocanna bambusoides*	Mul	Poceae	Common	NA
31.	*Panicum spp.*	?	Poaceae	Common	-
32.	*Paspalum scrobiculatum*	?	Poaceae	Common	NA
33.	*Phragmites karka*	Nal	Poaceae	Common	NA
34.	*Saccharum spontaneum*	Kans	Poaceae	Very Common	NA
35.	*Setaria glauca*	?	Poaceae	Common	NA
36.	*Themeda quadrivalvis*	?	Poaceae	Common	NA
37.	*Thysanolaena maxima*	Phulbahari	Poaceae	Rare	NA

Source: EIS and Forest working plan
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

During the site visit, the survey team found that there was no Grass species which is of serious concern in terms of scarcity in the project area. There are 23 nos. of common, 09 nos. of very common, 02 nos. of rare and 03 nos. of abundant species in the study area.

During the site visit, the type and details of parasitic angiosperms present in the project area has been provided in table 4.20.

Table 4.20: Parasitic angiosperms recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ ENGLISH NAME	FAMILY	LOCAL AVAILABILITY	IUCN STATUS
1.	*Cuscuta reflexa*	Amarbel	Convolvulaceae	Common	NA
2.	*Dendrophthoe falcata*	Banda	Loranthaceae	Rare	NF
3.	*Viscum articulatum*	Banda	Viscaceae	Common	NA

Source: EIS
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

During the site visit, the survey team found that there was no parasitic angiosperms species which is of serious concern in terms of scarcity in the project area. There are 02 nos. of common and 01 rare species of parasitic angiosperms in the study area.

4.2.2 Economically-Important Tree Species (Terrestrial)

Forests in Tripura are valuable sources of commercial timber and non-timber or non-Wood forest products (NTFP or NWFP). Forest products play an important role in the livelihood of the local people and socio-economic development of the State. In addition to meeting the bonafide needs of the villagers residing in and around the forest areas, sale of forest products contributes appreciably to the State exchequer. During the field survey, numbers of plant species which are of economic importance in the area were recorded. These plant species are used by local people for various purposes in their day to day life. These species include timber, firewood, fruits-yielding, fodder, oil-yielding, medicinal and multiple usages. During the site visit, the type and details of major economically-important plant species present in the project area has been provided in table 4.21.

Table 4.21: Major economically-important plant species recorded in the project area during the study period

Sl. No.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	FAMILY	ECONOMIC USE**
(A) TREE SPECIES				
1.	*Acacia catechu*	Khair	Papilionaceae	FW
2.	*A. leucophloea*	Ronjh	Fabaceae	FW
3.	*A. nilotica*	Babul	Fabaceae	T, FW
4.	*Ailanthes excelsa*	Maharukh	Simaroubaceae	FO
5.	*Angle marmelos*	Bel	Rutaceae	R, Me, FrE
6.	*Anogeissus pendula*	Kardhai	Combretaceae	FW
7.	*Azadhirachta indica*	Neem	Meliaceae	MP
8.	*Bauhinia purpurea*	Kanchan	Caesalpiniaceae	FO
9.	*Butea monosperma*	Dhak	Fabaceae	FW, LP

10.	*Emblica officinale*	Amla	Euphorbiaceae	FrE, Me
11.	*Saraca asoca*	Sita Ashok	Fabaceae	Me
12.	*Syzygium cumini*	Jamun	Myrtaceae	FrE, T
13.	*Tectona grandis*	Sagwan	Verbenacae	T
14.	*Vitex negabdo*	?	Verbenacae	Me
15.	*Vitex peduncularis*	Awal	Verbenacae	Me
16.	*Terminalia belerica*	Imli	Caesalpiniaceae	MP
17.	*Ficus bengalensis*	Bat	Moraceae	Me
18.	*Terminalia arjuna*	Arjun	Combretaceae	Me
19.	*Terminalia chebula*	Harra	Combretaceae	Me
(B) SHURB SPECIES				
1.	*Adhatoda vasica*	Adhusa	Acanthaceae	Me
2.	*Andrographis paniculata*	Green Chiretta	Acanthaceae	Me
3.	*Hemidesmus indicus*	Anantmul	Apocynaceae	Me
4.	*Holorrhena pubescens*	Kutaja	Apocynaceae	Me
5.	*Calotropis procera*	Aak	Apocynaceae	R
6.	*Clerodendron serratum*	Mamri	Celastraceae	Me
7.	*Justica adhatoda*	Malabar Nut	Acanthaceae	Me
8.	*Marsilea minuta*	Susnisak	Acanthaceae	Me
9.	*Phlogacanthus thyrsiflorus*	Titaphool	Acanthaceae	Me
10.	*Zizyphus jujuba*	Ber	Rhamnaceae	MP
C) CLIMBER SPECIES				
1.	*Tinospora cordifolia*	Gurj	Menispermaceae	Me
(D) HERBACEOUS SPECIES				
1.	*Asparagus filicinis*	Satavari	Liliaceae	Me
2.	*Achyranthus aspera*	Gathiya	Amranthaceae	Me
3.	*Acorus calamus*	Bach	Acoraceae	Me
4.	*Bamboosa spp. (03)*	Bans	Poaceae	MP
5.	*Curcuma angustifolia*	Tikhur	Zingiberaceae	Me
6.	*Dendrocalamus spp.(02)*	Bans	Poaceae	MP
7.	*Gloriosa superba*	Karihari	Liliaceae	Me
8.	*Saccharum spontaneum*	Sarkanda	Poaceae	MP

** Source: EIS and Forest working plan*

*****Economic Use: FW= Firewood, T=Timber, FO=Fodder, R= Religious, Me=Medicinal, FrE= Fruit edible, MP=Multi-purpose, O=Oil-***

A total of 38 major species of economically-important plants were recorded in the project area. These include 19 tree species, 10 shrub species, 01 species of climber and 08 herbaceous species.

(B) FAUNAL DIVERSITY

During the site visit, the type and details of butterflies present in the project area has been provided in table 4.22.

Table 4.22: Butterflies recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	*Antheraea mylitta*	Common	NA
2.	*Belenois aurota*	Common	NA
3.	*Curetis theitis*	Common	NF
4.	*Goladenia indrani*	Common	LC
5.	*Graohium nomius*	Abundant	NF
6.	*Prosotas dubiosa indica*	Common	NF
7.	*Talicada nyseus*	Common	NA

Source: EIS
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list; LC=Least concern; NF= not found in the catalogue of IUCN
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

The butterflies recorded in the project are common in nature.

During the site visit, the type and details of major Insect fauna present in the project area has been provided in table 4.23.

Table 4.23: Major Insect fauna recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	Trumpet tail	*Aisoma panorpoids*	Common	NA
2.	Giant honeybee	*Apis dorseta*	Common	NA
3.	Honey bee	*Apis indica*	Common	NA
4.	Ant	*Camponotus sp.*	Abundant	NA
5.	Blister beetle	*Mylabris pustulata*	Common	NA
6.	Scorpion	*Hottentotta tamulus*	Rare	NA

Source: EIS
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population
NA= not assessed yet for IUCN red list
Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

The survey team found that Scorpion is having rare availability. However project activities do not have any significant impacts on this specie.

The type and details of major amphibians and reptiles present in the project area has been provided in table 4.24.

Table 4.24: Major amphibians and reptiles recorded in the project area

Sl. No.	SCIENTIFIC NAME	LOCAL/ENGLISH NAME	LOCAL AVAILABILITY	WLA SCHEDULE	IUCN STATUS
(A) AMPHIBIANS					
1.	Toad	*Duttaphrynus melanostictus*	Abundant	IV	LC
2.	Frog	*Rana tigrina*	Common	IV	LC
(B) REPTILES					
1.	Krait	*Bangarus caeruleus*	Common	IV	NA
2.	Girgit	*Kelotes versicolor*	Common	IV	NA
3.	Cobra	*Naja naja*	Common	II	VU
4.	Lizard	*Agama tuberculata*	Abundant	IV	NA
5.	Ajgar	*Python molurus*	Rare	I	NA
6.	Dhaman	*Tiyas mucosus*	Abundant	IV	NA
7.	Pit viper	*Trimeresurus gramineus*	Rare	IV	LC
8.	Monitor lizard	*Varanus bengalensis*	Common	I	LC
9.	Russel viper	*Vipera russelli*	Rare	IV	LC

** Source: EIS*

NA=Not Assessed; NF=Not Found in the IUCN catalogue; LC= Least Concern; VU=Vulnerbale; EN=Endangered

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

There were two schedule I and one schedule II species of reptile reported in the project area based on secondary data. These species may exist in Gumti WLS which is within approx. 5 km away from the project boundary, the data have been taken from Forest Working plan of the project districts. The ESZ has already published notification for the Gumti WLS and it can be analyzed based on ESZ notification that these species do not move near the project alignment and confined within the ESZ boundary range which is maximum 1.20 kilometers around the boundary of Gumti WLS.

During the site visit, the type and details of Avifauna (bird species) present in the project area has been provided in table 4.25.

Table 4.25: Avifauna (bird species) recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILIBILITY	WLA SCHEDULE*	IUCN STATUS	Migratory Status
1.	Myna	*Acridotheres tristis*	Common	IV	LC	Resident
2.	Purple Heron	*Ardea purpurea*	Common	IV	LC	Resident
3.	Indian Pond Heron	*Ardeola grayii*	Rare	IV	LC	Resident
4.	Common Kingfisher	*Alcedo atthis*	Rare	-	LC	Resident
5.	Anjan	*Ardea cinerea*	Common	-	LC	Resident

6.	Golden-fronted leafbird / Green Bulbul	*Chloropsis aurifrons*	Common	IV	LC	Resident
7.	Jerdon's Leafbird	*Chloropsis jerdoni*	Common	IV	LC	Resident
8.	Roller / Blue Jay	*Corasias benghalensis*	Common	IV	LC	Resident
9.	Crow	*Corvus splendens*	Common	IV	LC	Resident
10.	Bater	*Coturnix coturnix*	Abundant	IV	LC	Resident
11.	Racket-tailed drongo	*Dicrurus paradiseus*	Common	IV	LC	Resident
12.	Kathphora	*Dinipium bengalense*	Rare	IV	LC	Resident
13.	Goldenbacked Woodpecker	*Dinopium benghalense*	Common	-	LC	Resident
14.	Bagula	*Egretta garzetta*	Common	IV	LC	Resident
15.	Koyal	*Eudynamys scolopacea*	Rare	IV	LC	Resident
16.	Titar	*Francoleus pondicerianus*	Rare	IV	LC	Resident
17.	Jal murgi	*Gallinula chloropuh*	Common	IV	LC	Resident
18.	Red Jungle fowl	*Gallus gallus*	Common	IV	LC	Resident
19.	Common crane	*Grus virgo*	Rare	IV	LC	Winter migratory
20.	White-backed Vulture	*Gyps bengalensis*	Rare	-	LC	Migration
21.	Common Hawk-Cuckoo	*Hierococcyx varius*	Rare	IV	NA	Resident
22.	Purple-rumped Sunbird	*Leptocoma zeylonica*	Common	IV	LC	Resident
23.	White-rumped munia	*Lonchura striata*	Common	IV	LC	Resident
24.	Small Green Bee-eater	*merops orientalis*	Common	-	LC	Resident
25.	White Wagtail	*Motacilla alba*	Common	IV	LC	Resident
26.	Cheel	*Milvus migrans*	Rare	IV	LC	Resident
27.	Black crown night Heron	*Nycticorax nycticorax*	Rare	IV	LC	Resident
28.	Indian Grey Hornbill	*Ocyceros birostris*	Common	-	LC	Resident
29.	Common Tailorbird	*Orthotomus sutorius*	Common	-	LC	Resident
30.	Spotted Scops owl	*Otus spilocephalus*	Rare	?	LC	Resident
31.	Sparrow	*Passer domesticus*	Common	IV	LC	Resident
32.	Small Minivet	*Pericrocotus cinnamomeus*	Common	-	LC	Resident
33.	Great Cormorant	*Phalacrocorax carbo*	Common	-	LC	Resident
34.	Little Cormorant	*Phalacrocorax niger*	Common	-	LC	Resident
35.	Baya weaver	*Ploceus philippinus*	Common	IV	LC	Resident

36.	Black headed myna	*Pogodarum sturnus*	Common	-	NA NF	Resident
37.	Parrot	*Psittacula krameri manillensis*	Common	I	LC	Resident
38.	Black heded Bulbul	*Pycnonotus atriceps*	Common	-	NA	Resident
39.	Little Grebe	*Tachybaptus ruficollis*	Rare	-	NA	Resident
40.	Common green shank	*Tringa nebularia*	Common	-	NA	Resident
41.	Common Babbler	*Turdoides caudata*	Common	IV	LC	Resident
42.	Common bustard Quale	*Turnix suscitator*	Common	-	NA	Resident

** Source: EIS and Forest working plan*
NA=Not Assessed; NF=Not Found in the IUCN catalogue; LC= Least Concern;
Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population.

Most of the avifauna species are commonly found in the study area and mostly fall in least concern category as per IUCN status.

The type and details of Mammal species present in the project area has been provided in table 4.26.

Table 4.26: Mammal species recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILIBILITY	WLA Schedule*	IUCN STATUS
1.	?	*Axis axis*	Rare	-	NA
2.	Gaur / Indian Bison	*Bos gaurus*	Rare	I	VU
3.	Neelgai	*Boselaphus tragocatnelus*	Common	III	NA
4.	Jackal	Canis aureus	Common	II	LC
5.	Sambhar	*Cervus unicolor*	Rare	III	VU
6.	Indian Wild Dog	*Cuon alpinus*	Rare	II	EN
7.	Asian Elephant	*Elephas maximus*	Rare	I	EN
8.	Jungle Cat	*Felis chaus*	Common	II	LC
9.	Nevla/Common mongoose	*Herpestus edwardsii*	Common	II	NA
10.	Western Hoolock Gibbon	*Hoolock hoolock*	Rare	I	EN
11.	Porcupine	*Hystrix indica*	Common	IV	NA
12.	Indian Hare	*Lepus nigricollus*	Common	IV	LC
13.	Common Otter	*Lutra lutra*	Rare	II	NT
14.	Monkey	*Maccaca mulata*	Common	II	NA
15.	Indian Pangolin	*Manis crassicaudata*	Rare	I	EN

16.	Sloth Bear	Melursus ursinus	Rare	I	VU
17.	Bherki/barking deer	*Muntiacus muntjac*	Common	III	LC
18.	Slow Loris	*Nycticebus bengalensis*	Rare	I	EN
19.	Leopard	*Panthera pardus*	Rare	I	VU
20.	Common Palm Civet	*Paradoxurus hermaphroditus*	Common	II	LC
21.	Phayre's Leaf-monkey	*Trachypithecus phayrei*	Rare	I	EN
22.	Indian Flying Fox	*Pteropus giganteus*	Common	IV	LC
23.	Indian Giant Squirrel	*Ratufa indica*	Common	II	LC
24.	Fulvous fruit bat	*Rousettus leschenaulti*	Common	IV	LC
25.	Rat	*Rattus rattus*	Common	V	NA
26.	Bat	*Skotophilus heathi*	Common	-	NA
27.	Langur	*Somnopithecus entellus*	Rare	II	NA
28.	Chhuchhunder	*Suncus murinus*	Common	-	LC
29.	Wild boar	*Sus scrofa*	common	III	LC
30.	Small Indian Civet	*Viverricula indica*	Common	II	LC
31.	Large Indian Civet	Viverra zibetha	Common	II	LC
32.	Indian Fox	*Vulpes bengalensis*	Common	II	LC
33.					
34.	Golden Cat	*Catopuma temminckii*	Rare	I	NT

***** *Source: EIS and Forest working plan*

NA=Not Assessed; LC= Least Concern; VU=Vulnerbale; EN=Endangered; NT= Near Threatened; CR = Critically Endangered

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

There were nine schedule I and twelve schedule II species of mammal in the project area as per secondary published data. These species have not seen by the survey team and may exists in Gumti WLS which is within approx. 5 km from the project boundary, the data have been taken from Forest Working plan of the project districts. The ESZ has already published notification for the Gumti WLS and it can be analyzed based on ESZ notification that these species do not move near the project alignment and confined within the ESZ boundary range which is maximum 1.20 kilometers around the boundary of Gumti WLS.

During the site visit, the type and details of aquatic phytoplankton & other plant species diversity present in the project area has been provided in table 4.27.

(C) AQUATIC FLORAL AND FAUNAL DIVERSITY

Table 4.27: Aquatic phytoplankton and other plant species diversity in the project area

Sl. No.	PHYTOPLANKTON SPECIES
1.	*Anabaena spp.*

2.	*Anacyustis spp.*
3.	*Arthrspiora spp.*
4.	*Chara spp.*
5.	*Chlorella spp.*
6.	*Chlorococcum spp.*
7.	*Desmidium spp.*
8.	*Euglena spp.*
9.	*Fragilaria spp.*
10.	*Nostoc spp.*
11.	*Oscillatoria spp.*
12.	*Ulothrix spp.*
13.	*Volvox spp.*

Sl. No.	HIGHER PLANT SPECIES	LOCAL AVAILABILITY
1.	*Acorus calamus*	Common
2.	*Arundo donax*	Common
3.	*Azolla sp.*	Common
4.	*Ceratophyllum sp.*	Very Common
5.	*Cyperus spt.*	Very common
6.	*Eregrostielis nordoides*	Abundent
7.	*Hydrilla sp.*	Abundant
8.	*Imperata cylindrica*	Common
9.	*Ipomoea aquatica*	Common
10.	*Justiacia sp.*	Rare
11.	*Limnophila chinensis*	Common
12.	*Melastoma spp.*	Common
13.	*Nelumbo nucifera*	Rare
14.	*Nyphaea sp*	Rare
15.	*Phragmites karka*	Common
16.	*Potamogeton pectinatus*	Abundant
17.	*Typha angustifolia*	Common
18.	*Vernonia anagallis*	Common

During the site visit, the survey team found that there was no aquatic flora and fauna species which is of serious concern in terms of scarcity in the project area.

During the site visit, the type and details of aquatic fauna diversity present in the project area has been provided in table 4.28.

Table 4.28: Aquatic fauna recorded in the project area

S. no.	GROUP	SPECIES
1	Zooplankton	*Brachionus spp*
		Bosmina spp.
		Cyclops spp.
		Daphnia spp.
		Euglaena spp.
		Filinia spp.
		Horerlla spp.
		Macrothrix spp.
		Moina spp.

		Nauplius spp.
		Vorticella sp.

Source: EIS

During the site visit, the type and details of Ichthyo fauna (fish species) present in the project area has been provided in table 4.29.

Table 4.29: Ichthyo fauna (fish species)* recorded in the project area

Sl. No.	LOCAL/ ENGLISH NAME	SCIENTIFIC NAME	LOCAL AVAILABILITY	IUCN STATUS
1.	Kotri	*Anabas testidinius*	Very common	NA
2.	?	*Barillius Barila*	Common	NA
3.	?	*Barillius bola (Raiamas bola)*	Common	LC
4.	Catla	*Catla catla*	Common	NA
5.	Channa	*Channa marulius*	Very Common	LC
6.	Channa	*Channa Punctatus*	Very Common	LC
7.	Mrigal	*Cirrhina mrigala*	Common	NA
8.	Magur	*Clarius batrachus*	Very common	NA
9.	Common Carp	*Cyprinus carpio*	Common	VU
10.	Kalbos	*Labeo calbasu*	Common	LC
11.	Rohu	*Labeo rohita*	Abundant	LC
12.	Tengra	*Mystus cavacius*	Very Common	*NA*
13.	Seenghar	*Mystus seeghalus*	Rare	NA
14.	?	*Barilius nelsoni*	Rare	NA
15.	?	*Puntius clavatus clavatus*	Rare	NA
16.	?	*Puntius gelius*	Rare	LC
17.	?	*Nemacheilus multifasciatus*	Common	NA
18.	Chital	*Notopterus chitala*	Very Common	LC
19.	?	*Punticus chola*	Common	LC
20.	?	*Punticus sophore*	Common	LC
21.	Karwadi	*Punticus ticto*	Common	LC
22.	?	*Raiamas bola*	Endangered	LC
23.	?	*Tor putitora*	Endangered	EN
24.	Mahseer	*Tor tor*	Endangered	DD
25.	?	*Labeo pangusia*	Vulnerable	NT
26.	?	*Chagunius chagunio*	Vulnerable	LC
27.	Rita	*Rita rita*	Vulnerable	LC
28.	?	*Pangasius pangasius*	Vulnerable	LC
29.	?	*Bagarius bagarius*	Vulnerable	NT

Source: EIS and Forest working plan

Rare=<20% of the total population, Common=20-50% of the total population, Abundant=50-70% of the total population, Very abundant= >70% of the total population

NA= not assessed yet for IUCN red list; LC= Least concern; VU= Vulnerable; NF= not found in the catalogue of IUCN; EN=Endangered; DD=Data Deficient; NT=Near Threatened

Note: The above listed species are not included in any schedule of Wild Life (Protection) Act, 1972.

****Migration for food only (sometimes due to pollution/siltation)***

During the site visit, the survey team found that as per IUCN status there was only one endangered species of fish i.e. *Tor putitora* in the project area. This specie confined in upper reach and do not found in water bodies along the project alignment.

4.2.3 Seasonal Variation in Biodiversity

The filed study was conducted in the peak growth period (rainy season) which produces maximum bio diversity of the site. The tree and shrub diversity will remain same in other seasons of the year. In the herb and grass species, there will be insignificant changes in the rest of the year. Similarly in case of the faunal diversity there will be minor variations in zooplanktons and bird species. Detailed studies on bio diversity in different seasons of the year could not be available for the project area. The secondary data is limited to a checklist of species which does not differentiate the availability of bio diversity in different seasons. However, being a linear project the impacts on seasonal variation of bio diversity is very limited and no detailed seasonal variation study is required.

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4.3. Economic Development

The economy of Tripura is agrarian. More than 50 percent of its population depends on agriculture for livelihood. Contribution of agriculture & allied activities to the Gross State Domestic Product (GSDP) is 23%. The economy of Tripura is characterized by high rate of poverty, low per-capita income low capital formation, in-adequate infrastructure facilities, geographical isolation and communication bottleneck, inadequate exploitation and use of forest and mineral resources, low progress in industrial field and high un-employment problem. The per capita income of the State with a recent new 2011-12 base also rose steadily from Rs.47,079 in 2011-12 to Rs.52,434 in 2012-13 and to Rs.61,570 in 2013-14 and to Rs.69,474 in 2014-15, to Rs.83,680 in 2015-16, to Rs.91266 in 2016-17 and to Rs.105044 in 2017-18 (Provisional). Agriculture growth has remained much lower than the growth rates witnessed in the industrial and services sectors in the State. The Gross State Domestic Product (GSDP) at current prices with a recent new 2011-12 base at current prices increased from Rs.19,208.41 crore in 2011-12 to Rs.21,663.20 crore in 2012-13 and to Rs.25,592.83 crore in 2013-14, to Rs.29,533.46 crore in 2014-15 and to Rs.35,937.73 in 2015-16, to Rs.39612.05 in 2016-17 and to Rs.46132.88 in 2017-18 (Provisional).

4.3.1 Agriculture, Forestry and Fisheries

Agriculture: Tripura is primarily an agrarian State, with about 42% of the population depending on agriculture and allied activities. However, only about 27% of the land is cultivable, rest being hilly and forested. Rice is the major crop in the State. Agriculture and allied activities is the main stay of the people of Tripura and provides employment to about 64% of the population. There is a preponderance of food crop cultivation over cash crop cultivation in Tripura. At present about 62% of the net sown area is under food crop cultivation. Paddy is the principal crop, followed by oilseed, pulses, potato and sugarcane. Tea and rubber are the important cash crops of the State. Tripura has been declared the Second Rubber Capital of India. The state is the highest producer of true potato seeds in the world. The state is self-sufficient in coconut production. It has immense potential for horticulture development. Fruits like pineapple, orange, jackfruit, and banana are traditionally grown in the state. Cashew and litchis are also produced. 7,46,954 MT of rice and 1,59,466MT of potato produced in 2014-15 by the state.

Forestry: Forest is an integral part of the culture and tradition of Tripura. Forestry sector provides important supplementary income and inputs in daily lives of tribal people residing in forested areas. 91.52% of total household depend on fuel wood in Tripura; which stands much higher than national average of 61.50%.Tripura is the second largest producer of rubber in India and rubber produced is of superior quality.

Fisheries: The state has made remarkable progress in fishery sector with limited resources and now, stands on the leading position in North Eastern Region. Considering the increasing demand for fish in the state, government has been giving emphasis to increase the productivity from the existing water areas. The total fish production in the State was 77,227.69 MT in 2017-18 (Provisional), which were 68,331.14 MT in 2016-17 and 69,055 MT in 2015-16.The necessary stress was given to raise fish seeds by adopting hypophysation technique, as there was no riverine and other sources in the State for collection of fish seed.

4.3.2 Industries and Mineral Resources

Industries: The industrialization in the State is yet to take off and industry sector is not able to open employment opportunities despite State Government's effort for comprehensive base for industrialization. There are 7 industrial estates, 2 large and medium industrial units and 2066 small scale units in the state. Industrial growth has been low mainly due to lack of infrastructure (roads, road transport and power) and being land locked. The handloom industry is an important sector in providing large-scale employment in Tripura. State government is focusing on development of Tea, Natural Gas and IT industries. There is no major industry along the project road except one small pipe and chemicals industry.

Minerals: The state is endowed with a number of mineral resources. Besides oil and gas, the state has good reserves of clay and silica sand. The total oil and gas wealth of state is 588 thousand tons whereas that of clay and quartz silica sand is 0.3 and 0.2 thousand tons respectively.

4.3.3 Infrastructure Facility

Transport: Road transport is not only dependable means of transport and lifeline of the state through its hostile-hilly terrain. The National Highway (NH-44) is the only link road with rest of the country which is passing-through neighboring states of Assam and Meghalaya. Details of road network in Tripura as on 2014-15 has been given below in table 4.30.

Table 4.30: Road Network in Tripura

Features	Length (in km)
National Highway (NH)	645
Major District Road (MDR)	90
Other District Road	1,195
Village Road (RD & ADC)	8,159
IBP Road (BRO)	726
Railway Road	158
Village Road (NHIDCL)	9,674
State Highway (SH)	532
Black topped road	10,011
Brick soled road	6,442
Earthen road	4,568

Tripura still remained backward in terms of railway connectivity and total railway link is 153 km. In 2008-09, the rail connectivity has been extended to the capital city of Agartala through the metre gauge connecting it to Badarpur and Lamding of Assam by same metre-gauge. The work for further extension of railway line from Agartala to Sabroom completed.

So far as civil aviation is concerned, the people of the state are dependent especially on the flights operating between Agartala-Kolkata and Agartala-Guwahati. Air has also been improved from Agartala to Delhi and Chennai. The runway at Agartala Airport has been extended to 7,500 feet. Helicopter service was introduced in October, 2002 to connect some remote areas.

Power: The State has two sources of generation of electricity namely, hydro and thermal. The State is endowed with natural gas, which enhances potentially for thermal power generation. Out of the two major sources of power generation, thermal power accounts for 94% while remaining 6% is generated from hydel power. Present peak demand of the State is around 400 MW. After commissioning of mega gas power project at *Paltana*, the state has been exporting power to its neighboring states.

Irrigation: Tripura has a total cultivable land of 2,55,241 ha and irrigation potential of 1,17,000 ha. 1,13,598 ha of area brought under irrigation as on 31st March'2015. Further, 78,330 ha area have been used for irrigation in 2014-15.

Water Supply and Sanitation: State and centre has given high priority in improving water supply and sanitation in both rural and urban areas. Presently, in 40 Blocks under 8 District of Tripura, daily drinking water is being supplied through 933 Deep Tube Well Schemes, 837 Small Bore Tube Wells, 8 Surface Water Treatment Plants, 312 Iron Removal Plants, 73 Over Head Tanks and Spot Sources. As on 01.04.2010, 547,206 nos. individual house hold toilets, 4,550 nos school toilets, 5,232 nos. Balwadi toilets, and 162 nos. sanitary complex have been constructed under different sanitation program.

4.3.4. Social and Cultural Resources

Demography: As per details from Census 2011, total population of Tripura is 36,73,917 of which male and female are 18,74,376 and 17,99,541 respectively. In 2001, total population was 3,199,203 in which males

were 1,642,225 while females were 1,556,978. The total population growth in this decade was 14.75% while in previous % it was 15.74%. The population of Tripura forms 0.30 % of India in 2011. In 2001, the figure was 0.31 percent. Literacy rate in Tripura has seen upward trend and is 87.2% as per 2011 population census. Of that, male literacy stands at 91.5 % while female literacy is at 82.7%. In 2001, literacy rate in Tripura stood at 73.19% of which male and female were 82.42% and 64.33% literate respectively. As per the Census 2011, project districts have following facts (Table 4.31) on demography Vis-a Vis state and the country. However, some of the basic information on demographic structure of Khowai , Gumti and South Tripura District is not available in public domain.

Table 4.31: Demography of the Project Districts, State and Country

Description	India	Tripura	Khowai District	Gumti District	South Tripura District
Population	1,21,01,93,422	36,73,917	3,27,564	4,41,538	4,53,079
Male	62,37,24,248	18,74,376	1,67,401	2,25,428	2,34,118
Female	58,64,69,174	17,99,541	1,60,163	2,16,110	2,18,961
Population Growth	17.64	14.84%	--	--	--
Sex Ratio (Female/1000 Male)	940	960	957	957	935
Density/km^2	382	350	270	286	299
Literacy	74.04%	87.2%	87.78 %	100%	85.09%
Male Literacy	82.14	91.5%	92.17%	100%	93%
Female Literacy	65.46	82.7%	83.17%	100%	79.4%

Source: Census of India, 2011

6, 54,918 of the total population belong to schedule castes (SC). Out of which 3, 34,370 are males and 20,548 are females. Proportion of SC population is 17.8% of the total population of the state as per the census'2011. 11, 66,813 of the total population belong to schedule tribes (ST). Out of which 5, 88,327 are males and 5, 78,486 are females. Proportion of ST population is 31.8% of the total population.

Working Class population: As per the census'2011, total working class population of Tripura is 14, 69,521. Hence, 40% of the total population of the state belongs to working class. The non-working population is about 60% which is an indication of the weak economic base and under-development. About 72% of the rural populations are living below poverty line. Details of working class population have been given below in table 4.32.

Table 4.32: Working Class Population of Tripura

Category	Population	Percentage
Total Workers	14,69,521	100%
Cultivators	2,95,947	20.14%
Agriculture labourers	3,53,618	24.06%
Category	Population	Percentage
Household industries	41,496	2.82%

Other workers	7,78,460	52.97%

Source: Census of India, 2011and District Administration

Educational Facilities: Tripura has made a comprehensive progress in the field of education since launching of first five-year-plan. It can be evident from the Census- 2011 data that overall literacy rate in the State is 87.75 % against the similar proportion for all India 74.04%. For school education facility, there are 2378-Junior Basic Schools, 1139-Senior Basic Schools, 459-High Schools and 311-Higher Secondary Schools in the state. For education, the State has one Central University and one private ICFAI-University, 15- General Degree Colleges, 1- Institute of Advanced Studies in Education, 2-Engineering Colleges, 1- Women's Polytechnic, 1- Government Law College, 1- Govt. Music College, and 1- Art & Craft College.

There are numbers of higher secondary schools, high schools, primary schools, numbers Anganbadis (institution to care for poor and deprived children as creche homes) etc. recorded in the project road stretch. Details of 15 major academic institutes within the ROW and touching the ROW of the project road have been given below in table 4.33.

Table 4.33: Educational Institutes near the Project Road

For section I

Sl. No.	Chainage (KM)	Key Environmental feature	Side	Remark
1	101.4	Ganaki ClassXII School	RHS	Within ROW
2	108.9	Gourangatila H.S. School	LHS	Within ROW
3	112.35	Darikapur High School	LHS	Within ROW
4	117.35	Utabari SB School	RHS	Within ROW
5	122.4	Moharchara HS School	LHS	Within ROW
6	122.45	Ananda Marga Primary School	RHS	Within ROW
7	126.15	Eacher Bill HS School	RHS	Within ROW
8	126.7	Teliamura English Medium High School	LHS	Within ROW
9	127.15	Teliamura High School	RHS	Within ROW

For section II

Sl.No.	Design Chainage (km)	Existing Chainage (km)	Side	Type	Remarks
1	3+200	4+550	RHS	School	Within ROW
2	23+370	28+850	RHS	School	Within ROW
3	25+400	31+000	LHS	School	Within ROW
5	73+020	-	LHS	School	Within ROW
6	76+290	90+050	LHS	School	Within ROW
7	83+700	-	LHS	School	Within ROW
9	89+700	110+450	LHS	School	Within ROW

10	104+500	-	RHS	School	Within ROW
11	106+500	-	RHS	School	Within ROW

Source: DPR

Health Care Facilities: There were 19-Hospitals, 11- Rural Hospitals and Community Health Centres, 77-Primary Health Centres, 579- Sub-Centres/Dispensaries, 6- Blood Banks and 7-Blood Storage centres in allopathic branch during 2008-09 through which the State Government has been providing basic health facilities to all section of the society. The State Government Medical College has been started from August 2006, which is the first medical college in the State, and named as Agartala Government Medical College (AGMC). Total no of beds in the hospital is 2894. There are number of public health care centres along the project road. Details of health centres in the project road have been given below in table 4.34.

Table 4.34: Health Centres near the Project Road (Section-I)

Sl. No.	Chainage (KM)	Key Environmental feature	Side	Remark
1	102.35	Santala Sub-health Centre	LHS	Within ROW
2	104.9	Chebri Primary Health Centre	RHS	Within ROW

Source: DPR

Tourism: Tourism based on wildlife, forest and Hindu / Buddhist religious places have good potential in the state. Presently promotion of tourists has been affected by inadequate infrastructure. The development of tourism related infrastructure facilities are essential and prerequisite for promotion of tourism in the state. Important tourist destinations in the project districts are Bhubaneswari Temple, Tripureswari Temple (Matabari), Trishna Wildlife Sanctuary in Gomati district and 14-Gods Temple, Ujjayanta Palace, Brahmakunda, Kamalasagar and Sepahijala Wildlife Sanctuary in Sepahijala district.

5. ANTICIPATED ENVIRONMENTAL IMPACTS AND ITS MITIGATION MEASURES

Road improvement projects are likely to bring several changes in the local environment both beneficial and adverse. This section of report prepared to identify nature, extent and magnitude of all such likely changes vis-a-vis project activities for all stage of project cycle i.e. pre-construction, construction and operation. Beneficial impacts are mostly long-term and permanent whereas adverse impacts are localized and temporary in nature and are likely to occur mostly during construction stage.

5.1 Beneficial Impacts

The objective of the project road is to improve the condition of the existing road by upgrading it to NH enhance improving connectivity to Agartala and neighboring towns of Assam, Meghalaya & Mizoram. In this process, the road will benefit the residents and other stakeholders in the settlement areas of important nearby towns of Dwarikapur, Kalyanpur, Totabari, Komolnagar, Mohorchora, Trishabari and Taidu, Jantana Pada, Tingharia, Rangamati, Chelagangmung, Suknachari, Rupachari and Harina by providing imporved connectivity to state capital and other important destination of nearby states of Assam, Meghalaya & Mizoram. Proposed road will be a vital link to connect NH-44 which is the only linking road connecting to the rest of the country passing via Agaratala, capital of the project state. This will resuscitate the local economy and help local people to be part of main stream society. Further, the proposed road project aims at improving horizontal geometry of the road for riders comfort.

During construction stage, the immediate benefits of road construction and improvement will come in the form of direct employment opportunities during construction for the roadside communities and specially those who are engaged as wage laborers, petty contractors and suppliers of raw materials.

During operation stage, road-side economic activities supporting transport like gasoline stations, automotive repair shops, lodging, and restaurants will increase due to increased number of vehicles. Increase in agro-industrial activities are also expected to take advantage of improved access to urban Centres where there are higher demands and better prices for agricultural products. Other generic benefits of road improvement projects are (i) reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

5.2 Adverse Impacts

Approx. 65 % of the project road is proposed for either realignment or bypass. This process involves diversion of both agriculture and forest land along with eviction of some existing structures including shops, school boundary wall and temples. The widening of the project road along with realignment and bypass development shall cause loss of vegetation/tree felling, other ecological imbalance and habitat destruction. Another significant impact identified during site visit is water quality deterioration of large number of ponds abutting the project road.

Other impacts arising from the project road improvement are: (i) acquisition of private land and other assets impacting livelihood of local population, (ii) borrowing, (iii) impact on water bodies, (v) increased risk of accident due to faster vehicular movement (iv) increase in air pollution and noise pollution due to increased traffic. Except for land acquisition and habitat destruction, all impacts are reversible, temporary, localized in nature, and can be easily mitigated/minimized/avoided by effective implementation of environment management plan (EMP).

Following subsections describes anticipated impacts and its mitigation measures on all aspects of physical, ecological and socio-cultural environment during construction and operation stage of the projects.

5.3 Pre-construction Impacts

5.3.1 Land Assets

Project will cause acquisition of private land resulting in loss of livelihood to the local population. Adequate compensation and rehabilitation assistance shall be proposed for affected households in consistent to Government of India's policies. Income restoration measures/livelihood options for vulnerable group/resource poor sections and other affected persons as recommended shall be implemented. All impacted common public utilities will be relocated and reconstructed in consultation with the respective local communities under the project.

5.3.2 Diversion of Forest Land & Tree cutting

Project road is passing through reserve/protected forest at considerable length. 126.2014 ha of forest land need to be acquired for the project road as per the estimation. A total of approx. 36774 nos of trees expected to fell due to project road construction activities. The plantation will be done as per the norms fixed by the Forest Department.

5.3.3 Natural Hazards

Proposed project road in general is not liable to flooding. During public consultation it was revealed by the local people that construction activities may block the natural flow of water during the months of monsoon season and may cause flooding in agriculture area. The project state is in seismic zone-V with high risk of seismic activities. Hence All CD structures have been proposed to design for 50yr return period with anticipated risk of rarer flood of next higher frequency i.e. 100 yr return period flood on the designed structure. Waterway and elevation of all the bridges shall be designed accordingly to counter impact due to flood or flash flood. Embankment height along potential flood affected areas shall increase. Lined and unlined side drains have been included in the design to avoid water-logging. Relevant IS codes have been adopted in designing the structures to sustain the highest magnitude of earthquake corresponding to Seismic zone V.

5.3.4 Wildlife Movement

The proposed alignment does not pass through any Wildlife Sanctuary or its eco sensitive zone. The Eco Sensitive Zone of Gumti Wildlife Sanctuary is approx. 5 km away from project alignment as per final ESZ notification no. 3663 dated 08.11.2019, therefore wildlife clearance is not applicable for this project.

The following Wildlife Sanctuary/KBA/IBA/Ramsar sites are in Tripura and in neighboring country Bangladesh. The distance of wildlife sanctuary from the project road alignment is presented in table 5.1.

Table 5.1: Wildlife Sanctuary/KBA/IBA/Ramsar sites found in Tripura

S.No.	Name of Protected Area	District	Distance w.r.t project road
1	Gumti WLS	South Tripura	5.0 km
2	Rowa WLS	North Tripura	60.0 km
3	Sepahijala WLS	Sepahijala	30.0 km
4	Trishna WLS	South Tripura	14.0 km
5	Rudrasagar Lake (Ramsar site)	Sepahijala	32.0 km
6	Rema Kalenga WLS	Habiganj (Bangladesh)	6.0 km
7	Satchari National Park	Habiganj (Bangladesh)	13.0 km

5.4 Construction Stage Impacts

5.4.1 Climate & Air Quality

The potential sources of air emission during the construction phase of the project are: (i) dust from earth works (during site preparation), (ii) emissions from the operation of equipment, machines and vehicles for construction, (iii) fugitive emissions during the transport of construction materials, (v) air emissions other than dust arise from combustion of hydrocarbons particularly from the hot mix plants and process of heating bitumen and (vi) dust generated due to rock cutting and blasting. Most of the emissions will be in the form of coarse particulate matter which will settle down in close vicinity of construction site.

The stone aggregate will be sourced from licensed quarries. The project implementation unit is not going to establish new quarries for the project. The pollution related aspects to these quarries are independently compiled by the quarry owners. The aggregate will be transported in the tarpaulin covered trucks.

Mitigation Measures

- Vehicles delivering loose and fine materials shall be covered.
- Loading and unloading of construction materials in covered area or provisions of water fogging around these locations.
- Storage areas should be located downwind of the habitation area.
- Water shall be sprayed on earthworks periodically
- Regular maintenance of machinery and equipment. Vehicular pollution check shall be made mandatory.
- Hot mix plants should be located at least 1.5 km from the nearest habitation, school, hospital, archaeological site, forest, rivers, streams and lakes, 500 m from ponds, and national highway, 250 m from state highway, unless otherwise required by statutory requirements after securing a No-

Objection Certificate (NOC) from the SPCB. Hot mix plant shall be fitted with stack of adequate height as may be prescribed by SPCB to ensure enough dispersion of exit gases.

- Bitumen emulsion and bitumen heaters should be used to extent feasible.
- Only crushers licensed by SPCB Tripura shall be used.
- LPG should be used as fuel source in construction camps instead of wood.
- Regular water sprinkling of unpaved haulage roads.
- Mask and other PPE shall be provided to the construction workers
- Diesel Generating (DG) sets shall be fitted with adequate height as per regulations (Height of stack = height of the building + 0.2 KVA. Low sulphur diesel shall be used in DG sets as well as machineries.
- Contractor should submit a dust suppression and control program to the NHIDCL prior to construction.

5.4.1.1 Prediction of Impact on Ambient Air Quality

To assess the impact on air quality of the project area during operation phase, air pollution dispersion modeling was carried out using future traffic projections. The modeling was carried out using CALINE-4, line source model developed by the California Transport Department. Carbon monoxide (CO) is the main component of the vehicular pollution. So, prediction of CO concentration is representative of the impacts of air pollution due to traffic movement.

CALINE - 4 Model

The air dispersion model used is ***CL4 (A Graphical User Interface for CALINE4)*** developed by the California Department of Transportation (Caltrans) for predicting air pollutant concentrations near roadways. CALINE4 is a simple line source Gaussian plume dispersion model.

CALINE4 is a model based on the Gaussian diffusion equation and employs a mixing zone concept to characterize pollutant dispersion over the roadway. The purpose of the model is to assess air quality impacts near transportation facilities. Given source strength, meteorology and site geometry, the model can predict pollutant concentrations for receptors located within 500 meters of the roadway. It also has special options for modeling air quality near intersections, street canyons and parking facilities.

CALINE4 divides individual highway sections into a series of elements from which incremental concentrations are computed and then summed to form a total concentration estimate for a particular receptor location. Downwind concentrations from the element are modelled using the crosswind FLS (Finite Line Source) Gaussian formulation, but óy and óz are modified to consider the mechanical turbulence created by moving vehicles and the thermal turbulence created by hot vehicle exhaust in the region directly over the highway, region considered as a zone of uniform emissions and turbulence.

(a) Input Data Requirement:

- **Emissions**
  The emissions are provided by traffic volume (vehicles/h) and emission factor (gr/mile/vehicle) for each section

- **Meteorology**
  Wind speed Wind direction Wind direction standard deviation Atmospheric stability Class Mixing Height Ambient Temperature.

The details of input parameters considered for the modeling exercises are presented in the following paragraphs.

- **Traffic Data**
  The traffic surveys have been carried out along the corridor to establish base year traffic with reference to traffic movements. Average hourly traffic data has been considered for the present modeling exercises.

- **Meteorological Data**
  "Worst case wind angle" run type was considered to predict the worst-case scenario. The met inputs entered were:

- Wind speed: 1.0m/s
- Stability Class: F
- Mixing Height: 50m
- Standard Deviation: 5°
- Ambient Air Temperature: 25°C

(b) PRESENTATION OF RESULTS

For One-hour simulations, the concentrations were estimated around 3 receptors to obtain an optimum description of variations in concentrations over the distance of 30m, 50m & 100m downwind from the centerline for the worst angles as identified by the model. Based on the observed traffic flows and reconnaissance surveys, the proposed project has been divided into three homogenous traffic sections. The nearest receptor was considered to be at 30m from the centerline of Homogenous Sections. Air modeling results of all the four homogenous sections of NH- 208 have been presented in **Table 5.1(a) to 5.1(d).**

For Section I (Khowai to Teliamura)

Table 5.1(a):- Air Modeling Result for section 85.500 km to 118.000 km

(Predicted Conc. of CO)

Predicted Maximum 1-hour Concentration of CO (ppm)				
Receptor Distance from Center Line	**2020**	**2025**	**2030**	**2033**
at 30 m	0	0.1	0.1	0.1
at 50 m	0	0	0.1	0.1
at 100 m	0	0	0	0

Predicted Maximum 1-hour Concentration of CO (µg/m3)				
Receptor Distance from Center Line	**2020**	**2025**	**2030**	**2033**
at 30 m	0	115	115	115
at 50 m	0	0	115	115
at 100 m	0	0	0	0

For Section II (Teliamura to Sabroom)

Table 5.1(b):- Air Modeling Result for section at km. 42.300
(Predicted Conc. of CO)

Predicted Maximum 1-hour Concentration of CO (ppm)					
Receptor Distance from Center Line	**2020**	**2025**	**2030**	**2035**	**2040**
at 30 m	0.1	0.1	0.1	0.1	0.1
at 50 m	0	0.1	0.1	0.1	0.1
at 100 m	0	0	0.1	0.1	0.1

Predicted Maximum 1-hour Concentration of CO (µg/m3)					
Receptor Distance from Center Line	**2020**	**2025**	**2030**	**2035**	**2040**
at 30 m	115	115	115	115	115
at 50 m	0	115	115	115	115
at 100 m	0	0	115	115	115

Table 5.1(c):- Air Modeling Result for section at km. 88.000

(Predicted Conc. of CO) Section I

Predicted Maximum 1-hour Concentration of CO (ppm)					
Receptor Distance from Center Line	**2020**	**2025**	**2030**	**2035**	**2040**
at 30 m	0	0	0	0	0
at 50 m	0	0	0	0	0
at 100 m	0	0	0	0	0

Predicted Maximum 1-hour Concentration of CO (µg/m3)					
Receptor Distance from Center Line	**2020**	**2025**	**2030**	**2035**	**2040**
at 30 m	0	0	0	0	0
at 50 m	0	0	0	0	0
at 100 m	0	0	0	0	0

Table 5.1(d):- Air Modeling Result for at km. 132.800
(Predicted Conc. of CO) Section I

Predicted Maximum 1-hour Concentration of CO (ppm)					
Receptor Distance from Center Line	**2020**	**2025**	**2030**	**2035**	**2040**
at 30 m	0	0	0	0	0
at 50 m	0	0	0	0	0
at 100 m	0	0	0	0	0

Predicted Maximum 1-hour Concentration of CO (µg/m3)					
Receptor Distance from Center Line	**2020**	**2025**	**2030**	**2035**	**2040**
at 30 m	0	0	0	0	0
at 50 m	0	0	0	0	0
at 100 m	0	0	0	0	0

Source: EIS

The predicted 1hr maximum concentration of CO after improvement and widening of the proposed project is found to be within 4000 µg/m^3 prescribed in National Ambient Air Quality Standards, 2009 for residential, rural and other areas.

5.4.1.2 Change in Ambient air and GLC

The air pollution impact of excavation in ordinary earth and boulders and rock is directly dependent upon construction methodology, annual rate of excavation, mode of transport within the construction site, mode of screening and method of crushing. The air pollution sources at the proposed project site can be broadly classified into three categories, viz. area source, line source and instantaneous point source.

Excavation by various activities in project area is construed as an area source which includes excavation pit(s) and activities happening in the excavation area like digging, dozing, hauling and loading/unloading. The dust emission from these areas will be fugitive in nature. The excavator operations, loading/unloading operations will also cause dust emission though it will be confined to the area of operation of the machinery. The gaseous emission from their operation shall be minimal and limited within the project.

Transportation of excavated material from the project site to dumping sites area categorized as line source. Since the dumper movement on haul road will be within the project area, no adverse impact shall be felt in the settlement area.

(i) Dust Dispersion Modeling for Excavation Operation

In the present study, United States Environmental Protection Agency (USEPA–42 series) approved mathematical equations have been used to predict concentrations for different operations in project including the material transportation. To predict the particulate emissions, Envitrans AERMODCloud. (Air Dispersion Modeling Software) an interface based on ISCST3 – was used to predict changes in air quality i.e., maximum ground level concentration (GLC's) of Particulate Matter. Short term model options were opted for uniform emissions rates. The concentration of other gaseous pollutants i.e. SO2 and NOx was found to be much lower than the threshold limit (80 µg/m3), the air modeling was restricted to determination of PM_{10} and $PM_{2.5}$ in the present case for the monitoring locations where respective maximum value was identified. The emission factors adopted for various project operations are mentioned below:
Emission Factor for Excavation and Material Loading/unloading.

For excavation and material handling the emission factor for PM_{10} has been adopted as per USEPA – 42 series.
For Dozing Operation:
$EFPM_{10}$ (kg/hr) = 0.34 X s1.5(%) / M1.4(%)
Where,
$EFPM_{10}$ (kg/hr) = emission factor in kg/hr
S = silt contents in percentage by weight
M = moisture content in percentage by weight
For Material Loading/unloading:
$EFPM_{10}$ (kg/hr) = 0.34 [0.119 / M0.9]
Where,
$EFPM_{10}$ (kg/hr) = emission factor in kg/ton

M = moisture content in percentage by weight.

Emission Factor for Material Haulage within Project:

The emission rate is dependent on several factors which include soil properties, climatic conditions, vehicular traffic, wind forces and machinery operation. The Empirical equation for calculation of emission rate is as under.

E= k*(1.7) *(s/12) *(S/48) *(W/2.7)0.7*(W/2.7)0.7 (w/4)0.5 * (365-p/365) g/VKT

Where,

E=Emission Rate

K = Particle size multiplier

s=Silt Content of the Road surface material

S= Mean Vehicle Speed (km/hr)

W=Mean Vehicle Weight (tons)

w=Mean number of wheels

p= Number of days with at least 0.254mm of precipitation per year

Note: The emission factor for $PM_{2.5}$ has been considered 60% of PM_{10}.

The Isopleth developed for PM_{10} and $PM_{2.5}$ along the road alignment where monitored values are highest in receptor villages and is shown in **Figure 5.1 and 5.2 for PM_{10} and $PM_{2.5}$** respectively. The maximum GLC due to excavation, loading & unloading activities for PM_{10} and $PM_{2.5}$ were found to be 5.7 µg/m3 and 3.5 µg/m3 respectively and has been shown in Table 5.2.

Table 5.2: Maximum Concentration at receptors

Location	Pollutants	N-Cord.	E-Cord.	GLC (µg/m³)
Harina	PM 10	23° 2'25.46"N	91°40'12.95"E	5.7
Harina	PM 2.5	23° 2'25.46"N	91°40'12.95"E	3.5

Source: EIS

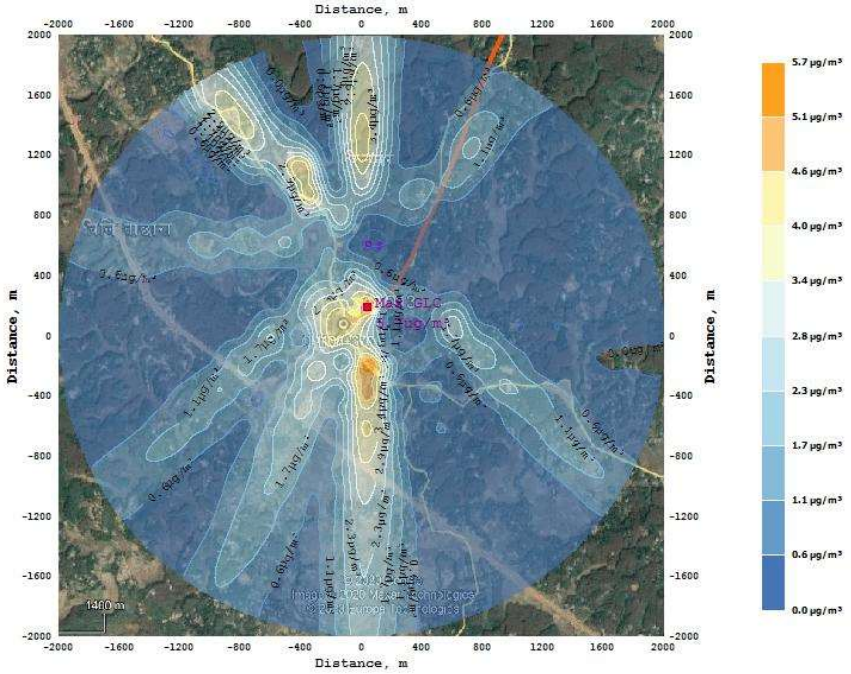


Figure 5.1: Isopleth of Maximum Predicted 24 hourly Ground – Level Concentrations for PM_{10}

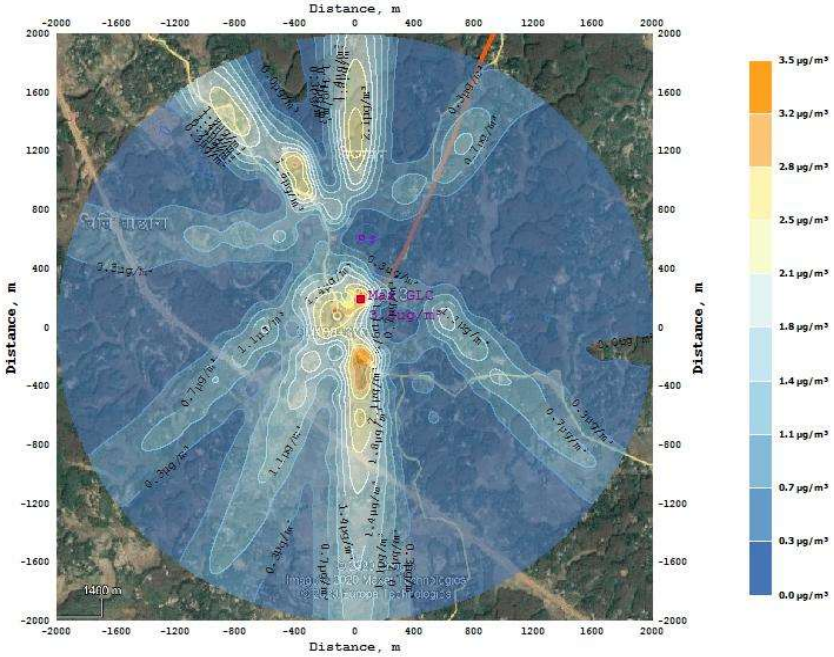


Figure 5.2: Isopleth of Maximum Predicted 24 hourly Ground – Level Concentrations for $PM_{2.5}$

Source: EIS

Resultant Impact

The resultant impact due to construction activities (excavation and crushing) on the ambient air quality for PM_{10} and $PM_{2.5}$ at monitoring station Harina is presented in **Table 5.3(a)** which shows that, the resultant concentration level is within the NAAQS whereas **Table 5.3 (b)** shows the resultant levels due to excavation and construction activities after taking Mitigation Measures (MM) as per EMP.

Table 5.3 (a): Resultant levels due to excavation and construction activities

Station Name	Pollutants	Max. Conc. (µg/m3)	Predicted GLC (µg/m3)	Resultant concentration (µg/m3)	NAAQS (µg/m3)
Harina	PM10	48	5.7	53.7	100
Harina	PM2.5	18	3.5	21.5	60

Table 5.3 (b): Resultant levels due to excavation and construction activities after taking Mitigation Measures (MM) as per EMP

Station Name	Pollutants	Max. Conc. (µg/m3)	Predicted GLC (µg/m3)	GLC after taking MM as per EMP (µg/m3)	Resultant concentration taking MM as per EMP (µg/m3)	NAAQS (µg/m3)
Teliamura (NH44)	PM10	48	5.7	1.14	49.14	100
Teliamura (NH44)	PM2.5	18	3.5	0.7	18.07	60

Source: EIS

5.4.2 Noise & Vibration

Noise level may increase temporarily in the close vicinity of construction activities, maintenance workshops and earth work site. These construction activities are expected to produce noise levels in the range of 80 - 95 dB(A) (at a distance of about 5 m from the source) . Although this level of noise is higher the permissible limit for ambient noise level for residential/commercial levels but will occur only intermittently and temporary. This noise level will attenuate fast with increase in distance from noise source. Since the project road is passing through considerable built-up area, impact of noise on sensitive structures such as schools, hospitals is highly anticipated. There are several noise sensitive receptors such as educational institutes, health centres along with residential areas. Noise barriers shall be provided in those sensitive noise receptors to avoid detrimental impact due to noise pollution. List of noise sensitive receptor in the project road has been given below in table 5.4.

Table 5.4: Sensitive Noise Receptors in the Project Road

For section I			
Sl. No.	**Design Chainage (KM)**	**Side**	**Type**
1.	101.4	RHS	School
2.	102.35	LHS	Sub-health Centre
3.	104.9	RHS	Primary Health Centre
4.	108.9	LHS	School
5.	112.35	LHS	School
6.	117.35	RHS	School
7.	122.4	LHS	School
8.	122.45	RHS	School
9.	126.15	RHS	School
10.	126.7	LHS	School
11.	127.15	RHS	School
For section II			
Sl.No.	**Design Chainage (km)**	**Side**	**Type**
1	3+200	RHS	School
2	23+370	RHS	School
3	25+400	LHS	School
5	73+020	LHS	School
6	76+290	LHS	School
7	83+700	LHS	School
9	89+700	LHS	School
10	104+500	RHS	School
11	106+500	RHS	School

Source: DPR

5.4.2.1 Impacts on noise levels

The assessment of potential road noise impacts helps in understanding one of the most significant pollution, the noise pollution. Some salient features related to potential noise impact of a road development include: (i) the road noise impact is greatest where busy road passes through densely populated areas, townships and markets (ii) the range of noise level should be understood in relation to the habitation type also; for example,

road noise in industrial area is not likely to be problematic but at sensitive location like schools and hospitals; its impact may be significant, (iii) mitigation of noise in urban areas is rather difficult, especially at the road intersections.

Environmental noise particularly highway traffic noise, is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of vehicles on the road.

The impacts of noise due to the project will be of temporary significance locally in the construction phase and slight increase may occur during the operation stages. **Table 5.5** presents the source of noise pollution and the impact categorization.

Table 5.5: Source of the Noise pollution and its impact

Sr. No.	Phase	Source of Noise pollution	Impact categorization
1	**Pre-construction**	• Man, material & machinery movements • establishment of labor camps, onsite offices, stock yards and construction plants	• All activities will last for a short duration and also shall be localized in nature
2	**Construction Phase**	• **Plant Site** Stone crushing, asphalt production plant and batching plants, diesel generators etc. • **Work zones** Community residing near to the work zones	• **Plant Site:** Impact will be significant within 500m. • **Work zones**: Such impacts again will be of temporary nature as the construction site will go on changing with the progress of the works.
3	**Operation Phase**	• Due to increase in traffic (due to improved facility)	• Will be compensated with the uninterrupted movement of heavy and light vehicles.

Source: EIS

Although the baseline day & night time noise levels monitored at thirteen locations along the proposed project are within permissible limits specified by the MoEF&CC. The highest Leq noise levels was recorded at Teliamura (NH44) which is 56 dB(A) during daytime and 44 dB(A) during night time. The Mathematical equation used for noise prediction is L2 = L1-20 Log D2/D1.

5.4.2.2 Prediction of Noise Impact on Noise level

A noise propagation modeling study has been conducted to find out the impact from the noise generated because of the estimated total traffic flow as well as the significance of these impacts. The noise modeling

has been done taking into account the design speed at various stretches and the stretches with restricted speeds have also been considered. DhwaniPRO is a computer program developed to undertake construction, industrial and traffic noise propagation studies for noise assessment.

The Traffic data has been collected at four locations along the project road as per table 5.6 and table 5.8. Different operative speeds have been used for various horizon years in the design life to get a realistic picture of the noise levels.

Table 5.6: Projected Traffic for section I

Year	Homogeneous Section (KM 85.500-KM 118.000)	
	Length- 32.500 km	
	No	PCU
2020	9576	9624
2025	12221	12283
2030	15598	15676
2033	18057	18147

Source: DPR

DhwaniPRO model is used for noise modeling and predicted noise levels are presented in **Table 5.7** and **Figure 5.2(a) to (d)**.

Table 5.7: Noise level predictions for the receptors at the homogenous intersections

S.No.	Locations	2020	2025	2030	2033
1	Mahadevtila/Chebri village	31	32	33	34
2	Dwarikapur	40	41	42	43
3	Kalyanpur	35	36	37	38
4	Teliamura (NH44)	48	49	50	52

Source: EIS

Outcome of the Noise level Modelling:

The outcome of the noise modeling is as follows:

- The predicted noise levels during both day and night time are within limit upto the end of design life of the project for all the land uses i.e., commercial, residential/rural and sensitive.

The Contour map showing noise levels due to total traffic outcome at the homogenous intersections from the period of 2020 – 2033 has been shown in **Figure 5.3 (a)** to **5.3 (d).**

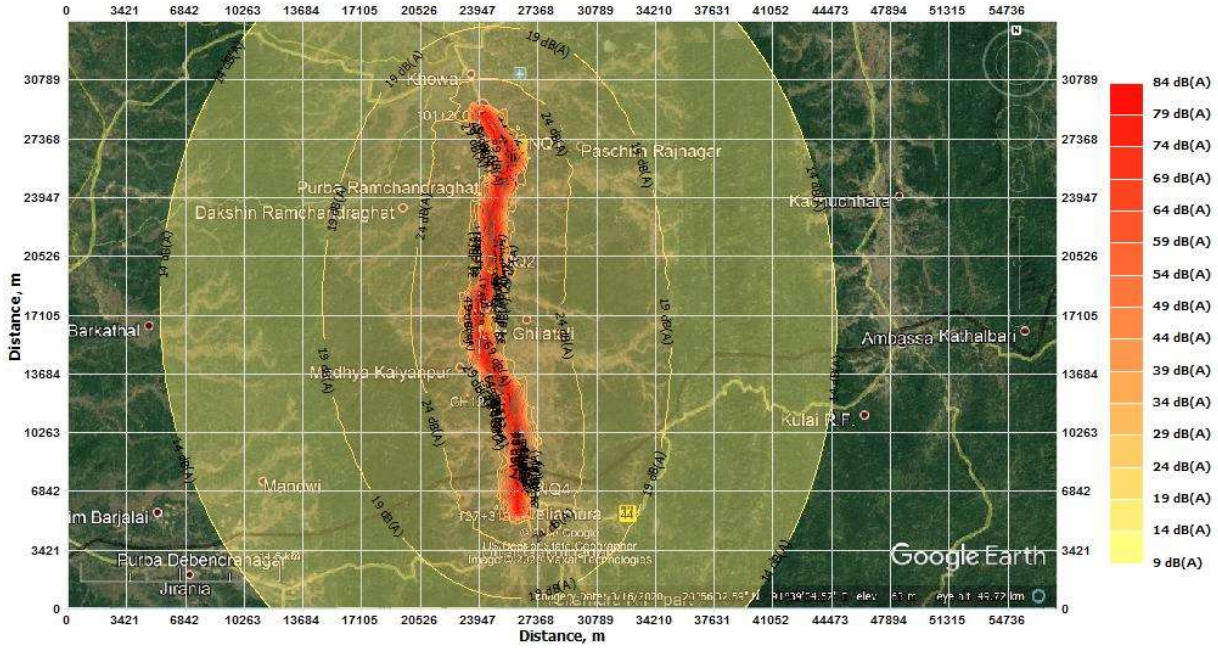


Figure 5.3 (a):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2020 year

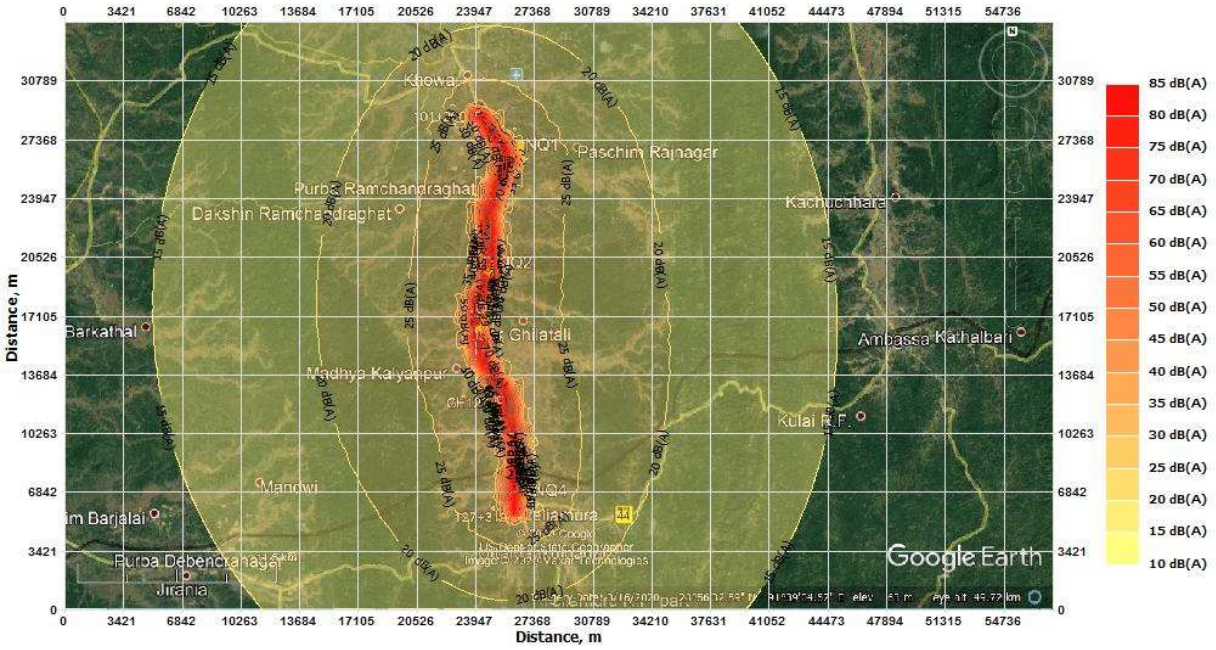


Figure 5.3 (b):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2025 year

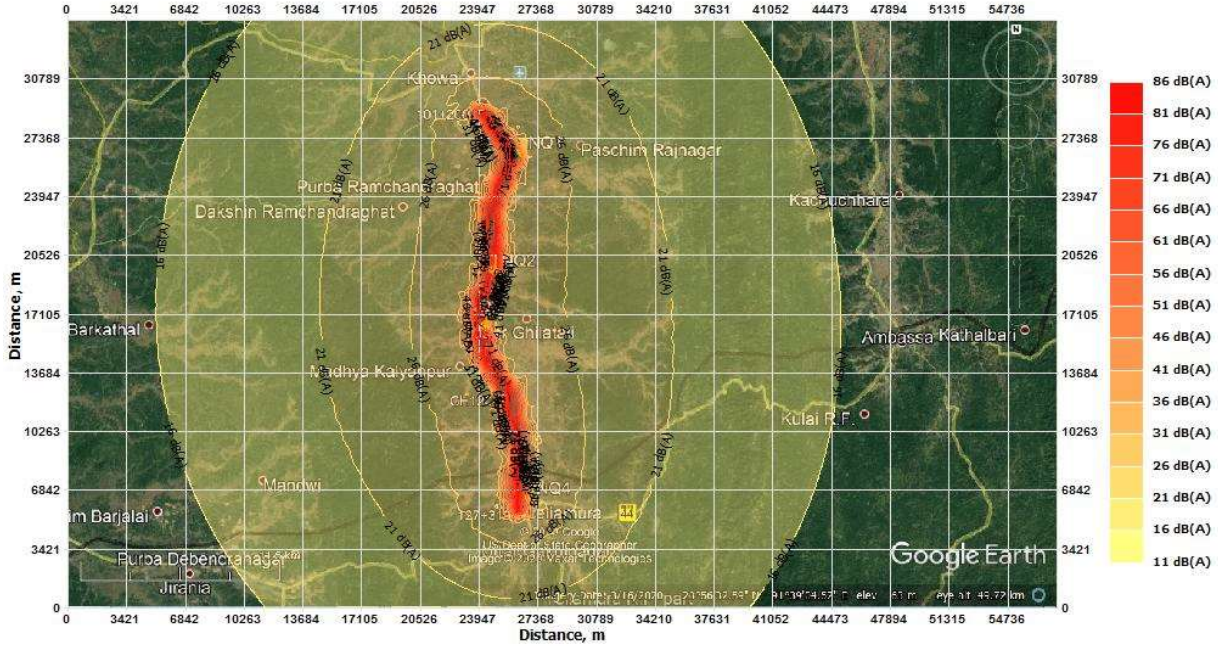


Figure 5.3 (c):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2030 year

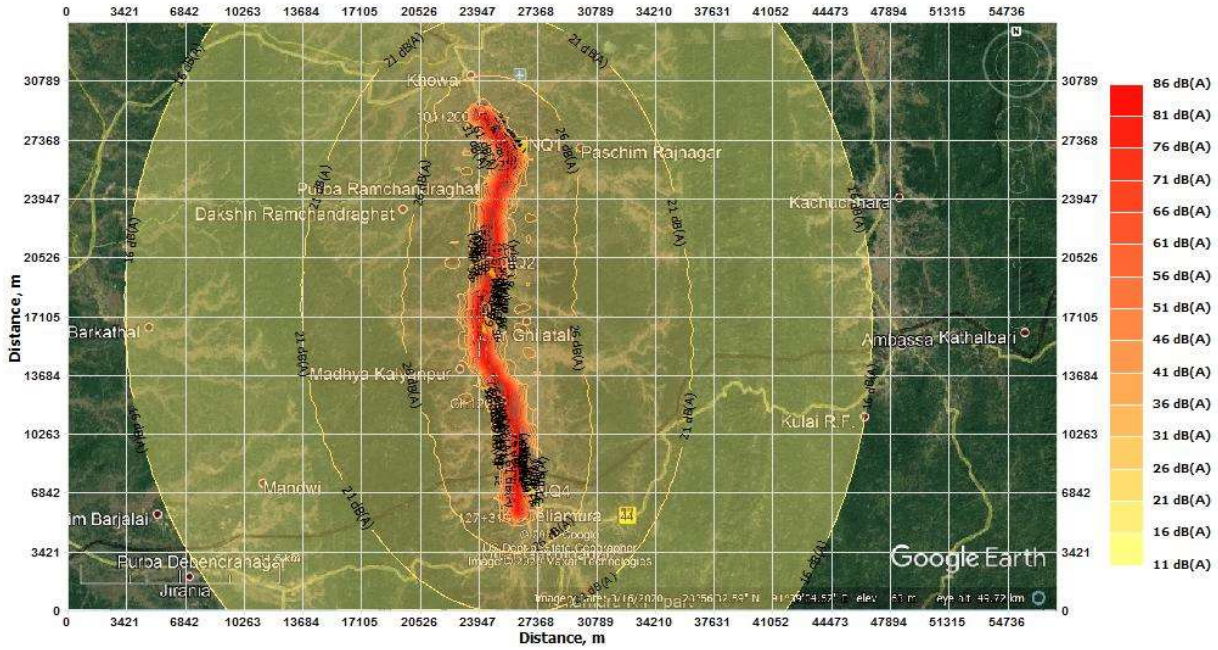


Figure 5.3 (d):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2033 year

Source: EIS

Table 5.8: Projected Traffic for section II

Year	Homogenous sections		
	PCU at km 42.30 (Near Rangamati)	**PCU at km 88.00 (Near Ailmara)**	**PCU at km 132.80 (Near Harina)**
2020	2162	299	334
2025	2750	368	423
2030	3500	451	532
2035	4457	559	666
2040	5673	696	854

Source: DPR

DhwaniPRO model is used for noise modeling and predicted noise levels are presented in Table **5.9** and **Figure 5.2(a) to (d)**.

Table 5.9: Noise level predictions for the receptors at the homogenous intersections

S.No.	Locations	2020	2025	2030	2035	2040
1	BSF camp area	31	32	33	34	35
2	Taidu	35	36	37	38	39
3	Jantrana Para	32	33	34	35	36
4	Tingharia	30	31	32	33	34
5	Rangamati	36	37	38	39	40
6	Chelagangmung	31	32	33	34	35
7	Suknachari	29	30	31	32	33
8	Rupachari	30	31	32	33	34
9	Harina	32	33	34	35	36

Source: EIS

Outcome of the Noise level Modelling:

The outcome of the noise modeling is as follows:

- The predicted noise levels during both day and night time are within limit upto the end of design life of the project for all the land uses i.e., commercial, residential/rural and sensitive.

The Contour map showing noise levels due to total traffic outcome at the homogenous intersections from the period of 2020 – 2040 has been shown in **Figure 5.4 (a)** to **5.4 (e).**

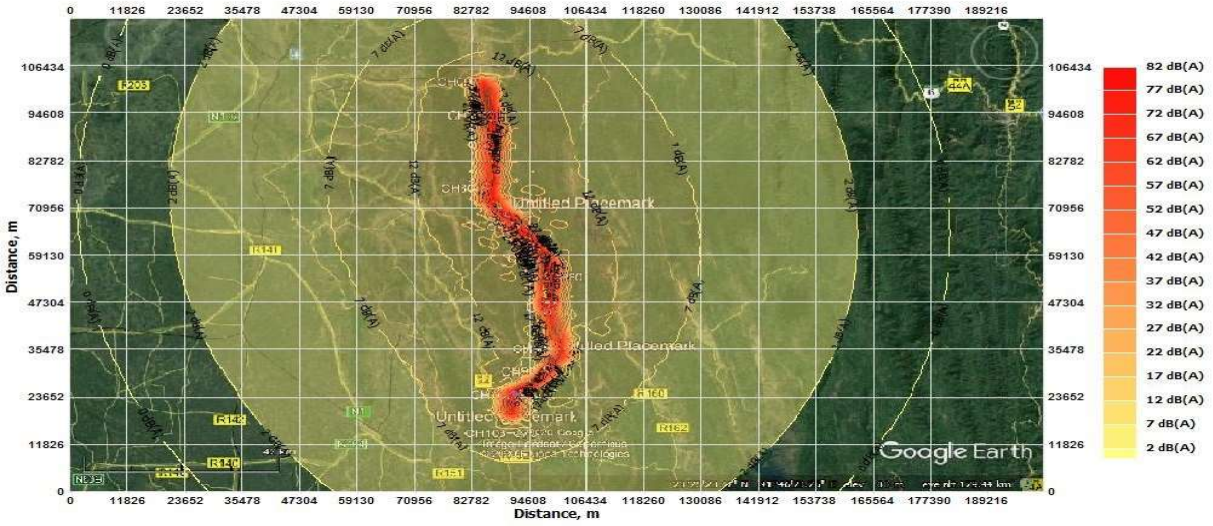


Figure 5.4 (a):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2020 year

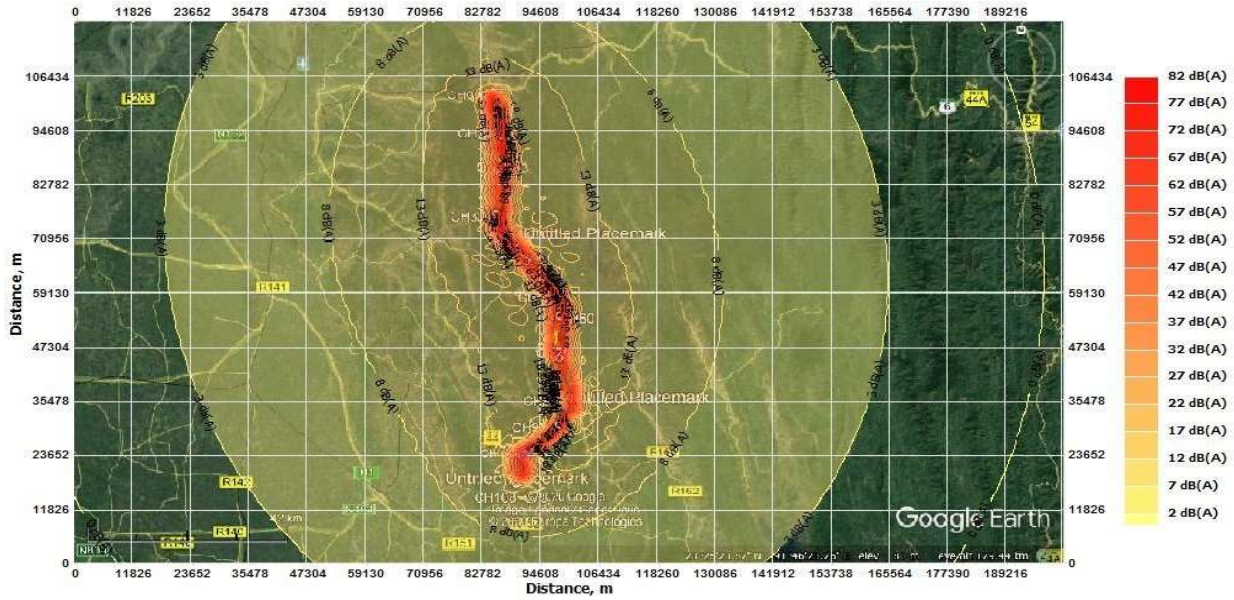


Figure 5.4 (b):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2025 year

Figure 5.4 (c):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2030 year

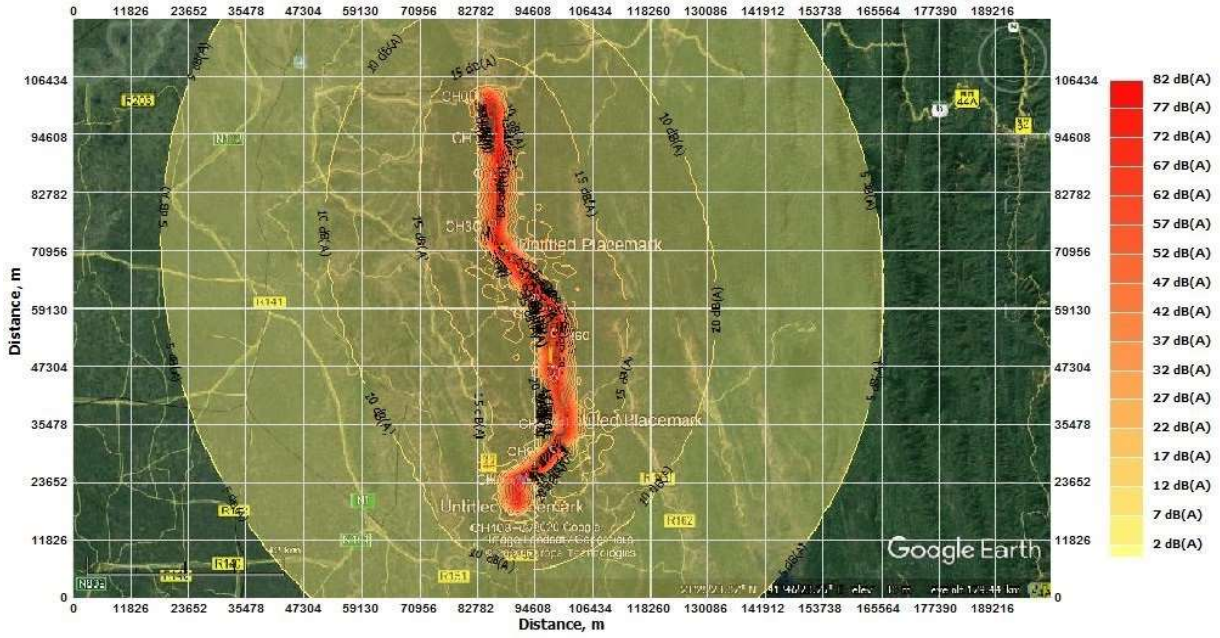


Figure 5.4 (d):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2035 year

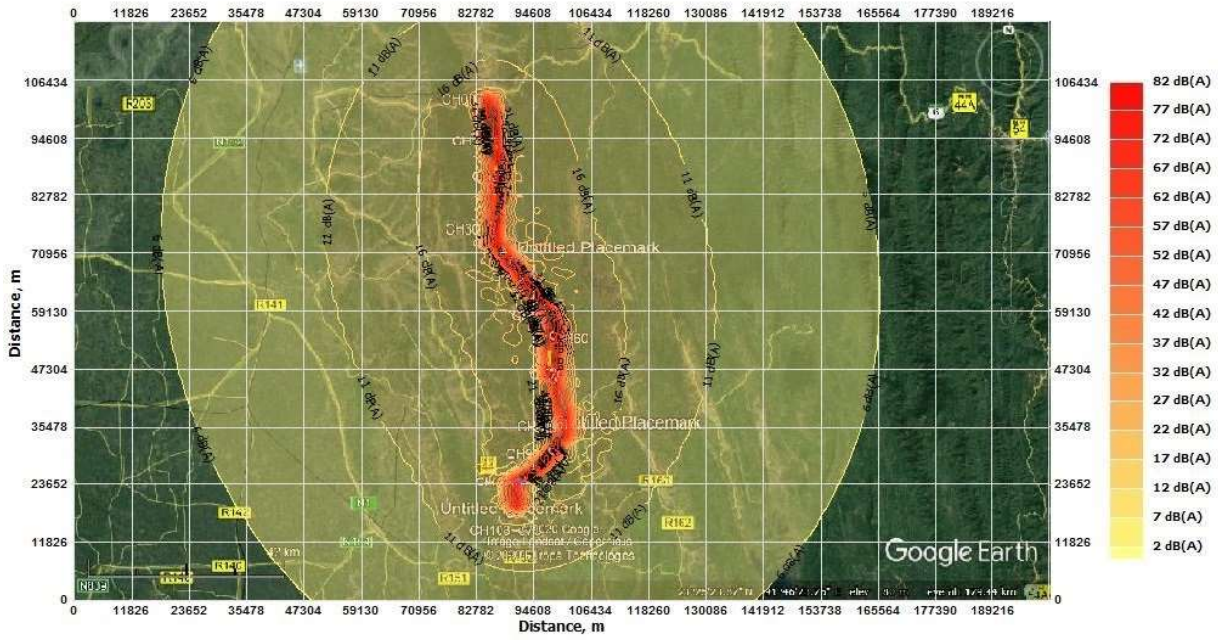


Figure 5.4 (e):- Contour map showing noise levels due to total traffic outcome at the homogenous intersections of 2040 year

Mitigation measures to reduce Noise levels

The following are the mitigation measures to reduce noise pollution:

- Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery. All construction equipment used for an 8-hour shift will conform to a standard of less than 90dB (A). If required, high noise producing generators such as concrete mixers, generators, graders, etc. must be provided with noise shields.
- Machinery and vehicles will be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum.
- Workers in the vicinity of high noise levels will be provided earplugs, helmets and will be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8 hour shift.
- During construction vibratory compactors will be used sparingly within the urban areas. In case of complaints from roadside residents, the engineer will ask the site engineer to take suitable steps of restricting the work hours even further or use an alternative roller.
- Proposed tree and shrub plantations planned for avenue plantation especially close to settlements, may form an effective sound buffer during the operation stage.

5.4.3 Land & Soil

Topography and aesthetics: Activities like (i) Clearing of vegetation (ii) Cutting of highland (iii) Waste/Debris disposal and (iv) Establishment of labour camps change the topography and appearance of the landscape. Following mitigation measures to overcome the issue.

Mitigation Measures

- Cut materials should be used in road embankment or disposed-off in environmentally acceptable manner.
- Cut slopes should be re-vegetated immediately after widening activities
- Borrow areas, if required should be rehabilitated and brought back as far as possible to their previous appearance. Some borrows shall be converted into ponds to compensate loss of water bodies. This will also enhance the local aesthetics
- Cut off material should be used to widen the road or disposed of at proper disposal sites
- Provision and allocation of proper waste disposal bins and sites are required. Supply of cooking gas should be provided by the contractor to eliminate the use of fire wood.

Loss of Productive Soil and Change in Land use: Proposed project road shall be passing through agriculture and forest land in realignment and bypass portion. This will lead to acquisition of substantial quantity of land. Hence, agricultural yield of the area is likely to be affected.

Mitigation Measures

- The top soil from the productive land if required shall be preserved and reused for plantation purposes. It shall also be used as top cover of embankment slope for growing vegetation to protect soil erosion.
- It shall be ensured that the land taken on lease for access road, borrow areas, construction camp is restored back to its original land use.

Soil Erosion/Silt Runoff: Soil erosion may take place near cutting areas, at steep and uncompact embankment slope, and wherever vegetation is cleared. Soil erosion may have cumulative effect viz. siltation, embankment damage, drainage problem etc. Loss of soil due to run off from earth stock-piles may also lead to siltation.

Mitigation Measures

- Bank protection measures shall be taken at erosion prone areas.
- Provision of side drain to guide the water to natural outfalls.
- When soil is spread on slopes for permanent disposal, it shall be buttressed at the toe by retaining walls.
- Side slopes of the embankment shall not be steeper than 2H: 1V. Turfing of embankment slopes shall be done along the stretch.
- IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control shall be taken into consideration.

Borrow Areas and Quarries: Need for opening borrows areas is anticipated. It may cause some adverse impacts if left un-rehabilitated. It may pose risk to people, particularly children and animals of accidentally falling into it as well as become potential breeding ground for mosquitoes and vector born disease. Illegal quarrying may lead to unstable soil condition; destroy the landscape of the terrain, air and noise pollution. Opening of new quarries is not envisaged due to the proposed project. Quarry material will be sourced from

existing licensed quarries. The dredging and use of dredged material, if involved, may have its impact in terms of localized sedimentation level increase and dispersion of pollutants present in the dredged material in the river water.

Mitigation Measures

- Borrow areas if required, shall not be located near forest areas. The edges of borrow sites shall be no closer than 3 meters from any fence line or boundary. Adequate clearance shall be provided for the construction of catch drains. Borrow sites shall have adequate drainage outlets unless the relevant landowner has agreed that the borrow area is to create a permanent tank or dam. Cut batter slopes shall not be steeper than 3 to 1 and shall be left by the Contractor in a tidy and safe condition to the satisfaction of the Engineer. Written clearance from the land owner/village head shall be obtained before leaving a site
- Obtain statutory approval from competent authority as detailed in chapter II (recent policy initiatives on mining of minor mineral)
- Borrow pits shall be selected from barren land/wasteland to the extent possible. Borrow areas should not be located on cultivable lands except in the situations where land owners desires to level the land. The top soil shall be preserved and depth shall be restricted to the desired level.
- Borrow areas should be excavated as per the intended end use by the owner. The Indian Road Congress (IRC):10-1961 guideline should be used for selection of borrow pits and amount that can be borrowed.
- The dredged material from the nearby water body shall be tested for presence of heavy metals and other pollutants before its reuse.
- The depths in borrow pits to be regulated so that the sides shall not be steeper than 25%, to the extent possible, borrow areas shall be sited away from populated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil.

Compaction and Contamination of Soil: Soil of the haulage roads and construction camp area may be compacted due to movement of construction vehicles, machineries and equipment's, and due to sitting of construction camps and workshops. Soil may get contaminated due to inappropriate disposal of liquid waste, (lubricating oil and fuel spills, waste oil and lubricant and vehicle/equipment washing effluent) and solid waste (fuel filters, oily rags) likely to be generated from repair and maintenance of transport vehicles, construction equipment and machinery.

Soil may also get contaminated due to inappropriate disposal of domestic solid waste and sewage from construction camps. Sub soil contamination may also be attributed to: scarified bitumen wastes, operation of the emulsion sprayer and laying of hot mix, storage and stock yards of bitumen and emulsion, excess production of hot mix and rejected materials.

Mitigation Measures

- Fuel and lubricants shall be stored at the predefined storage location. The storage area shall be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils.
- Unavoidable waste shall be stored at the designated place prior to disposal. To avoid soil contamination at the wash-down and re-fueling areas, "oil interceptors" shall be provided. Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labeled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/ MoEF&CC authorized re-refiners.

- Movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route.
- Approach roads shall be designed along the barren and hard soil area to reduce the compaction induced impact on soil.
- The productive land shall be reclaimed after construction activity.
- Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp.
- Domestic solid waste at construction camp shall be segregated into biodegradable and non-biodegradable waste. Non-biodegradable and non-saleable waste shall be disposed-off to authorize land fill site. If land fill site not available then burial of the waste in a secured manner shall be ensured.

5.4.4 Water Resources

Loss of Water Bodies: There are 103 locations where the proposed road passes through the edge of ponds / well. Most of them are within the right of way very close to the alignment. Retaining walls are proposed at such locations. Earth filling may be required in some cases but limited to a narrow strip of 1-1.5 m. This will cause reduction in volumetric capacity of these ponds. However, overall impact will not be significant since the project area is endowed with abundant surface water resources. Moreover, the usage of these ponds is limited to washing/cattle bathing and fishing. No other aquaculture was observed other than fishing of some indigenous variety mostly for domestic consumption and restricting mosquito breeding.

Apart from this, the project road is intersecting few rivers & streams including major rivers such as Khowai River. New bridges are proposed to construct in these water bodies. There will be temporary disturbance to the water bodies limited to bridge construction period. Construction activities on bridges shall be stopped during breeding time of fish and other aquatic species.

Mitigation Measure

- Alignment may be suitably modified to avoid encroachment of water bodies wherever possible
- Efforts shall be made to increase its volumetric capacity either by increasing depth or area wherever feasible.
- Borrow areas shall be converted into ponds at least equivalent to filling.

Siltation and Deterioration in Surface Water Quality: Construction activities may increase turbidity level increasing the sediment load. Sometimes contamination of surface water may take place due to accidental spills of construction materials, oil, grease, fuel, and paint. Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas. During construction phase, care would be exercised to control silt so that the water available in the ponds and wells especially those located very near to the ROW may not be contaminated.

Extraction of sand from the river bed will increase turbidity and affect propagation of fishes and other aquatic life mainly benthic organisms. The macro-benthic life which remains attached to the river bed material may get dislodged and carried away downstream by turbulent flow. Mining and dredging activities, poorly planned stockpiling and uncontrolled dumping of overburden, and chemical/fuel spills from equipment's and machinery involved in dredging may cause deterioration of water quality for downstream users, and poisoning of aquatic life. However, the river bed sand quarries identified for the project have no density and diversity of benthic fauna. Fishing is practiced in the water bodies intersecting the project road. There are several ponds adjacent to the proposed project road. Moreover, any extraction of river bed material is

regulated by different authorities like State Environmental Impact Assessment Authority, State Pollution Control Board and State Mining Department with an objective to conserve top soil, avoid impact on aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals. The project will utilize river bed materials from existing licensed quarries with all stipulated conditions of above mentioned authorities.

Mitigation Measure

- Construction works near waterways/water bodies will not be undertaken during the monsoon season
- Retaining walls have been proposed to prevent erosion
- Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- No construction camp within 500m of any water body

- Locate all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards.
- Refuel vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water separator before discharge
- Collect all waste oil, store in sealed damage-proof containers and dispose it to recyclers.
- All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual cleanup.
- temporary retention ponds, interception drains, and silt traps are installed to prevent silt laden water from entering adjacent water bodies/waterways;
- The slopes of embankments leading to water bodies should be modified and rechanneled to prevent entry of contaminants.
- Comply with requirements of the clearance issued by the relevant state authority for mining in rivers
- No construction related activities of bridges during breeding season of fish and other aquatic species.

Alteration of Surface Water Hydrology/Drainage: Alteration of Surface Water Hydrology/Drainage: Diversion of major streams due to construction is expected. In section I, total 15 bridges exist on project alignment, 13 existing minor bridges, 01 major bridge is proposed for reconstruction and 1 existing bridges is retained due to realignment. Total 32 existing culverts are proposed for reconstruction and 14 new culverts are proposed in entire length.

In section II, total 32 bridges exist on project alignment in which 1 existing bridge is proposed for reconstruction, 31 existing bridges are retained due to realignment and 59 additional new bridges are proposed on the realignment & bypass. Total 258 culverts exist on project alignment in which 28 culverts are proposed for reconstruction. 230 culverts are retained due to proposal of realignments /bypasses. 306 new culverts are proposed in entire length as balancing culverts.

Groundwater: Water for construction purpose will be sourced mainly through major streams along the project road. Suitable arrangement for drinking in the campsite will be managed by contractor without affecting availability to local community. The area is not classified as critical semi-critical or overexploited by CGWB. However, uncontrolled drinking water abstraction can deteriorate the situation. Contamination of groundwater is not envisaged since all construction camps will have septic tanks or mobile toilets depending on the number of workers in each camp.

Mitigation Measures

- Provision for adequate numbers of septic tank to avoid contamination of ground water.
- Requisite permission will be obtained for abstraction of groundwater.
- The contractor will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected.
- Water harvesting structures shall be proposed for groundwater augmentation in the project area.
- No change in groundwater regime is envisaged hence no mitigation is proposed.

5.4.5 Construction Debris/ Waste/Muck

Muck/Debris is likely to be generated since dismantling of existing pavement is involved. The muck will also be generated during construction of road section. 22,91,852 cum of muck will be generated in the project. The disposal locations have not been identified till date and are under process. All the muck generated will be disposed as per C&D Waste Management rule 2016.

Mitigation measures

- All excavated materials from roadway, shoulders, verges, drains, cross drainage and the like will be the property of the EA and will be used for backfilling embankments, filling pits, and landscaping.
- Unusable debris material should be suitably disposed-off at pre-designated disposal locations, with approval of the concerned authority. The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner.
- Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.

5.4.6 Ecological Resources

Terrestrial: Estimation of felling number of trees has been carried out by the state forest department, government of Tripura. Felling of trees is also involved resulting in habitat destruction and fragmentation. Plantation in adjacent unused land shall be carried out throughout the project road effectively with proper provision as per norms fixed by the forest department. This will bring down the adverse impact of tree felling and help in restoration process of local ecosystem. It must also be ensured that there is no impact on any rare threatened or endangered species. A total of approx. 36774 numbers of trees likely to be fallen down during the widening process.

Forest Fires: Risk of forest fire cannot be ruled out due to uncontrolled burning of grasses/shrubs for clearance of ROW, fuel accumulation due to accidental spillage or improper storage of explosives.

Mitigation Measures

- Requisite clearance and permission from forest department shall be obtained for cutting all the felling trees.

- Plantation shall be done on areas exposed after site clearance as per the norm fixed by the state forest department. All tree plantations will be carried out in close consultation with forest department.
- For safe traffic operation, vertical clearance between the crown of the carriageway and lowest part of overhang of the tree available across the roadway shall conform to the standards laid down in IRC: SP: 21-2009. The pit size, fencing, watering, and manure/fertilizing requirements shall also conform to the above standard. Excess use of pesticides shall be restricted.
- Immediate removal of fuel accumulations near forest areas;
- Clearance of vegetation shall not be done by burning along forested/thickly vegetated areas.
- Planting and management of fire-resistant species adjacent to and within ROW.
- Plantation of local/ endogenous species to attract avian fauna.
- Provision of fire lines to avoid further spread over of fire.

Aquatic Ecology: Temporary sedimentation and water quality deterioration is expected from the project during the construction stage. Improvement of existing embankments particularly along the waterways may increase silt while accidental spill of materials, chemicals, and fuels will deteriorate receiving water quality.

There are numbers of water bodies in the form of private and community ponds along with rivers, streams and nallah. Majority of those streams and nallahs are seasonal and only active during the monsoon season. It has been observed during the field survey that fishing activities practiced along the existing road in those ponds. 103 nos. of ponds come within the ROW of the road. Alignment of the road should be designed to avoid any kind of construction activities in these existing fisheries to safeguard aquatic life. Provision of retaining walls already mentioned in the civil designing of the project road

Mitigation Measures

> Siltation shall be avoided by measures suggested above in impact on surface water resource section.
> Strict monitoring during construction of bridge over the river as well as during renovation of culvert to avoid contamination of the river and stream water.
> Labour camps shall be minimum 500m away from any type of water bodies.

5.4.6.1 Conservation and Mitigation Measures

Being the tropical moist environment, the flora of the project area has high potential of regeneration and can withstand the adverse influences of the project activities. However, the following measures could be essentially practiced for upscaling environmental and biodiversity conservation in the project area.

1. **Monitoring**: Regular monitoring of the existing vegetation for aerial extent, Species composition , biomass production and successional status are necessary besides monitoring of faunal population.

2. **Management of Conservation Activities**: The conservation need be practiced **at landscape level following local people-centric decentralized participatory approach** where bottom up approach for generation of information and practices for conservation need be given priority. **A collaborative management approach** involving all stakeholders such as the Forest department, Wildlife wing, local people and knowledge partners-academia and research, and interface institutions like non-profit organizations and trusts would be appropriate for this purpose. Whenever possible, the

Corporates may also be involved as stakeholder to perform social responsibility (corporate social responsibility) in terms of their contribution as monetary support and technology for maintenance of habitat, habitat improvement and awareness generation.

3. Awareness Generation: The knowledge and technical skills are pre- requisite for human capital to perform in a desired manner. It is, therefore, suggested that the information in regard to species of plants and animals existing in the project site, importance of these species for conservation of food chain organisms and ecological processes essential for ecological balance at the site, threats for their survival and suitable package of practices for conservation of biodiversity need be made available to the local people and other stakeholders **through print and electronic media, street plays *(nukkad natak)* and exhibitions. Local festivals and fairs (*mela*) can serve as better opportunities for awareness generation.**

Awareness generation with respect to the importance of keystone species particularly, about religious taboos of local communities and indigenous practices of biodiversity conservation **among youth** need to be promoted. **The youth and socially-accepted persons may be utilized as guards against illegal utilization of wild plant and animal species in the area.**

4. Promotion of Eco-development and Eco-tourism: In order to reduce the dependency of local people on the forest, savanna, grassland and natural biodiversity for different socio-economic needs, such as, fire-wood, small timber, leaf fodder and medicinal species, etc., the eco-development programmes considering the cultural and socio-economic and environmental dimensions specific to the project site need be encouraged utilizing local population, their indigenous knowledge and practices. Wherever necessary, the technology developed through scientific experiments and field experiences in regard to sustainable utilization of natural resources and organic agriculture including agro-forestry need be integrated with the traditional practices. Eco-development is now seen as a site- specific conservation-friendly measure for environmentally-compatible and socially-acceptable economic development.

5. Aquaculture for Fishery: Fish provides meat of white category which in addition to serve as a source of beneficial protein and fat also contributes as animal- based food that does not lead to cardio-vascular diseases and high blood pressure in human-beings. Additionally, fish is among the most potential source of vitamin-A. It is, therefore, suggested that **fish farming** as an aquaculture practice need be popularized in the project area to meet the **twin objectives of fish harvest** and **fish conservation** in natural water bodies and wetlands. The pond-based fishery may be promoted in the project area. Suitable fish species such as *Barilius barila*, *Channa punctatus*, *Cirrhinus mrigala, Catla catla, Labeo rohita, Nemacheilus multifasciatus and Puncticus ticto etc.,* may get priority for this activity. Fishery Department of the Government of Tripura can contribute as resource organization for fish seed and capacity building programmes.

6. Promotion of Farm Forestry, Agro-Forestry and Silvo-pasture: The multi- species landuses, such as, agro-forestry and farm forestry in the wet farm land, and horti- pastoral and silvo-pastoral practices on the abundant *jhum land,* barren lands and wasteland need be given priority to achieve soil conservation and to obtain plant species-based economic goods, such as, food grains, fire-wood, small timber, fodder, other minor forest and wasteland produces and fruits simultaneously. For this purpose, locally-preferred species must be considered on priority.

7. Promotion of Traditional Agriculture: As the bird fauna prefer a mosaic of grasslands and croplands with traditional crops, the cultivation of traditionally grown crops, such as, sorghum, pearl millet, sesame,horse gram, black gram, green gram, lentil etc. should be promoted on private farmlands. Thus, cultivation of crop species on farm land and abundant agricultural land together with grassland management will provide suitable habitats to the bird fauna.

8. Control of Illegal Harvest: The poaching and killing of the large herbivores and bird fauna in the project area during the construction phase of the Project may occur due to influx of project-related human forces,. Such activities need to be monitored regularly in the large project area. **The labourers need to be educated about the significance of herbivores and avifauna for ecosystem functions of biodiversity so that they develop a concern of care**. Wherever necessary, the poachers must be punished suitably following the legislative procedures.

9. Habitat Management for Wildlife: Both regulatory (for human actions) and habitat management practices, including engineering devices need be utilized for managing and improving the wild flora and habitat for wildlife. **The landscape approach following decentralized collaborative management need be adapted for this purpose**.

The habitat management practices such as, road-side plantation, rain water harvesting, biofencing along road-side and plantation areas , eradication of *Prosopis juliflora, Parthenium hysterophorus and other weedy and invasive alien species,* regulated grazing of domesticated livestock at selected sites could be adopted.

For good governance in the interest of biodiversity conservation and sustainable economic development, the following regulatory measures need be considered equitably in case of common citizens, authorities and very important persons.

- Wildlife (Protection) Act 1972 and amendments
- The Forest Conservation Act 1980
- The (Prevention and Control of Air Pollution) Act 1981 and cess Act, 1984
- The (Prevention and Control of Water Pollution) Act 1974
- The Environment (Protection) Act 1986
- The Biodiversity Act, 2002 and Rules 2004
- Discharge of effluents as per EPA 1986
- Noise Pollution and Control Rules 2000
- Construction and Demolition of Waste Management Rules 2016
- Solid Waste Management Rules 2016
- Plastic Waste Management Following Plastic Waste Management Rules 2016

The habitat requirement for the animal species included in schedule –I and II and as per IUCN REDLIST, is given in Table no. 5.10. It is evidence that no habitat protection is required for these species in the project site as these habitats are available in plenty.

Table 5.10: Habitat requirement of the proposed project site specific faunal species listed in Schedules – I (S-I) and II (S-II) of the wildlife (protection) Act, 1972

S.NO.	Faunal Species Botanical name / Local or English name	Conservation Status		Habitat Requirement	Habitat Protection Need
		WPA 1972	IUCN		
1	Python molurus / Ajgar	S-I	NA	Forest, grasslands, marshes and streams	Not needed as the habitats are available in plenty in the proposed project site
2	Varanus benghalensis / Monitor Lizard	S-I	LC	Prefers forest, large trees and agricultural areas	Not needed as the habitats are available in plenty in the proposed project site
3	Psittacula krameri manillensis / Parrot	S-I	LC	All habitats can withstand the onslaughts of urbanization and deforestation	Not needed as the habitats are available in plenty in the proposed project site
4	Panthers pardus / leopard	S-I	VU	Forest, savannas, can disturbed sites, adoptable to human disturbances but prefers appropriate vegetation covers	Not needed as the habitats are available in plenty in the proposed project site
5	Bos gaurus / Gaur	S-II	VU	Prefers relatively undisturbed forest in hilly terrain, bamboo areas, shrub lands and grasslands	Not needed as the habitats are available in plenty in the proposed project site
6	Maccaca mulata / Monkey	S-II	NA	Adapted to wide range of habitats including urbanized areas	Not needed as the habitats are available in plenty in the proposed project site
7	Semnopithecus entellus / Langur	S-II	NA	Adapted to wide range of habitats	Not needed as the habitats are available in plenty in the proposed project site
8	Vulpes bengalensis / Indian fox	S-II	LC	Prefers short open grasslands, flat	Not needed as the habitats are available in

				undulating terrain and scrub lands	plenty in the proposed project site

Source: EIS

10. Conservation of water bodies:

The availability of water, particularly during drier seasons and in upland areas, becomes the most important factor to all types of wild animals including the mammals, birds and reptiles. If water is available sufficiently, then all other factors become secondary for the presence and survival of the wildlife in any wild land area. Places suitable for mini ponds and water holes, watershed development need be identified in the vicinity of the project area to store rainwater. Further, to make water available throughout the year, some of these water holes could be recharged through artificial means if necessary. Proper slope need be given at these points so that these water sources can be conveniently accessed by the wild animals. Proper cover through vegetation need be developed near these water sources so that the prey species are able to hide themselves from the predators at the time of approaching the water sources. To attract the birds, plant species of food value to the birds need be planted near water holes. If water and food are available to the birds and other fauna without any anthropogenic disturbances, the area can also become an ideal place for bird and wild animal watching and ecotourism.

5.4.7 Construction Camp & Immigration of Workers

Poor sitting and improper management of construction camp may lead to several adverse impacts on environment viz. (i) loss of vegetation due to use of wood as fuel source for cooking (ii) deterioration in nearby surface water bodies' quality (iii) compaction and contamination of soil due to uncontrolled disposal of solid waste (iv) Poor sanitation may result to transmission of communicable diseases among the workers and the host communities. This include the possible spread of sexually transmitted disease, diseases from improper handling and supply of foodstuffs, poor water supply, insect-borne diseases, and alcoholic and drug.

Mitigation measures

- No productive land should be utilized for construction camp. All sites must be graded, ditched and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities including recreational facility for workers shall be erected and maintained to standards and scales approved by the resident engineer. All camps should maintain minimum distance of 500 m from habitation and water bodies.
- All construction camps shall be provided sanitary toilet with provision of septic tanks attached with soak pits. Storm water drains shall be provided for the flow of used water outside the camp. Drains and ditches shall be treated with bleaching powder on a regular basis. Garbage bins must be provided in the camp and regularly emptied and disposed-off in a hygienic manner. LPG cylinders shall be provided as fuel source for cooking to avoid any tree cutting.
- At every workplace, the Contactor will ensure that a readily available first-aid unit. Workplaces away from regular hospitals shall have indoor health units. Suitable transport shall be provided to approach the nearest hospital. At every workplace an ambulance containing the prescribed equipment and nursing staff shall be provided.
- The Contractor will ensure the good health and hygiene of all workers to prevent sickness and epidemics. These include the HIV/AIDS prevention program to reduce the risk and transfer of HIV

virus. Activities under the program include monthly information, education, and communication campaigns to workers, drivers, delivery crew, and communities on the risk. Health check-up by health professionals should be carried out for the construction labours from time to time at regular interval.

- The Contractor will provide adequate and safe drinking water supply for the use of the workers as per the latest permissible limit of drinking water. The Contractor will ensure that all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. No alcoholic liquor or prohibited drugs will be imported to, sell, give, and barter to the workers of host community.
- Migrant workers may be the potential carriers of various diseases. Local community may get exposed to the diseases carried by migrant workers. Regular health check-up and immunization camps shall also be organized for the workers and nearby population.

5.4.8 Safety of Construction Workers and Accident Risk to Local Community

The following safety aspects viz. (i) safety of construction workers, (ii) safety of road users including pedestrians and cyclists (iii) safety to animals; (iv) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during design and construction stage and (v) conduct of safety audit. Impact and mitigations due to blasting operation as already been detailed in Noise and Vibration section.

Mitigation measures

- During the construction phase, contractors shall be required to adopt and maintain safe working practices. Internationally accepted and widely used safety procedures should be followed during (i) road works (ii) handling of large construction equipment and machineries, (iii) handling of chemicals and hazardous materials and inflammable substances (iii) welding (iv) electrical works etc.
- Contractor shall arrange all PPEs for workers, first aid and fire-fighting equipment's at construction sites. An emergency plan shall be prepared duly approved by engineer in charge to respond to any instance of safety hazard.
- To avoid disruption of the existing traffic due to construction activities, comprehensive traffic management plan shall be drawn up by the concessionaire. Traffic in construction zones shall be managed as per the provisions of IRC SP 55.
- After construction is completed in a particular zone, it shall be opened for normal operation. All diversions/access roads should be closed before start of normal operation.
- Use of retro-reflectorized traffic signs, and cantilever/gantry types overhead signs, thermoplastic road marking paints, delineators, traffic cones, empty bitumen drums, barricades, and flagmen will be used to ensure traffic management and safety. Conduct of regular safety audit on safety measures adopted during construction. The audit will cover manpower and their safety, machinery, temporary works, equipment and vehicles, materials storage and handling, construction procedures, environment, site safety guidelines, and miscellaneous services.

5.4.9 Obstruction & Disruption of Traffic

Disruption of access to infrastructure or social resource due to construction activity will cause nuisance and to a certain extent additional cost to the public in terms of longer travel period due to diversion or heavier traffic. It will also pose risk of accident to motorist at night if these blockages and disruption are not clearly demarcated.

Mitigation Measures

- The contractor will submit a Traffic Plan to the Project Engineer at least two weeks before the construction starts that will result to obstruction. This Plan will recommend for approval, the safe and convenient temporary diversion of traffic during construction, design of barricades, delineators, signs, markings, lights, and flagmen, among others.
- For widening of existing carriageway and part of it will be used for passage of traffic, paved shoulder will be provided on one side of the existing road by the contractor with the following minimum requirements:
- The surface used by the through traffic will be firm bituminous compacted surface free of defect
- On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. These paved diversions will comply with standards on junctions and temporary cross drainage.
- Transportation of quarry material to the construction sites through heavy vehicles shall be done through existing major roads to the extent possible. This will restrict wear and tear to the village/minor roads. Small vehicles/non-motorized vehicle can also be used for its further transportation to the construction sites from temporary storage areas.

5.4.10 Transports & Storage Materials

The construction material primarily will consist of aggregate, sand, cement, bitumen, lubricating oil and fuel for vehicle and construction equipment's. These will be primarily stored temporarily at construction camps. The oils, fuels and chemicals will be stored on concreted platform with spills collection pits. The cement will be stored under cover. All these temporary storage areas will be located at least 150m away from the habitat. The likely impacts due to transportation and storage including fugitive emission have already been covered under different sections above.

5.4.11 Land & Private Properties

The assessment made in resettlement plan shall be referred for exact loss of private properties and measures to compensate such losses. Besides monetary compensation for any loss of private trees, compensatory afforestation as per the norms fixed by state forest department and extensive plantation has been incorporated in the EMP to have long-term environmental benefits. Income restoration measures/livelihood options for vulnerable group/resource poor sections and other affected persons as recommended by social development/resettlement expert shall be implemented.

5.4.12 Common Property Resources

Project road is proposed through existing road passing through mainly built-up areas including schools, health centres and other common public properties. However, a total of 87.88 km of the project road is proposed for either realignment or bypass. Realignment portion is mostly passing through agriculture and forest land. Hence, there will be loss of community structures/ facilities/utilities along the proposed alignment. Geometric adjustments have been made to minimize the loss to any such facilities. Alternate access has to be provided to access these structures during construction stage. All community structures likely to be dismantled shall be suitably relocated. For exact extent of impact on these structures and mode of compensation, resettlement/land acquisition plan shall be referred.

5.5 Operation Stage Impact

5.5.1 Road Maintenance

Lack of proper maintenance may deteriorate the road condition over the years resulting into numerous problems such as rise in accidents, disruption of transportation services, tree survival. Project implementation unit must allocate adequate resources and logistics to ensure that the road is being maintained and intended benefits are generated thereof.

5.5.2 Soil Erosion and its Cumulative Impacts

The consequences of soil erosions are far wider than repair and maintenance of the road. Along the project road, the inflow of water into ponds during rains causes erosion of the embankment besides seepage of water into embankment and subgrade resulting in softening of the subgrade. This may also increase siltation in water bodies. Project design includes provisions of retaining walls/retaining walls for the protection. Regular checks shall be made to ensure its effectiveness.

5.5.3 Air Pollution

Likely rise in traffic after road improvement may cause air and noise pollution in the vicinity of the project Vehicular emission will be the principle source of pollution during operation stage. The project road is located in thickly vegetated and open agricultural land which will provide adequate dispersion dynamics of gaseous pollutants. Vegetation acts as sink to air pollutants. Further, the improved road condition will facilitate free flow of traffic thereby reducing the emission level significantly.

5.5.4 Noise Pollution

Noise level is likely to increase due to increased traffic. Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch and speed limitation and honking restrictions may be enforced near sensitive locations. Solid noise barrier shall be placed especially in academic institutes (Anganvadis, primary schools, high schools, higher secondary schools) and health centres adjacent to the project road.

5.5.5 Water Pollution

Accidental oil spillage, washing of vehicles, used engine oils can contaminate the nearby water bodies. Expansion joints and drainage spouts are choked due to silt and vegetation growth. In order to prevent water pollution; communities should not allow drivers washing their vehicles near the streams and ponds. Regular removal/cleaning of deposited silt shall be done from drainage channels and outlet points before the monsoon season. Rejuvenation of the drainage system by removing encroachments/ congestions will be regularly conducted.

5.5.6 Ecology Environment

Survival rate of road side plantation shall be ensured during the operation stage. Regular monitoring of plantation shall be carried out. Implementation of compensatory afforestation fund shall be release on time to the state forest department. Execution of compensatory afforestation shall be supervised time to time in collaboration with state forest department. Effectiveness of measures suggested for any adverse impact on wildlife and loss of floral diversity must be strictly adhered to in consultation with forest department.

5.5.7 Ribbon Development/Encroachment of ROW

Increase in economic activities more often results in ribbon development along highways. This may cause congestion to road users and increase in accident. NHIDCL Tripura shall explore options like avenue plantation and/or fencing and initiating regulatory provisions to stop encroachment of ROW.

5.5.8 Pedestrian and Commuter Safety

Improvements to the road surface will be conducive to safe vehicle travel at higher speeds. Such speeds may increase the incidences of accidents. Incorporating the following measures could offset this negative impact;

- Provision of centre line road marking where possible, edge delineation etc.
- Provision of clearly marked signing at townships, sensitive areas such as schools, temples and health centres
- Enforcement of speed limits and other traffic rules, especially near schools, hospitals, temples and built-up sections
- Safety of road users could be ensured during repairing of carriageway and hydraulic structures by placing standard sign boards, barricading of the repairing site etc.

5.5.9 Cumulative and Induced Impacts

Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with increase of traffic and induce development in the project area. Increase in agro-industrial activities are also expected to take advantage of improved access to urban centers where there are higher demand and better prices for agricultural products. The project area is in the vicinity of Indo-Bangladesh international border. Hence the project will accelerate industrial activities and induce development significantly to enhance cross border trade. The improved road will provide better connectivity and result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

5.6 GHG Emissions from the Road Project

i. Vehicles Details

Car, Trucks, Motorcycle etc. type Vehicles will be run on the proposed section of NH-208. The running of this vehicle has been divided in four sections along the proposed road. The Vehicles are converted in PCU for estimation purpose.

ii. Prediction of Traffic Volume for Section I (Khowai to Teliamura)

DPR team has forecasted the road traffic and flow of the traffic for the years 2033 considering 2015 as a base year for which traffic survey was done. The details of estimated traffic from 2015 to 2033 in various sections are presented in **table-5.11.**

Table 5.11: Estimated Vehicles (PCU) Number/per day

	Homogeneous Section-I (KM 85.500-KM 118.000)
	Length- 32.500 km

	PCU
2015	7541
2018	8729
2020	9624
2025	12283
2030	15676
2033	18147

Source: DPR

iii. Traffic Details

It is assumed that the traffic will run on the road for as per Table 5.11 and the estimated travel for each vehicle would be as per distance in respective section. It has also assumed that all the vehicles will run on diesel fuel. The average run of traffic per liter diesel would be 4 kilometers (Fuel Consumption Standards for Heavy-Duty Vehicles in India).

iv. GHG Emission Factor

This study has followed the method of IPCC GHG emission factor. It is related with the gram emission of GHG per liter burning of diesel fuel. The IPCC GHG Emission factors are listed below.

Sources of Emission Factor

On-road mobile sources	GHGs Emission Factor		
	CO_2	CH_4	N_2O
Gasoline vehicles - Motorcycles - Passenger cars - Light-duty gasoline trucks	IPCC (2241 g/L)	IPCC (1.107 g/L)	IPCC (0.078 g/L)
Diesel vehicles - Light-duty diesel trucks - Buses - Heavy-duty diesel trucks	IPCC (2701 g/L)	IPCC (0.153 g/L)	IPCC (0.102 g/L)

v. GHG Emission for Section I (Khowai to Teliamura)

The GHG emissions are estimated based on the per day traffic volume of the yearly estimated total Passenger car unit (PCU) is presented in Table 5.12.

Table 5.12: GHG Emissions in Homogeneous Section-I (KM 85.500-KM 118.000)

GHG Inputs	Emission Calculations (Tonnes)

GHG	Factor(g/l)	Diesel Fuel consumption Litre per Km travelling	Travelling Distance(Km)	2015	2018	2020	2025	2030	2033
CO_2	2701	0.25	32.5	165	0.191	0.211	0.270	344	398
Ch_4	0.153	0.25	32.5	0.009	0.010	0.011	0.015	0.019	0.022
N_2o	0.102	0.25	32.5	0.006	0.007	0.007	0.010	0.012	0.015

Source: EIS

The generated CO2 emission per day would be 165 Tones in the base year 2015. The CO2 emission in the projected year 2033 would be 398 Tones which is 2.4 times more than the base year estimated GHG. The impact due to other greenhouse gases will be insignificant.

vi. Prediction of Traffic Volume for Section II (Teliamura to Sabroom)

DPR team has forecasted the road traffic and flow of the traffic for the years 2040 considering 2015 as a base year for which traffic survey was done. The details of estimated traffic from 2020 to 2040 in various sections are presented in table-5.13.

Table 5.13: Estimated Vehicles (PCU) Number/per day

Year	Homogenous sections		
	Homogeneous Section-I (KM 0-KM 42.300)	Homogeneous Section-II (KM 42.300-KM 88.000)	Homogeneous Section-II (KM 88.000-KM 132.800)
2020	2162	299	334
2025	2750	368	423
2030	3500	451	532
2035	4457	559	666
2040	5673	696	854

Source: DPR

vii. GHG Emission for Section II (Teliamura to Sabroom)

The GHG emissions are estimated based on the per day traffic volume of the yearly estimated total Passenger car unit (PCU) at each section are presented in Table 5.14 to 5.16 and Table 5.17 give total GHG emissions of the road project.

Table 5.14: GHG Emissions in Homogeneous Section-I (KM 0-KM 42.300)

GHG Inputs				**Emission Calculations (Tonnes)**				
GHG	**Factor(g/l)**	**Diesel Fuel consumption Litre per Km travelling**	**Travelling Distance(Km)**	**2020**	**2025**	**2030**	**2035**	**2040**
CO_2	2701	0.25	42.3	61.75	78.54	99.97	127.30	162.03
Ch_4	0.153	0.25	42.3	0.0034	0.004	0.0056	0.0072	0.0091
N_2o	0.102	0.25	42.3	0.0023	0.0029	0.0037	0.0048	0.0061

Source: EIS

Table 5.15: GHG Emissions in Homogeneous Section-II (KM 42.300-KM 88.000)

GHG Inputs				**Emission Calculations (Tonnes)**				
GHG	**Factor(g/l)**	**Diesel Fuel consumption Litre per Km travelling**	**Travelling Distance(Km)**	**2020**	**2025**	**2030**	**2035**	**2040**
CO_2	2701	0.25	45.7	9.22	11.35	13.91	17.25	21.47
Ch_4	0.153	0.25	45.7	0.0005	0.0006	0.0007	0.0009	0.0012
N_2o	0.102	0.25	45.7	0.0003	0.0004	0.0005	0.0006	0.0008

Table 5.16: GHG Emissions in Homogeneous Section-II (KM 88.000-KM 132.800)

GHG Inputs	**Emission Calculations (Tonnes)**

GHG	Factor(g/l)	Diesel Fuel consumption Litre per Km travelling	Travelling Distance(Km)	2020	2025	2030	2035	2040
CO_2	2701	0.25	44.8	10.10	12.79	16.09	20.14	25.83
Ch_4	0.153	0.25	44.8	0.0005	0.0007	0.0009	0.0011	0.0014
N_2o	0.102	0.25	44.8	0.0003	0.0004	0.0006	0.0007	0.0009

Source: EIS

Table 5.17: Total GHG Emissions in Homogeneous Section-II

GHG Inputs				Emission Calculations (Tonnes)				
GHG	**Factor(g/l)**	**Diesel Fuel consumption Litre per Km travelling**	**Travelling Distance(Km)**	**2020**	**2025**	**2030**	**2035**	**2040**
CO_2	2701	0.25	108.670	81.07	102.68	129.97	164.69	209.33
Ch_4	0.153	0.25	108.670	0.0044	0.0053	0.0072	0.0092	0.0117
N_2o	0.102	0.25	108.670	0.0029	0.0037	0.0048	0.0061	0.0078

The generated CO2 emission per day would be 81.07 Tones in the base year 2020. The CO2 emission in the projected year 2040 would be 209.33 Tones which is 2.58 times more than the base year estimated GHG. The impact due to other greenhouse gases will be insignificant.

5.7 Summary of Assessment

Summary of the Assessment has been provided below in Table 5.18.

Table 5.18: Summary of Impact Assessment

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
Pollution Control	1	Air Quality	B-	B-	D	B-	Construction phase: - Minimum dust dispersion will be expected. - Maintenance of machinery will be conducted regularly, resulting in reducing exhaust gas emissions. Operation phase: - Air pollution caused by exhaust gas generated as the more vehicles traffic predicted.
	2	Water Quality	B-	B-	B-	B-	Construction/Operation phase: Although turbidity increases due to construction around the river, the effect is temporary. For wastewater accompanying concrete construction and wastewater containing oil, the muddy stream caused by embankment at the time of rainy weather.
	3	Waste	B-	D	B-	D	Construction phase: - Waste containing hazardous materials will be generated by construction work. Operation phase: - Minimum solid waste is expected.
	4	Soil Contamination	B-	B-	B-	D	Construction phase: Since there is a possibility of soil contamination due to leakage of fuel oil and lubricant from construction vehicles and construction machinery, appropriate measures are taken. Operation phase: The impacts to soil are limited.
	5	Noise and Vibration	B-	B-	B-	B-	Construction phase: - Due to construction machinery and vehicles certain noise and vibrations are expected. - Low-noise/ low-vibration machinery will be used and noise levels generated from construction machinery will meet noise level standards at the nearest residential area Operation phase: - Noise levels generated from construction machinery will be caused though the noise level standards at the nearest residential area and will be limited to small amount.
	6	Odor	D	D	D	D	Construction/Operation phase: Little materials will cause the odors.
	7	Sediment	B-	D	B-	B-	Construction phase: Negative impacts due to disturbing river mud at the time of bridge constructions can be considered. Operation phase: Bridge will be far above from the sediment but some dust fall will be expected.
Natural Environment	8	Protected Areas	D	D	B-	B-	Construction phase: There is no protected area in the planned site. However some minus impacts will be expected due to construction activities. Operation phase: There is no protected area in the planned site. Some minus impacts will be expected due to increased traffic.

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
	9	Ecosystem	B-	B-	B-	D	Construction phase: As there are forests by afforestation or natural forests along the road and it will be logged, there is some negative effect on animals and plants. Operation phase: Although there are some effects on animals and plants in the adjacent area, the impacts are limited.
Natural Environment	10	Hydrology	D	B-	B-	D	Construction phase: Individual hydrological conditions are altered by construction work such as embankment. Although it is affected by bridge construction over rivers, appropriate measures are taken. Operation phase: No impact
	11	Topography and Geology	B-	B-	B-	B-	Construction phase: Construction works such as filling embankments and measures against soft soils may affect the topography and geology. However, the impacts are not critical because the levees are installed, and the majority of project planned places are flat. Operation phase: Although there is erosion on the embankment surface due to the occurrence of storm surge or flooding, the damages should be minimum before the disasters by constructing a protective surface protector.
Social Environment	12	Resettlement and Land Acquisition	B-	C	A-	D	Pre-Construction: Approximately 311 ha of private land including residential and commercial structure need to be acquired. The people who are required to be resettled need approximate resettlement assistance and/or compensation. Construction/Operation: Few impacts are expected due to availability of resettlement sites adjacent to present location and adequate compensation and resettlement assistances.
	13	Poor Classes	B-	B-	B-	B+	Pre-Construction: Some of the project affected households are under BPL. As per the land acquisition law, additional cash compensation will be provided to BPL households Construction: Positive impacts are expected from direct or indirect job opportunities along the construction site. Operation: Positive impact are expected due to improvement of local economy facilitated by improved road network.
	14	Tribal Peoples	B-	B-	B- /+	B+	Pre-Construction: Mostly non-titled tribal households and/or product sales stands will be resettled but limited agricultural land will be affected. Construction: Disturbances from construction activities and non-tribal people are expected while direct and indirect job/business opportunities are expected during construction. Operation: Positive impacts are expected from the implementation of the Tribal Development Plan as a part of development assistance by project owner for the affected tribal

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							communities in course of the competent authorities' plans including TTAADC's plans
	15	Local Economy such as Employment and Livelihood, etc.	B- /+	B+	B- /+	B+	Pre-Construction: Positive impacts are expected due to additional cash flow in PAHs and constriction of the resettlement households, etc. Construction: Some changes are required to adapt construction activities while positive impacts are expected from construction work and additional employment. Operation: The construction of road and bridges will benefit the lives of local people such as improvement of access to social services and opportunity of employment.
Social Environment	16	Land Use and the Utilization of Local Resources	B-	D	B-	D	Pre-Construction/ Construction: The implementation of this project will change the traditional land use pattern. Local resources can get stringent. Operation: No impact is expected, as activities requiring change of land use and utilization of local resources will be completed by the end of construction.
	17	Water Usage and Water Rights	B-	B-	B-	D	Pre-construction: No activities are expected to give any impact on water usage. Construction phase: Some impacts are expected due to additional need of water for construction and the turbid water discharged from the construction site. Operation phase: No impacts are expected.
	18	Existing Social Infrastructure and Services	B-	B-	B-	B-/+	Pre-construction: Some social infrastructure will subject to relocation. Access to social infrastructure and social service may be affected due to resettlement of project affected persons. For mitigating this impact, appropriate resettlement assistance will be required. Construction: Construction work will disturb access to existing social infrastructure and social services for mitigating this impact, passage shall be secured during construction. Operation: Access to social infrastructure and services will be improved. Increased traffic volume may disturb the access of Community to existing social infrastructure and services. For mitigating this, passage needs to be secured.
	19	Local Communities and Decision-making Institutions	B-	B-	B-	B-	Pre-construction: Displacement may affect the existing network of local communities and decision-making institutions. Construction: can be further separated due to construction work. Operation: Flow of new residents could change the priorities of the local communities and decision making.
	20	Unequal Distribution of Benefits and Damages	B-	B-	B-	D	Pre-Construction: Particularly cash compensation could be unequally distributed without supervision by the authorities. Construction: Job and business opportunities could be

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							unequally distributed without supervision by the authorities. Operation: Generally, all stakeholders will be benefit from the projects as same as common road projects.
	21	Local Conflicts of Interest	B-	D	B-	D	Pre-Construction: All project affected stakeholders understand the project impacts and are appreciated for the improvement of the NH208. Construction: Equal job and business opportunities may not be distributed due to political influences or other localized practices without proper accountability mechanism for procurement. Operation: No impacts are expected.
	22	Cultural Heritage	B-	D	B-	D	Pre-Construction/Construction/Operation: There is no historical/cultural/archaeological properties nor heritage sites at the project site. Some minor community religious facilities would be required to relocate, but they will remain same area and cause little inconvenience.
	23	Landscape	B-	D	D	D	Pre-construction: No impacts are expected. Construction: No significant impact will be expected due to the existence of present NH208. Operation: No impacts are expected.
	24	Gender	B-	B+	B-	B+	Pre-construction: Unequal distribution of compensation can be occurred within households. Construction: Unequal employment opportunity can be provided at construction site. Operation: Improvement of local economy will give positive impact on improvement of job opportunity and livelihood.
	26	Children's Rights	B-	B+	B-	B+	Pre-construction phase: There are children among households to be resettled and/or lose their livelihood means. Children from households losing their land or jobs may suffer from adverse impact on their household economy, such as dropping-out of school. Construction phase: Access way to their schools will be physically hindered by the construction site. For mitigating this impact, passage shall be secured. Child labour can be provoked at the construction site because of the huge demand for unskilled workers. Operation phase: Children will have better access to social services throughout the year. Education opportunity can be improved. Conversion of existing traffic to the access road will improve safety of children as pedestrian.
	27	Infectious Disease such as HIV/AIDS	B-	B-	B-	B-	Pre-construction: No impact is expected as no influx of migrant labor is expected at this phase. Construction: A temporary influx of migrant labor during the

Item	No.	Impact	Scoping		Result of Assessment		Rationale
			Pre- / construction Phase	Operation Phase	Pre- / construction Phase	Operation Phase	
							construction period may increase the risk of infectious diseases. For mitigating this risk, measure for prevention of infection shall be taken. Operation: Improved mobility of local residents and influx of external residents may increase the risk of infectious diseases. For mitigating this risk, measure for prevention of infection shall be taken.
	28	Work Environment (Including Work Safety)	B-	D	B-	B+	Pre-construction: No activities are expected to give any impact on work environment. Construction phase: Accidents may be caused by construction work. Operation phase: Less road maintenance work is expected and less work accidents are expected.
	29	Sunlight	D	D	D	D	Pre-construction/Construction/Operation: No impact is expected due to the existence of present NH208.
	30	Accidents	B-	B-	B-	B-	Pre-construction: No activities are expected to cause accidents. Construction phase: Accidents may be caused by construction work. Operation phase: Road accidents may be increased without prevention measures and safety education along the communities.
Others	31	Cross-boundary Impact and Climate Change	C	C	D	B-	Construction phase: CO2 emissions due to construction activities are temporary/minimum impact on climate change. Tree felling can be a loss of GHG absorption but it is compensated. Operation phase: CO2 emissions due to the vehicles that run by fossil fuels affect climate change in the long term.

Note: A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C: Impact is unknown. (Further examination is needed, and the impact may be clarified as the study progresses.)
D: No impact is expected.

6. Public Consultation and Information Disclosure

6.1 Meaningful Consultation

Meaningful consultations were carried out during detailed design and EIA preparation. All the principles of information dissemination, information solicitation, integration, co-ordination, and engagement into dialogue were incorporated in the consultation process. A framework of mitigating different environmental impacts likely from the project was strengthened and modified based on opinions of all those consulted, especially at the micro level by setting up a dialogue with the village people from whom information on site facts and prevailing conditions were collected. This will be continued during the implementation of the project through grievance redress mechanism.

6.2 Objectives of the Public Consultations

Public consultations were held to allow the incorporation of relevant views of the stakeholders in the final project design, mitigation measures, implementation issues, and enhance the distribution of benefits. Stakeholder's consultations were held with intent to understand their concerns, apprehensions, overall opinion and solicit recommendations to improve project design and implementation. Informal meetings, interviews were organized covering the entire project design stage. Consultations provide affected public a platform to ensure incorporation of their concerns in the decision making process and foster co-operation among officers of NHIDCL Department, Govt. of Tripura, the community and the stakeholders to achieve a cordial working relationship for smooth implementation of the project. It inculcates the sense of belongingness in the public about the project.

The discussions were designed to receive maximum inputs from the participants regarding their acceptability and environmental concerns arising out of the sub-project. They were given the brief outline of the project to which their opinions was sought particularly in identifying and mitigating any potential adverse impact.

6.3 Methodology

Consultation with the stakeholders, beneficiaries, and community leaders were carried out using standard structured questionnaires as well as unstructured questionnaires. Questionnaire survey/ discussions were designed to obtain background information and details of general environmental issues that concern people in the project area. In addition, environmental issues were discussed with relevant organizations, government officials, beneficiaries, community leaders and experts. In addition, personal discussions with officials, on site discussion with affected stakeholders, and reconnaissance visits have also been made to the project area. The executive summaries of the Drat EIA and SIA reports have been provided at designated locations and prior information have been given to the stake holder about consultation. The schedule of public stake holder meeting, location along with nos. of participants details are presented in table 6.1.

Table 6.1: Schedule of public stake holder meeting, location along with nos. of participants details

Sr.No	Date & Time	Name of District	Locations	Nos. of participants
1.	04.09.2020 10.00 am to 12.30 pm	Khowai	Near Community hall Bchaibari, Tripura	35
2.	04.09.2020 2.00 pm to 04.30 pm	Khowai	Near Community hall Kalyanpur, Tripura	34
3.	05.09.2020 10.00 am to 12.30 pm	Gomati	Near Community hall Lalgiri, Tripura	12
4.	05.09.2020 2.00 pm to 04.30 pm	Gomati	Near Community hall, Suknachari, Tripura	21
5.	06.09.2020 10.00 am to 12.30 pm	South Tripura	Near Community hall, Rupaichari, Tripura	42
6.	06.09.2020 2.00 pm to 04.30 pm	South Tripura	Near Community hall, Harina, Tripura	40

The details attendance sheet is attached as Annexure 13.

6.4 Project Stakeholders

All types of stakeholders were identified to ensure as wide coverage as possible like Residents, shopkeepers and businesspeople who live and work along the road specially the project affected persons, road users/commuters, executing agency, government institutions whose remit includes areas or issues affected by the project (state environment and forest department, Tribal Council etc and most importantly the beneficiary community in general.

6.4.1 Consultations with Government Agencies

The list of officials from various government departments contacted during EIA preparation and issues discussed is summarized in Table 6.2.

Table 6.2: Summary of Consultation Held with State Government Departments

S. No.	Name	Department	Post	Mob no.	Issues Discussed
1.	Mr. A.K Kushwah	NHIDCL	ED	8318580698	Discussed about the project alignment, bypass, alternative etc.
2.	Mr. Trivendra Kumar	NHIDCL	GM	9868588984	
3.	Mr. Shankar	NHIDCL	AE	7002328071	
4.	DR. Neeraj Chanchal	DFO Khuwai	DFO	9436544332	Discussedabout the eco-sensitive zone, wildlife habitat and
5.	Mr. Mahendra singh	DFO Gomati	DFO	8787710387, 8118930672	

6.	Mr. Sanjeev Das	DFO South Tripura	DFO	7630049150	tree felling details related to the project road. Suitable species for road side plantation and movement of wildlife in project corridor
7.	Mr. B. Charkbartory	Tripura State Council for Services and Technology	Deputy Se creatary	9436454775	Regarding forest maps in Khowai, Gumti and South Tripura
8.	Mr. Bhabesh Debbarma	Tripura Tribal Areas Autonomous District Council	E.O (Planning)	0381-2530034	Regarding indigenous people programme in Tripura.

Source: EIS

6.4.2 Consultation with Local People/Beneficiaries

The informal consultation generally started with explaining the project, followed by an explanation to potential impacts. Participant's views were gathered with regard to all aspects of the environment which may have direct or indirect impact on local people. Table 6.1 summarizes the details of consultation with local people. Key issues discussed are:

- Awareness and extent of the project and development components;
- Benefits of the project for the economic and social upliftment of community;
- Labour availability in the project area or requirement of outside labour;
- Local disturbances due to project construction work;
- Necessity of tree felling etc. at project sites;
- Impact on water bodies, water logging and drainage problem if any;
- Environment and health
- Flora and fauna of the project area
- Socio-economic standing of the local people and

Consultations were held along all sub-projects. Local community welcomed the decision of road proposal. They perceived several benefits like faster and cheaper connectivity, improved accessibility to better infrastructure facilities, reduction in migration, increased economic activities and appreciation in value of land and many others. But at the same time they apprehended that the risk of accident, air and noise pollution will increase due to high traffic density after widening. Main demand and suggestions made by the participants are;

- Adequate compensation and rehabilitation assistance to affected households

- Employment and petty contracts during construction
- provision of side drains
- Provision of adequate culverts
- Road safety measures.
- Extensive plantation
- Protection of Ponds
- Restriction on honking near built-up areas and sensitive receptors
- Measures to minimize air and noise pollution
- Bus Shelters and toilets

Design considerations have been made to incorporate most of the suggestions and demands of the local people except those which are beyond the scope of project like extra advantage to the effected persons, health services etc. Summary of key points discussed in Public Consultation conducted during September, 2020 presented in table 6.3.

Table 6.3: Summary of key points discussed in Public Consultation conducted during September, 2020

S No	Public Hearing Comments	Response	Photographs
	Kalyanpur, <u>Khowai District</u>		
1	Mr. Nilay Sutradhar told that the curves in the road result in accidents. What is the solution for it?	The revised alignment /bypass at such places will improve the horizontal geometry and eliminate the reverse curves which will reduce the accidents.	
2	Mr. Souvik Chandra asked what amount of compensation will be provided for the land acquisition.	Compensation for land acquisition will be provided as per RFCTLARR- 2013 guidelines.	

3	Mr. Samir Sarkar asked what provisions will be provided so that water bodies do no obstructed during construction of the road as this may create flood like situation in agriculture field?	Bridges/Culverts will be made to protect the water bodies from any kind of destruction / obstruction.	
4	Mr. Sanjay Das asked can we built our shops on the side of road after it's constructed?	It will be decided as per local government rules and regulations.	
5	Mr. Viswajeet Sheel (Farmer) asked will we get compensation for the trees that will be cut from our land?	Compensation will be provided as per RFCTLARR- 2013 guidelines	
	Bachai Bari, Khowai District		
1	Mr. Chandra Kumar asked what is the width of the road that will be constructed.	The proposed road is two lane with paved shoulder having carriage width 7.0 m, paved shoulder 1.5, on both sides and earthen shoulder 1.0 and 1.0 RCC drain.	

2	Mr. Bishwambar Dev Verma asked will jobs be provided to the people whose land will be acquired?	Compensation will be provided for the acquired land as per RFCTLARR- 2013 guidelines. However job preference will be given to the local people by contractor during construction period.	
3	Mrs. Munda told that she has her vegetable shop on the road side. It will be destructed during road construction. Will compensation be provided?	Compensation will be provided as per RFCTLARR- 2013 guidelines and as per entitlement matrix disclosed in executive summary.	
4	Mr. Bisarod Dev Burma (Labour) asked will we get employment in the road construction work?	Local labour will be given preference in the road construction work by the contractor.	
5	Mr. Kirid Dev Burma told that domestic / wild animals come on the road now and then which lead to accidents on the road. How it can be prevented?	Barriers will be provided along road side to prevent domestic / wild animals coming on the road in settlement area	

		in consultation with local people/Forest dept.	
	Lalgiri, Gomti District		
1	Mr. Indra Jamatia (Farmer) told that there is no provisions of shelter while waiting for local buses for travelling and to protect from rainfall. What can be done about it?	These facilities will be provided as per IRC guidelines.	
2	Mr. Mani Chandra Jamatia (Tea shop owner) asked will toilets be made along road side for public?	These facilities will be provided as per IRC guidelines.	
3	Mr. Rajhari Jamatia (Labour) told that during heavy rainfall potholes get created in the roads. What provisions will be provided to improve the drainage system.?	Road side drains will be provided for proper drainage. The road is maintained during operation period.	
4	Mr. Amar Manik Jamatia told that he has a meat shop on the road side. It will be destructed during road construction. Will compensation be provided?	Compensation will be provided as per RFCTLARR- 2013 guidelines.	

5	Mr. Hriday Jamatia asked about the measures taken to reduce the air pollution during the construction phases of the road.	All necessary precautions such as regular water sprinkling, metal carring trucks shall be covered, hot mix will be installed with pollution control measures and located away from the settlements. And regular ambient air quality monitoring to check the air pollution level.	
	Suknachari, Gomti District		
1	Mr. Nurwan Mokhri (Worker) asked what amount of compensation will be provided for the land acquisition?	Compensation for land acquisition will be provided as per RFCTLARR- 2013 guidelines.	

2	Mr. Konchari Mog (Farmer) asked about measures for noise pollution along sensitive receptors such as School/Hospitals.	Road side plantation will be done to minimise noise level, the sign board no honking zone will be provided along the sensitive receptors. Further noise barriers may be provided if levels increase the prescribed limits.	
3	Mr. Shibu Chakma (Student) asked will jobs / employment be provided during road construction?	Local people will be given preference in the road construction work	
4	Mr. Thingya Mog (Farmer) asked what provisions will be provided so that water bodies do not get destroyed / obstructed during construction of the road as this may result in blocking water going in the crop fields?	Bridges/Culverts will be made to protect the water bodies from any kind of destruction / obstruction.	
5	Mr. Sukamal Chakma (Shop owner) told that the curves in the road result in accidents. What is the solution for it?	The revised alignment /bypass at such places will improve the horizontal geometry and eliminate the reverse curves which will reduce the accidents.	

S No	Public Hearing Comments	Response by Department	
	Rupachari, South Tripura District		
1	Mr. Bipul Devnath (shop owner) told that there are no provisions of shelter while waiting for local buses for travelling and to protect from rainfall. What can be done about it? He also asked about provision of toilets facilities along the roads.	These facilities will be provided as per IRC guidelines.	
2	Mr. Narayab Devnath (Service personnel) asked completion period of this road?	The road will be completed approx. 2 to 3 year after getting final approval.	

3	Mr. Bhatranjan Nath (Business) told that he has a shop on the road side. It will be destructed during road construction. Will compensation be provided?	Compensation will be provided as per RFCTLARR- 2013 guidelines	
4	Mr. Arnab Das asked will jobs / employment be provided during road construction.	Local people will be given preference in the road construction work	
	Harina, South Tripura District		

1	Mr. Nikhil Chandra Dey (Shop owner) asked what amount of compensation will be provided for the land acquisition.	Compensation for land acquisition will be provided as per RFCTLARR- 2013 guidelines.	
2	Mr. Jagnath Bal (Farmer) asked will we get compensation for the trees that will be cut from our land also nos. of trees need to be cut in Government/Forest land? How the same will be compensated?	Compensation of trees in private land will be provided as per RFCTLARR-2013 guidelines. The compensatory afforestion in Government/Forest land will be done at the ratio 1:10 or as per condition of forest dept.	
3	Mr. Bajan Mallick (Service personnel) asked will jobs / employment be provided during road construction?	Local people will be given preference in the road construction work	
4	Mr. Ashish Bhowmick (Driver) told that what road sides amenities will be provided?	The necessary road furniture like shelter, common toilets as per IRC guidelines.	

5	Mr. Saikat Dey (Shop owner), Mrs. Basanti Debnath (House Wife), Mr. Haider Roy (Student) and Mr. Sushant Das (Driver) said they welcome the construction of new road as it will create employment opportunities and make travel easier.	Thanks for their appreciation for the proposed project.	

Source: EIS

6.5 Consultations held for this project

Consultation held with various government officials and local people from the fringe area of the project road. Divisional Forest Officers of all the three project districts were consulted during the field study along with officials from the Tripura Tribal Area Autonomous Council. Formal public consultations were held at six important locations of the project road covering two locations in each three beneficiary district. All of them welcomed the road development and improvement project. Suggestion received mainly on improved drainage system, adequate compensation, protection measures for water bodies (mainly ponds) and petty contracts/employment for the local contractors/labour during the construction phase of the project road.

6.5.1 Second stage public consultations/stakeholder meeting

The second stage Public/stake holder consultation will be planned as per JICA guidelines after disclosure of the final draft EIA report.

7. Environmental Management Plan, Monitoring Plan & Grievance Redress Mechanism

7.1 Environmental Management Plan

Environmental Management Plan (EMP) is intended to set out clearly and unambiguously the likely negative impacts of construction and/or operation of the project, the action that is required to avoid or mitigate each impact and the responsibility for taking each action. Responsibility is made legally binding when actions are subsequently specified in contracts. The EMP (**Annexure 2**) also ensures that the positive impacts are conserved and enhanced. It addition, it provides measures for institutional strengthening and effectiveness assessment through defined monitoring plan, reporting and corrective & preventive action planning. More specifically the objectives of the EMP are:

- To ensure compliance and regulatory requirements of Tripura and the Government of India;
- To formulate avoidance, mitigation and compensation measures for anticipated adverse environmental impacts during construction and maintenance and ensure that environmentally sound, sustainable and good practices are adopted;
- To stipulate monitoring and institutional requirements for ensuring safeguard compliance;

The EMP has been prepared based on all foreseen impacts at the time of preparing this EIA. It is a living document. If any new or unforeseen impacts occur during project implementation, the EMP will be updated by the CSC Environmental Specialist. The new impacts may be due to design changes or changes in project situation or other reasons. If the new or unforeseen impacts are deemed significant, NHIDCL, Govt. of Tripura will revise the EIA report as well.

7.2 Environment Monitoring Program

The monitoring and evaluation are critical activities in implementation of the project. Monitoring involves periodic checking to ascertain whether activities are going according to plan or not. It provides the necessary feedback for project management to ensure project objectives are met and on schedule. The reporting system is based on accountability to ensure that the environmental mitigation measures are implemented. Environmental monitoring program has the underlying objective to ensure that the intended environmental mitigations are realized and these results in desired benefits to the target population causing minimal deterioration to the environmental parameters. Such program targets proper implementation of the EMP. The broad objectives are:

- To evaluate the performance of mitigation measures proposed in the EMP.
- To evaluate the adequacy of environmental assessment.
- To suggest ongoing improvements in management plan based on the monitoring and to devise fresh monitoring on the basis of the improved EMP.
- To enhance environmental quality through proper implementation of suggested mitigation measures.
- To meet the requirements of the existing environmental regulatory framework and community obligations.

7.2.1 Performance Indicators

The significant physical, biological and social components affecting the environment at critical locations serve as wider/overall performance Indicators. However, the following specific environmental parameters can be quantitatively measured and compared over a period of time and are, therefore, selected as specific Performance Indicators (PIs) for monitoring because of their regulatory importance and the availability of standardized procedures and relevant expertise. A comprehensive monitoring plan for all performance indicators has been prepared for all stages appended as **Annexure 3.**This includes parameters to be measured,

methods to be used, sampling locations, frequency of measurements, detection limits, cost and responsibility for implementation and supervision. Performance indicators requiring quantitative measurements are:

- Air quality with respect to PM2.5, PM10, NOx and SO2 at selected location.
- Water quality with reference to DO, BOD, Oil and grease, COD, Suspended Solids and Turbidity, Alkalinity rivers/streams and water bodies at selected points.
- Noise levels at sensitive receptors (schools, hospitals, community/religious places).
- Survival rates of trees planted as compensatory plantation to compensate for lost forestlands and compensatory plantation rose for removal of roadside trees.

Ambient Air Quality (AAQ) Monitoring: Ambient air quality parameters recommended for monitoring road development projects are PM2.5, PM10, Carbon Monoxide (CO), Oxides of Nitrogen (NOx) and Sulphur Dioxide (SO2). These are to be monitored, right from the commencement of construction activity at selected locations of plants and machinery, crushers on sites, excavation works etc. Data should be generated once in a season excluding monsoon in accordance with the National Ambient Air Quality Standards as per CPCB recent notification of 2009 (**Annexure 4**).

Water Quality Monitoring: The physical and chemical parameters recommended for analysis of water quality relevant to road development projects are pH, total solids, total dissolved solids, total suspended solids, oil and grease, COD, Chloride, Lead, Zinc and Cadmium. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are given in the Environmental Monitoring Plan. The monitoring of the water quality is to be carried out at locations identified along the project road during construction and operation phase. The Indian Standard Specifications - IS10500: 1991 is given in **Annexure** 5. Surface water quality will be monitored as per fresh water classification of CPCB (**Annexure** 6).

Noise Level Monitoring: The measurements for monitoring noise levels would be carried out at sensitive receptors and construction sites along the project roads. The Ambient Noise Standards formulated by Central Pollution Control Board (CPCB) in 1989 or the standards by State Pollution Control Board. The CPCB standards are given in **Annexure** 7. Sound pressure levels would be monitored on twenty-four hour basis. Noise should be recorded at "A" weighted frequency using a "slow time response mode" of the measuring instrument.

Success of Re-vegetation: Additional compensatory plantation will be carried out by the civil works contractor in partnership with the local Joint Forest Management (JFM) Committee. NHIDCL through the CSC will seek necessary support and guidance from the local Forestry Department for getting plantation activities carried out through the JFMs. Suggested plantation locations are multi-layered plantation near sensitive receptors and other community property resources. Further, trees preferred by local birds can be planted on the forest land along the project roads in consultation with forest department. Remaining trees can be planted near rivers and canals intersecting project roads. Survival rate till construction period will be monitored by supervision consultant. Later on it can be handed over to forest department. Survival rate of a minimum of 75% shall be ensured.

Records of Accidents: Contractors to keep records of all types (construction sites/road accident) of accidents during construction period. During the operation stage monitoring, NHIDCL will maintain records of traffic through their field offices with support from forest department and local people.

7.3 Organizational Set-up of Implementing Agency

NHIDCL Tripura is the implementing agency for the project. NHIDCL is a section of state NHIDCL, govt. of Tripura and mandated with construction and maintenance of national highways and bridges with its own resources, private funding or external funding. Presently, it is having a lean organizational set-up in comparison to its mandate. It is headed by Chief Executive Officer (CEO). The CEO has joint charge as, under the Act, the position is held by the Principal Secretary, Road Construction Department. Technical wing is headed by Member Technical supported by General Managers, Deputy General Managers and Managers for different cells.

7.4 Proposed Institutional Arrangement

NHIDCL, as the Project Executing Agency, shall be responsible for overall implementation of the project, and shall perform, or cause to be performed, its obligations as set forth herein and the Project Agreement through Government of Tripura.

A dedicated safeguards team for implementation of safeguards for all projects under NHIDCL including the current project, shall be appointed. The team will be headed by the Member (Administration) and supported by a Deputy General Manager (DGM) and Manager at the headquarter level and an engineer from each Project Implementation Unit (PIU) at the field level.

NHIDCL shall establish field Project Implementation Unit (PIU) for implementing the project. PIU will oversee works for roads under the project. One of the engineers in PIU will be appointed as the safeguards focal person and be responsible for overseeing implementation of EMP.

A construction supervision consultant (CSC) firm will be recruited to supervise and administer civil works contracts and to ensure the works are executed in accordance with the drawings, technical specifications and contract conditions including implementation of EMP. The CSC team will include one environmental specialist and one wildlife specialist. Below Table 7.1 presents responsibilities for Environmental Safeguards Implementation

Table 7.1: Responsibilities for Environmental Safeguards Implementation

S. No	Agency	Responsibility
1.	NHIDCL Tripura - HQ Level, Member (Administration), Deputy General Manager (DGM), Manager	– Ensure that project complies with GOI laws and regulations – Ensure that contract documents include all relevant parts of the environmental assessment and project agreements. – Ensure that sufficient funds are available to properly implement all agreed environmental safeguards measures – Obtain all statutory clearances and permissions – Review and approve the Contractor's Implementation Plan with Supervision Consultant for the environmental measures, as per the EMP – Review the environmental performance of the project through an assessment of the periodic environmental monitoring reports submitted by the Supervision Consultants – overall project coordination and management through PIU supported by CSC – Formation of Grievance Redress Mechanism – Ensure updating of the EMP if any new or unanticipated environmental impacts occur during project implementation due to design change or other reasons
2.	Project Implementation Unit (PIU) – Field Level	– Ensure that Project complies with GoI laws and regulations – Ensure that the environment checklist is completed on time by contractor, reviewed by CSC and submitted to NHIDCL – Participating in State and District level meetings to facilitate LA and R&R activities – Periodic appraisal of progress and reporting to the HQ on

S. No	Agency	Responsibility
		monthly basis, - Facilitating the contractor to obtain necessary permissions/ approvals and its submission to HQ - Directly interact with project affected persons and record their views and grievances and transmit the same to HQ - Settle grievances if any at field level. - Review and approve the package specific EMP's and EMOP's and make necessary modifications if required. - Facilitate the establishment of a grievance redress mechanism, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances related to environment safeguards - Ensure that all mitigation measures as given in the EMP are implemented properly - Ensure proper conduction of environmental monitoring during pre-construction, construction and operation phases - Verify the monitoring checklists/reports prepared by the CSC - Ensure annual environmental monitoring reports are prepared - Identify environmental corrective actions and prepare a corrective action plan, as necessary
3.	Environment Specialist, Construction Supervision Consultant (CSC)	– Review and approve the contract package specific EMAP's prepared by the contractor – Daily on site supervision for implementation of environmental safeguards – Completion of monitoring checklists – Close coordination and communication with the contractor to facilitate implementation of all mitigation measures identified in EMP – Preparation of monitoring reports and submission to PIU – Provide technical support and advise for addressing complaints and grievances – Provide technical advice and on the job training to the contractors as necessary – Preparation of annual monitoring reports based on the monitoring checklists and submission to NHIDCL – Review and approve updated/revised contract specific EMP's if an new or unanticipated environmental impacts occur during project implementation due to design change or other reasons
4.	Contractor	– Responsible for the physical implementation of the mitigation measures proposed in the Environmental Management Plans (EMP) associated with the construction activities. – Responsible for implementation of the Environmental Monitoring Program (EMOP) on collection of environmental quality data. Prepare contract package specific (EMOP) for approval by the CSC and/or PIU before the start of physical works – Ensure that adequate budget provisions are made for implementing all mitigation measures specified in the EMP and EMOP – Participate in induction training on EMP provisions and requirements delivered by the PIU – Obtain necessary environmental license(s), permits etc. from relevant agencies for associated facilities for project road works, quarries, hot-mix plant etc. prior to commencement of civil

		works contracts – Implement all mitigation measures in the EMP – Ensure that all workers, site agents, including site supervisors and management participate in training sessions delivered by CSC. – Ensure compliance with contractual obligations – Collect the baseline data on environmental quality before the start of physical works and continue collection of environmental quality data as given in the Environmental Monitoring Plan during construction – Respond promptly to grievances raised by the local community or and implement corrective actions

Source: DPR

7.5 Institutional/Capacity Building

To enhance the capacity of officials for effective implementation of proposed mitigation measures and monitoring the resultant effects, as well as create awareness amongst workers and public, the training and awareness program is planned and is given in Table 7.2. The institutions/agencies like regional office of MoEF, SPCB/CPCB, and Indian Institute of Technologies can be consulted for such trainings. Independent subject's experts/consultants (e.g., for the environmental awareness program, impact assessment specialist will be the resource person) can also be the resource persons to impart trainings. These experts /agencies shall be appointed based on specific need for the training. A separate budget for training has been allocated under the CSC budget.

Table 7.2: Training/Workshop for EMP Implementation

S.No	Target group	Subject(s)	Method	Time Frame
1	All staffs of NHIDCL including PIU project staff involved in implementation of the	**Environmental Overview:** Environmental Regulations, project related provisions of various Acts/ Guidelines, Procedures of EC and FC, process and methodology for EIA, EMPs	Lectures cum interaction	Before beginning of the implementation of the subproject.
2	Managers (Env.) at PIU, Supervision Consultant's Environmental Specialists and Select	**Implementation of EMPs:** Basic features of an EMP, Planning, designing and execution of environmental mitigation and enhancement measures, monitoring and evaluation of environmental conditions - during construction and operation	Workshops and Seminars	Before the construction begins
3	Environmental officer, design team, Supervision Consultant Construction Contractors' staff	**Environmentally Sound Construction Practices:** Clean construction technology, alternatives materials and techniques for construction, Waste Management and minimization in construction, pollution control devices and methods for construction sites and equipment, Environmental clauses in contract documents and their implications, protection of flora and fauna Environmental monitoring during construction	Workshops and Site visits	Before the construction

4	PIU and Supervision Consultant, NGOs and community representatives	**Monitoring Environmental Performance during Construction:** Air, Water, Soil and Noise, tree survival Monitoring requirement and techniques, Evaluation and Review of results, Performance indicators and their applicability, possible corrective actions, reporting requirements and mechanisms	Lectures, Workshop and site visits	During initial phases of construction
5	-do-	Long-term Environmental Issues in Project Management: Designing and implementing environmental surveys for ambient air, noise, biological and water quality surveys, data storage, retrieval and analysis, contract documents and environmental clauses, risk assessment and management, contingency planning and management and value addition	Workshops and seminars	During implementation of the Subproject
6	Public /contractors workers	Awareness program on environmental protection and measures being implemented by NHIDCL and their role in sustaining the measures taken including for noise pollution, air pollution, safety, soil conservation, and agricultural productivity enhancement	Workshops	During construction and initial phase say 3 years of operation
7	NHIDCL Staff, Supervision Consultant, Engineering Staff of	Restoration of sites viz borrow areas, construction Camps, Crushing units, HMP etc. And Reporting Formats/procedure	Lecture/Presanitations	before Contractor Demobilization

Source: DPR

7.6 Grievance Redress Mechanism

All the three parties involved in this project implementation i.e. Contractor, CSC and executing agency will maintain complaint registers at their following respective offices:

- Contractor's main site offices i.e. office of the Project Manager;
- CSC's main site office i.e. office of the Engineer's Representative; and
- PIU DGM office i.e. Employer's field office

Level 1 - PIU level: All public complaints regarding environmental issues received by any of the above mentioned offices will be entered into the register with specific details such as name and address of the person or representative of the community registering a complaint, the details of complaint, and time. The Executive Engineer and Engineer's Representative will immediately communicate the details of the complaint to the Contractor. The environment and safety officer of the contractor will promptly investigate and review the environmental complaint and implement appropriate corrective actions to arrest or mitigate the cause of the complaints within 3 days' time of receiving the complaint. The contractor will report to CSC environment expert about the action taken on the complaint, also within 3 days' time of receiving the complaint, for his further intimation to DGM PIU. The person making the complaint will also be intimated by the complaint receiving person or his representative, about the action taken, within 3 days.

Level 2 - State level: Grievances not redressed by the PIU level will be brought to the State level Grievance Redress Committee (GRC). The State level GRC will be headed and chaired by Executive Engineer. The state level GRC will comprise of the following:

- Member (Administration), NHIDCL

- Environmental Specialist, CSC
- A representative from the respective local community or JFM committee member
- Representative of concerned agency such as Forestry Department or State Pollution Control Board depending on the nature of the complaint/issue

The main responsibilities of the GRC will be to: (i) record grievances, categorize, and prioritize grievances and resolve them as soon as possible; (ii) immediately inform the EA of serious cases; and (iii) report to complainants on decisions made regarding their grievances within three weeks of receiving the grievance from the PIU level. The decision must include the agreed timeline for addressing the grievance. Grievances related to resettlement benefits, compensation, relocation, replacement cost and other assistance will be addressed by following the grievance redress system.

7.7 Environment Management Budget

Most of the measures have been addressed as part of good engineering practices, the costs for which have been accounted for in the engineering/cost. All costs towards pre-construction clearances/permission will be borne by executing agency. These costs are indicative. The environmental budget for the various environmental management measures proposed under the project is presented in Table below. A total budget amount of **Rs. 78, 52,000/-** (excluding compensatory afforestation and NPV decided by forest dept.) has been allocated for implementation of environment safeguards under the project. Table 7.3 shows Environment Management Budget

Table 7.3: Environment Management Budget

Sl. NO.	ITEM DESCRIPTION	QUANTITY	UNIT	RATE (Rs.)	AMOUNT (Rs.)	Responsibility
A	**Tree Plantation**					
A.1	Net present value over 126.2014 ha of forest land under DFO, South Tripura/Gumti/Khowai	126.2014	Ha	(Will be decided by Forest Dept. during stage 1 clearance)	-	PIUNHIDCL/CSC through Forest Department
A.2	Cost of compensatory afforestation	-	Ha	(Will be decided by Forest Dept. during stage 1 clearance)	-	PIUNHIDCL/CSC through Forest Department
				Sub Total	**--**	
B	**Environmental Monitoring**					
B.1	Ambient air quality monitoring (Construction Stage) as per **Annexure** 3 for 2 years at thrice in a year	15	No.	10,000	9,00,000	NHIDCL/CSC through Approved Monitoring Agency
B.2	Ambient air quality monitoring (Operation Stage) as per **Annexure** 3	9	No.	10,000	2,70,000	
B.3	Ambient noise level monitoring (Construction Stage) as per **Annexure** 3 once in a year for two	13	No.	5000	1,30,000	
B.4	Ambient noise level monitoring as per **Annexure** 3 once in a year for one year	9	No.	5000	45,000	

B.5	Water quality monitoring of surface water as per **Annexure** 3 for two years at 8 location for three times including samples from construction camp for drinking water quality	8	No.	5000	2,40,000	
B.5	Water quality monitoring of surface water as per **Annexure** 3 for one year at 5 location for three times including samples from construction camp for drinking water quality	5	No.	5000	75,000	
B.6	Ground Water quality monitoring for 13 locations three times a year during construction stage	13	No.	5000	3,90,000	
B.6	Ground Water quality monitoring for 10 locations three times a year during operation stage	10	No.	5000	1,50,000	
B.7	Soil Quality analysis as per **Annexure** 3 during construction stage	13	No.	8000	1,04,000	
B.8	Soil Quality analysis as per **Annexure** 3 during operation stage	6	No.	8000	48,000	
				Sub Total	**23,52,000**	
C	**Environmental Training/ Awareness Camp**					
C.1	Training at site	2		1,00,000	2,00,000	PIU through Supervision Consultant
C.2	Awareness Camp	6		50,000	3,00,000	
				Sub Total	**5,00,000**	
D	**Budget for conservation and management of biodiversity in and around the project site**				**50,00,000**	PIU through Supervision Consultant
Grand Total= Rs. 78,52,000/-						

Source: DPR & EIS

8. CONCLUSION AND RECOMMENDATION

EIA Study of the project road ascertains that it is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed project, most of which are localized and temporary in nature and easy to mitigate.

Project road is not located in any environmentally sensitive areas. However, considerable portion of the project road passes along/through forest cover. There are numbers of sensitive noise receptors such as higher secondary schools, high schools and primary schools & Anganwadis adjacent to the ROW of the project road. Hence, environmental management plan shall be strictly implemented to overcome all the adverse impacts from the project activities specially in forest area and sensitive noise receptors.

The significant environmental impacts attributable to the upgrading of the road sections pertains to tree cutting, construction of bridges, temporary deterioration of environmental attributes/ambient during construction phase from land clearing, silt run off, borrowing of earth, camp operations and community and occupational health and safety. These impacts can be mitigated adopting good construction practices and effective implementation of Environmental Management Plan (EMP). During operation stage, the main impacts are increase in mobile emissions, noise level, accident risk to motorist, pedestrian and animals. Road safety measures are proposed as per IRC: SP: 44-1996 like road delineators, signage, metal beam crash barriers and guide posts etc. Retaining walls have been proposed on embankment slopes where ponds are abutting to avoid seepage into sub grade and erosion of road embankment.

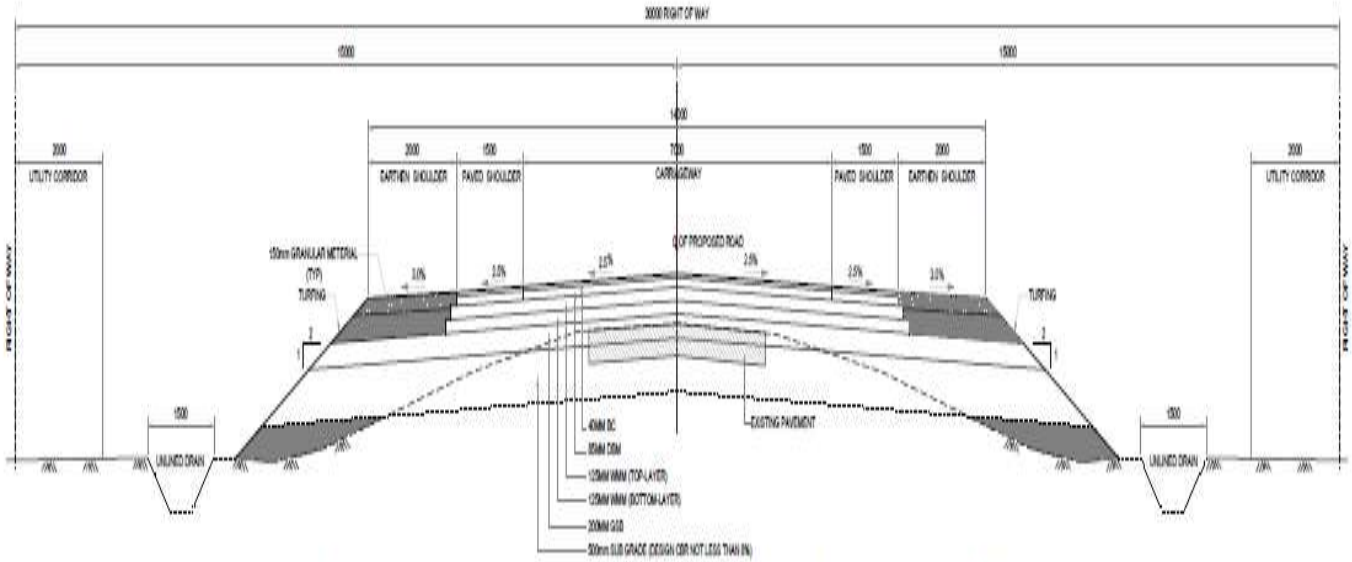
Horizontal geometry is found to be very poor with very sharp turns and reverse "S" curves are found at many locations causing discomfort to the drivers in most of the stretch of the alignment. The local people appreciated that improved connectivity will bear out several socio-economic positive benefits resulting to improved quality of life. Project road is starting near Khowai to Harina near Sabroom. It connects some important habitats of Khowai, Gumti & South Tripura districts. It has immense potential to boost economy of the region since the livelihood of most of the peoples form the local people dependent on agriculture. Improved road condition will encourage them to invest more in agriculture and take the opportunity to connect to the mainstream economy of the country.

EIA study ascertains that the project is unlikely to cause any significant environmental impacts. The Executing Agency (NHIDCL, Tripura) shall ensure that EMP and EMoP are included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. The same shall be revised if necessary during project implementation or if there is any change in the project design with approval of Project In-Charge, NHIDCL.

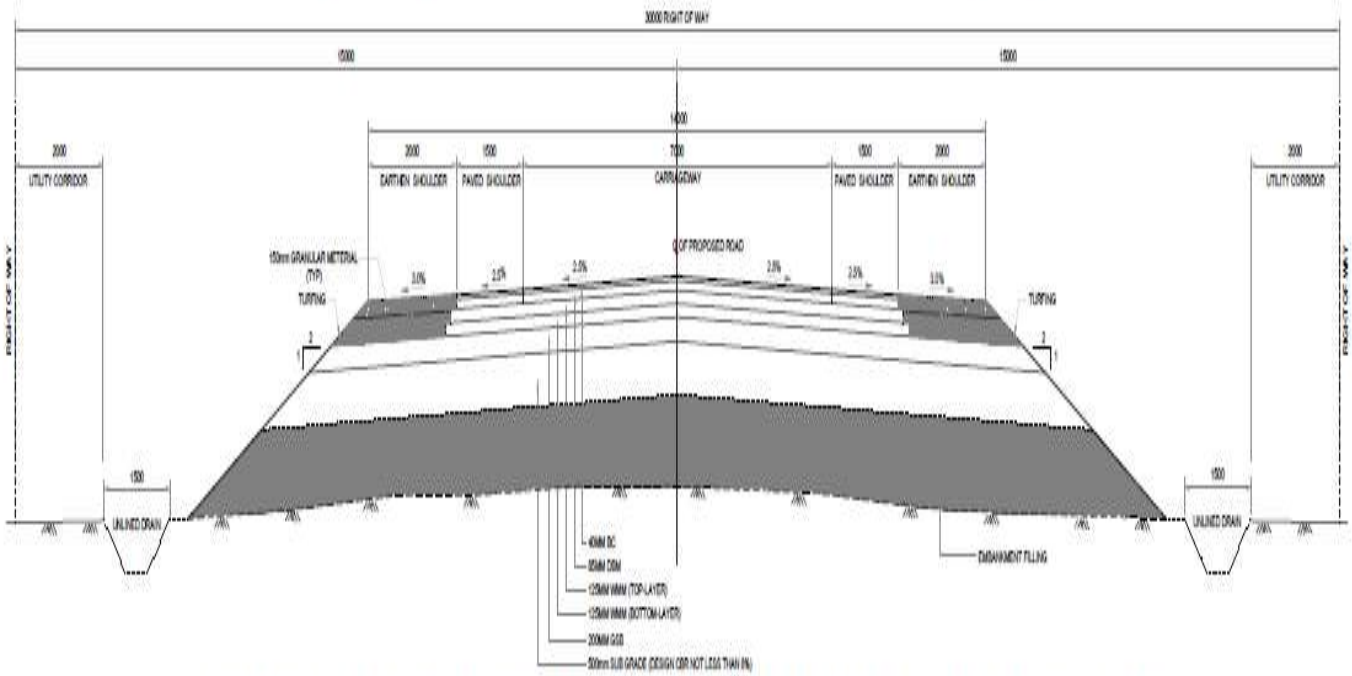
ANNEXURES

Annexure-1

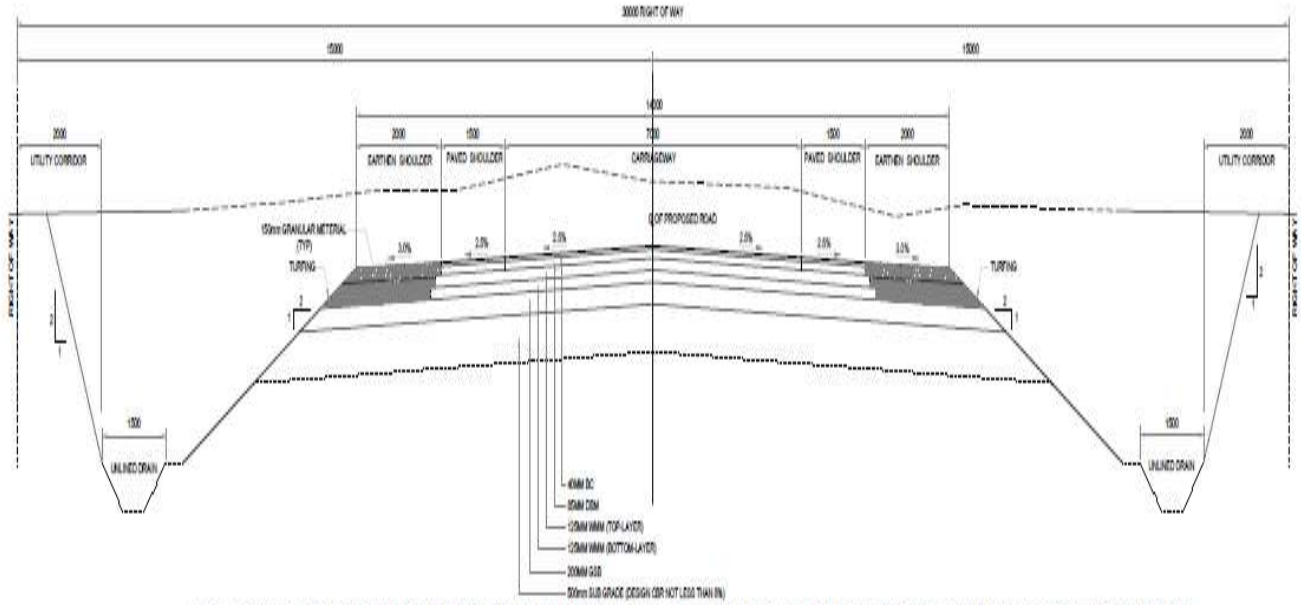
Typical cross sections for Road



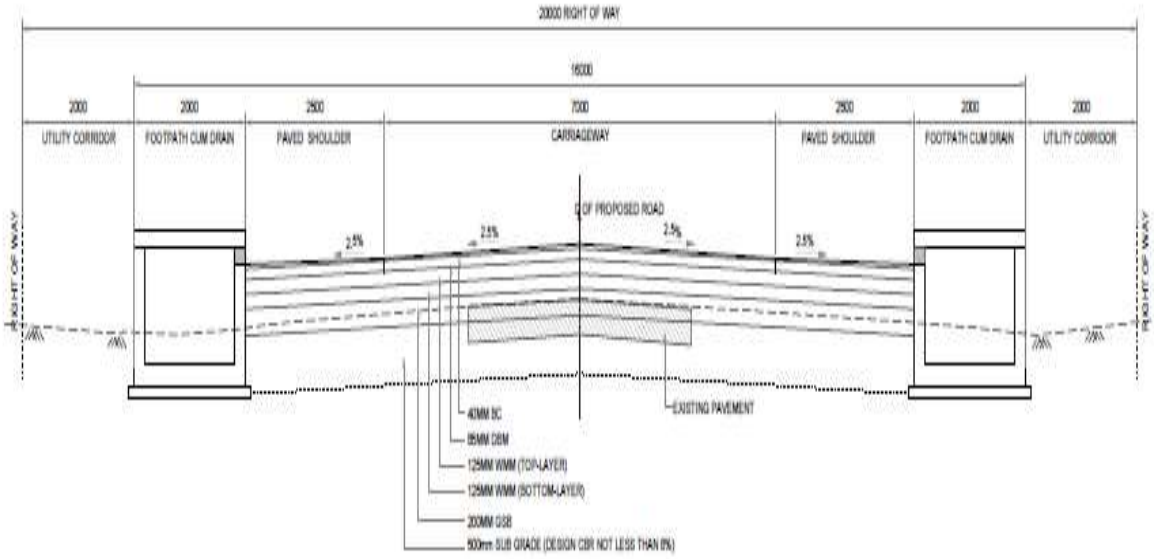
TCS-1 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN RURAL AREA APPLICABLE FOR PLAIN/ROLLING TERRAIN (RECONSTRUCTION)



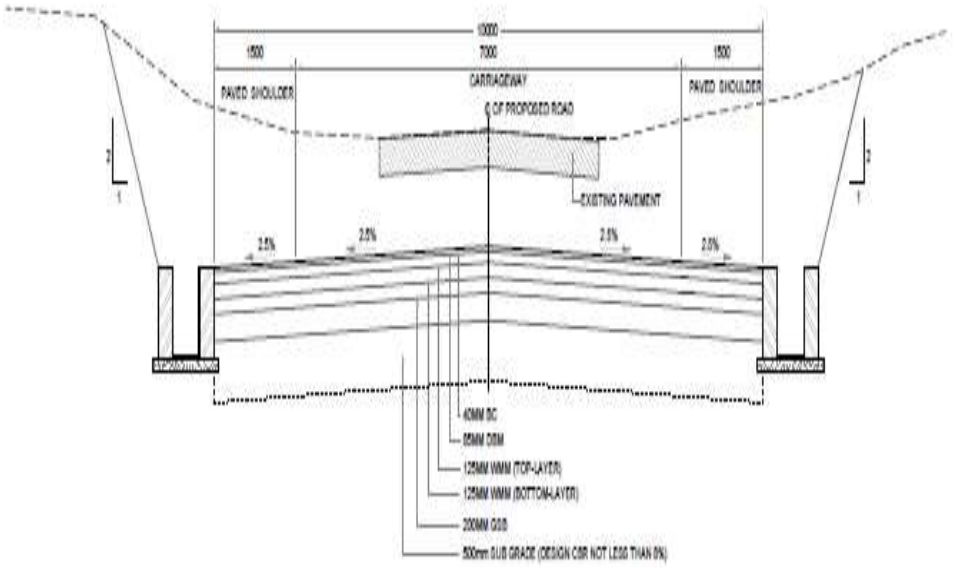
TCS-2 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS AND REALIGNMENT STRETCH APPLICABLE FOR PLAIN/ROLLING TERRAIN (NEWCONSTRUCTION)



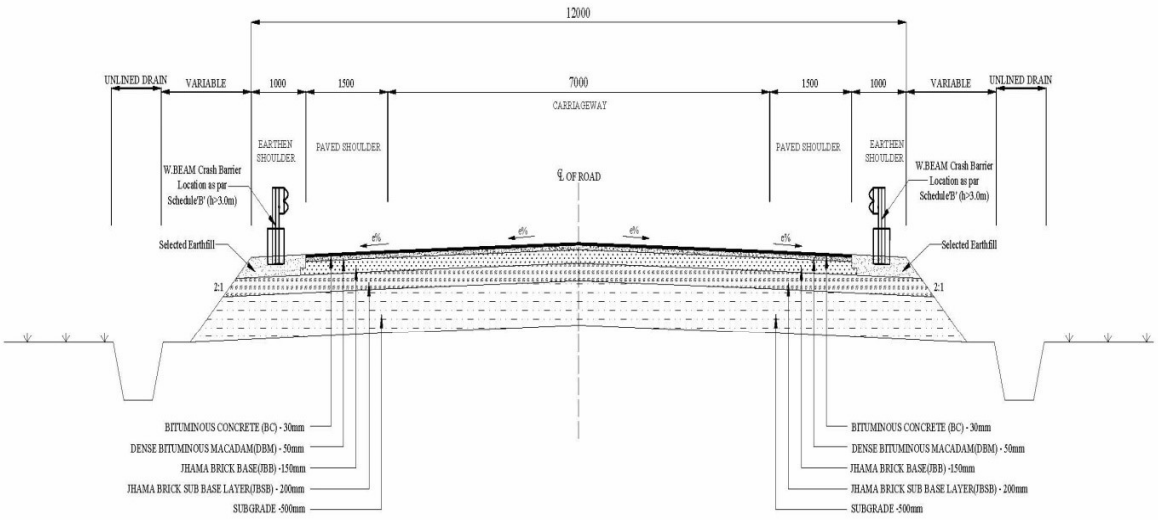
TCS-3 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER IN BYPASS AND REALIGNMENT STRETCH APPLICABLE FOR PLAIN/ROLLING TERRAIN IN CUTTING SECTION (NEWCONSTRUCTION)



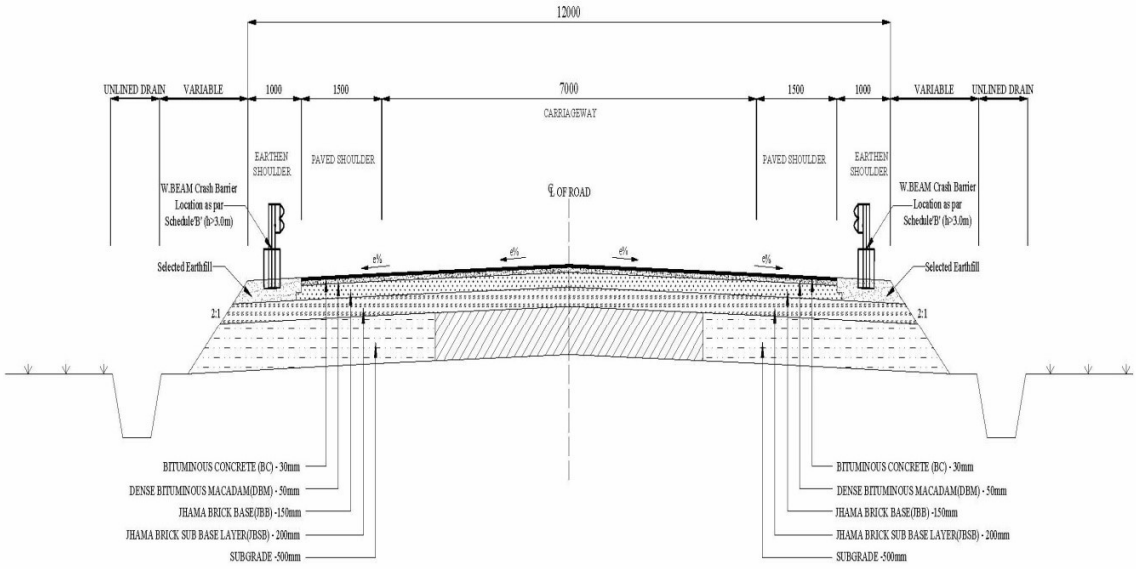
TCS-4 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RCC COVER DRAIN IN BUILTUP AREA APPLICABLE FOR PLAIN/ROLLING TERRAIN (RECONSTRUCTION)



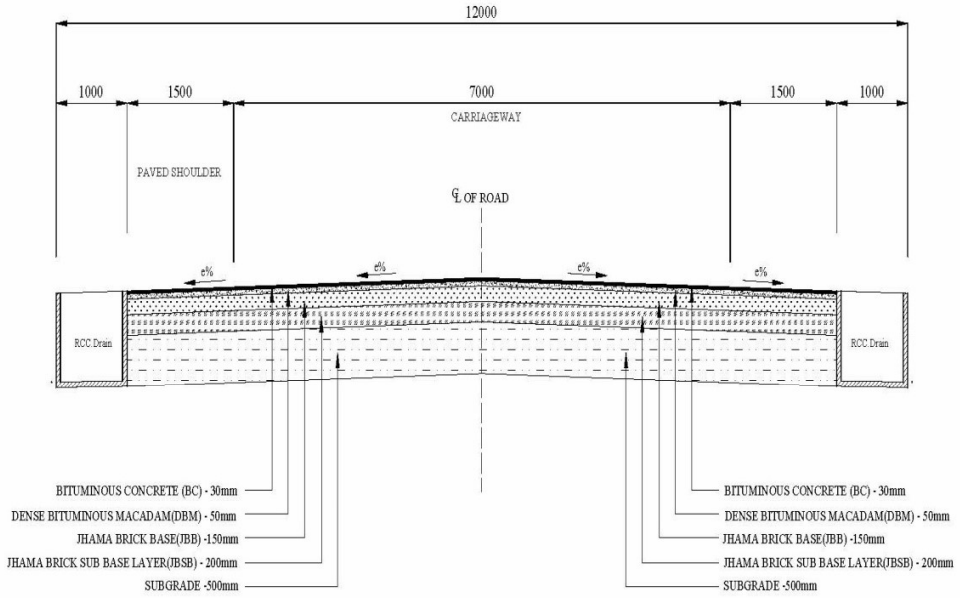
TCS-5 : TYPICAL CROSS SECTION OF 2-LANE CARRIAGEWAY WITH PAVED SHOULDER AND BOTH SIDE RECTANGULAR BRICK MASONARY DRAIN APPLICABLE FOR MOUNTAINOUS TERRAIN (RECONSTRUCTION)



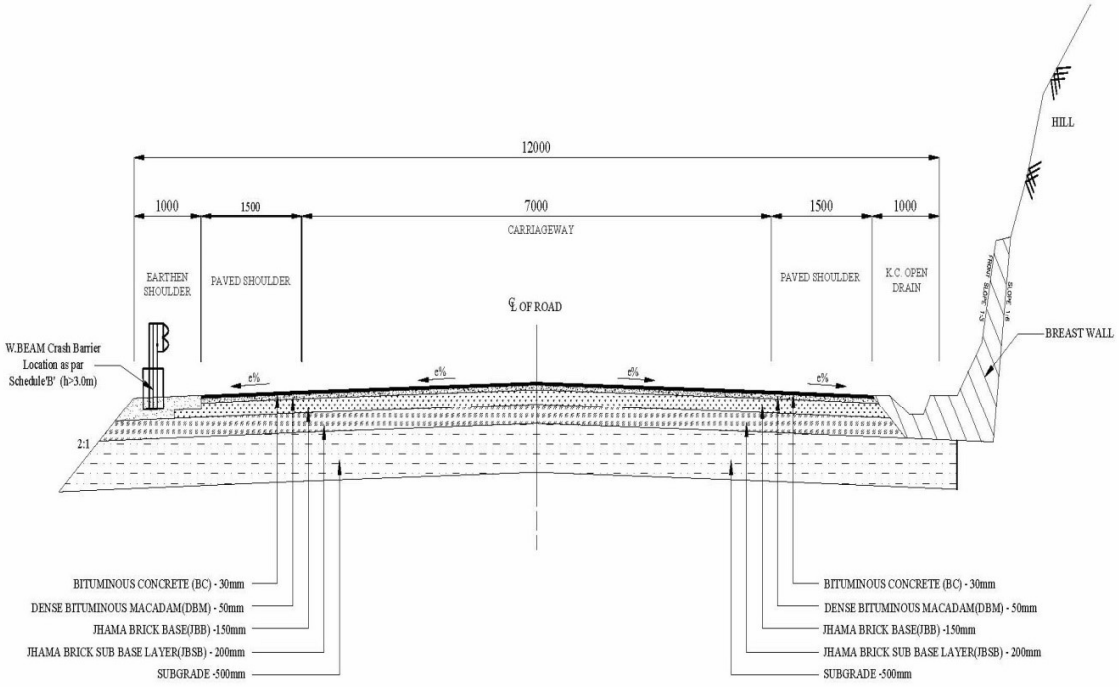
TYPE- 1 TWO LANE WITH PAVED SHOULDER (New Construction)



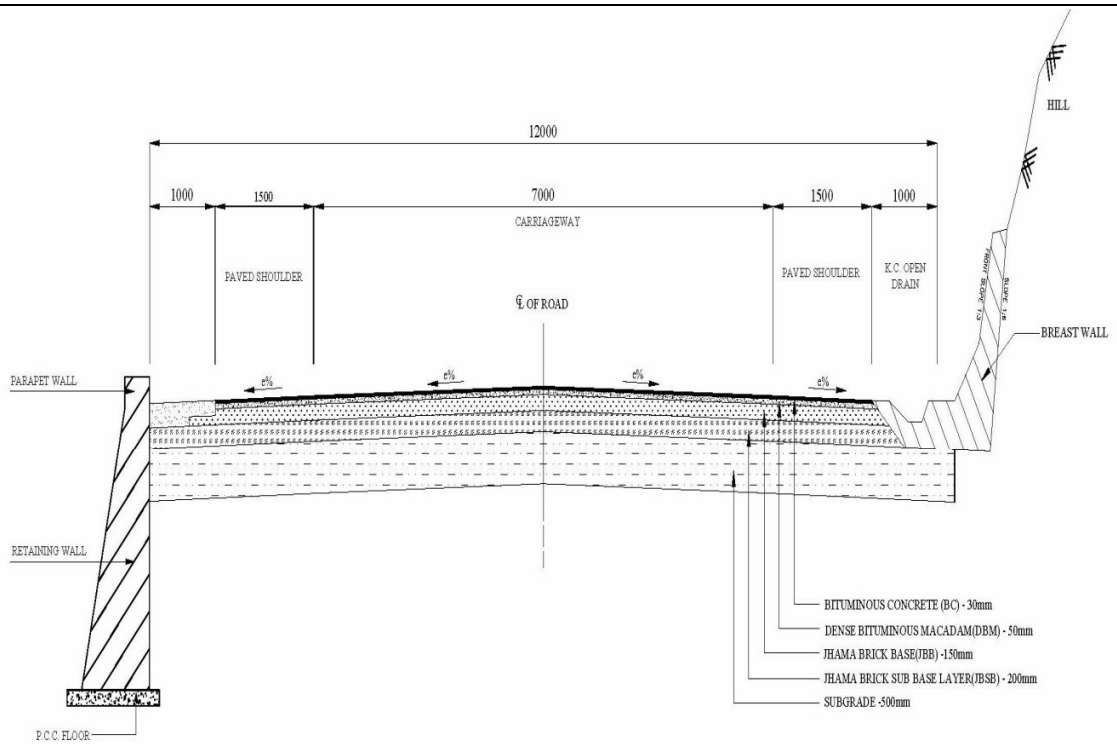
TYPE- 2 TWO LANE WITH PAVED SHOULDER OVER EXISTING ROAD



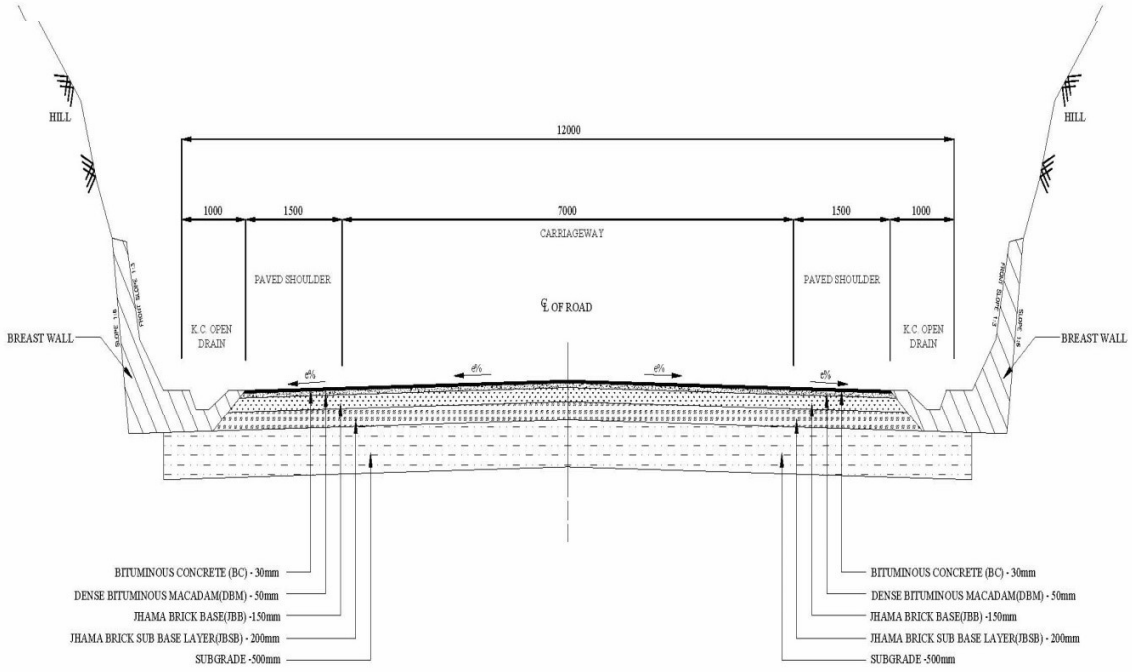
TYPE- 3 TWO LANE WITH PAVED SHOULDER WITH RCC DRAIN (Built-up Section)



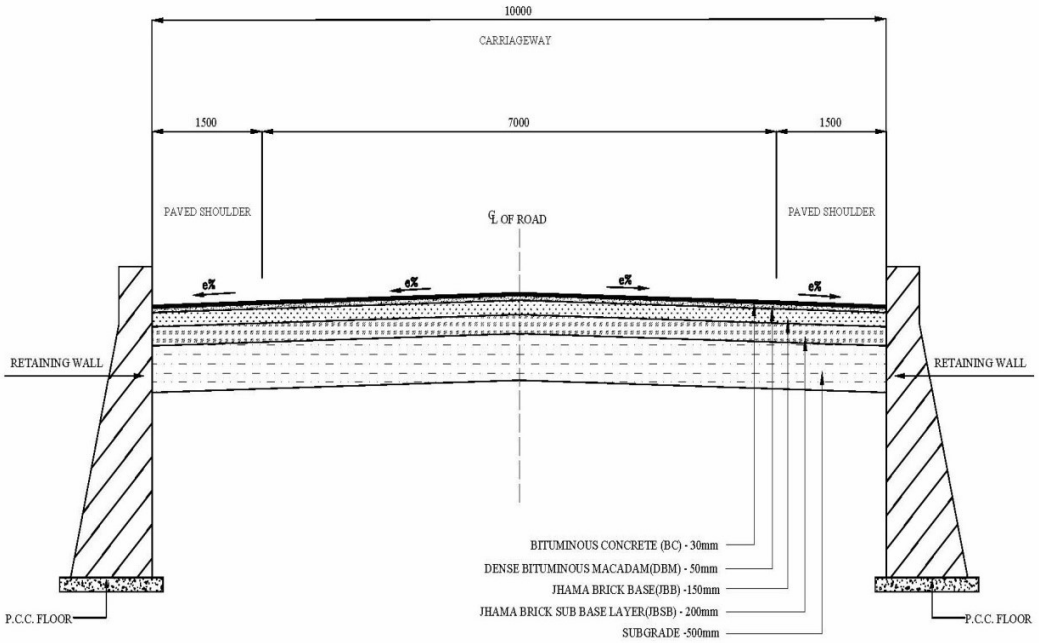
TYPE- 4 TWO LANE WITH PAVED SHOULDER (WITH PROTECTIONS WORKS)



TYPE- 5 TWO LANE WITH PAVED SHOULDER (BOTH SIDE PROTECTIONS WORKS)



TYPE- 6 TWO LANE WITH PAVED SHOULDER (WITH PROTECTIONS WORKS (Both Side)



TYPE- 7 TWO LANE + PAVED SHOULDER (Both Side)RETAINING WALL

Source: DPR

Annexure 2

ENVIRONMENTAL MANAGEMENT PLAN

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
A. Design and Pre-construction Stage								
1. Alignment/Pavement								
1.1 Pavement damage and inadequate drainage provisions 1.2 Construction of concrete pavement in habitat areas considering alignment level and drainage.	• Raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water and domestic discharges (drained by habitats occasionally to prevent damage to road and rain water entry to habitats' houses. ▪ Provision of adequate no. of cross drainage structures based on drainage pattern around the alignment	To meet the Design requirement IRC: SP: 19. IRC: 37-2012 IRC:SP:73-2007 and avoid water logging	Throughout the habitat areas Provision for Both side drains in all the important locations including built-up areas.	MI: Design and number of cross and side drains, slab/box culverts, and Hume pipes PT: Design and numbers are in accordance with site needs	Review of detail design documents & drawings and comparison with site conditions/ During design stage	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	Design Consultant	NHIDCL/CSC

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1.3 Safety along the proposed alignment	▪ Vertical and horizontal geometrics in consistent to IRC/MORTH guidelines ▪ Provision of crash barriers at high embankments. ▪ Speed breakers in habitat areas, schools, junction and curves to regulate speed. ▪ Provision of retro-reflective warning signboards near school, hospital ,religious places and forests ▪ Safety kerb at all bridge s ▪ Informatory signage on approach to school, ▪ Ambulance and medical aid posts ▪ Checking for overloading at toll plazas ▪ Speed restrictions in built up sections curve locations etc	To meet the Design requirement IRC:SP:73-2007 IRC:SP:84-2014 IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:103 and Section 800 of MoRTH Specifications Horizontal geometry will be based on IRC: 38-1988 and vertical geometry will be based on IRC: SP 23-1993 ". IRC: SP: 67-2012 and to make sure safety provision in design stage	Crash barriers Speed Restriction sign posts at road junction All Major intersections	MI: number and location of crash barriers, speed breakers, warning sign boards, road studs, object markers etc. PT: numbers and location are in accordance with site needs	Review of design documents and drawings and comparison with site conditions/ During design stage	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	Design Consultant	NHIDCL (NH)/CSC
2. Cross border, Natural Hazards and Climate Change risks								
2.1 Damage to pavement integrity like Rutting, embankment softening and migration of liquid asphalt. Thermal expansion in bridge expansion joints and paved surfaces	▪ Asphalt binder specifications based on viscosity-grade specifications as per IS 73-2013 guidelines and IS 15462 2004 for rubber modified binder and polymer modified binders.	To meet the IRC 37 2012 for flexible pavement design, IRC 81 1997 for strengthening of flexible pavement and to minimize damage to the bridges/pavments	Entire stretch	MI: Pavement Surface and bridge expansion joints during extreme heat PI: No softening, rutting, asphalt migration/thermal expansion of joint	Review of design documents and drawings and comparison with site conditions/ during design stage	preliminary design cost of F/S consultant Detailed design cost to be borne by concessionaire	Design consultant	NHIDCL/CSC

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2.2 Earthquake	▪ Relevant IS codes shall be adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone of the project area	To make the Dislodgement of superstructure as per Clause 222 of IRC: 6 and design new bridge as per relevant IRC code, to minimize damage in case of an earthquake	Entire Stretch	MI: Bridges and Culverts PT: Design conforms BIS and IRC guidelines	Review of design documents and drawings and comparison with site conditions/ during design stage	F/S consultant, Detailed design cost to be borne by concessionaire	concessionaire	NHIDCL/ CSC
3. Protected area, Diversion of Forest Land and Cutting of Trees								
3.1 Need for cutting of trees and diversion of forest land	▪ Geometric adjustments to minimize tree cutting and diversion of forest land ▪ Obtain tree cutting permission from forest department ▪ Provision for mandatory compensatory afforestation as per the norms for deposit of payment to Forestry Department	To follow Forest Conservation Act, 1980 and minimize cutting of trees & forest land acquisition	Throughout the corridor. Especially in the forest cover area. Hence all the trees coming in ROW in those parts will fell down.	MI: Number and location of geometric adjustments made to avoid forestland and tree cutting, budget amount allocated for compensatory afforestation as per the norms fixed by state forest department PT: Unnecessary tree felling on forest land avoided. Budget allocation is adequate,	Review final design. Check budget provision for compensatory afforestation and additional Plantation/ during design stage	Covered under preliminary design preparation by F/S consultant Detailed design cost to be borne by concessionaire	NHIDCL, Design consultants forest department	NHIDCL/ Forest department

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
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4. Ecosystem								
4.1 Road design causing accidents of wild animals and disruption in their movement	▪ Provision of rumble strip, cautionary and informatory sign boards near potential wildlife crossing locations ▪ Speed restriction in the sections where wildlife movement is reported ▪ Clearance of all shrubs grown inside the ROW once in a year after monsoon to provide better lateral visibility to drivers ▪ Maintain 15 m distance between two trees during avenue plantation	To minimize accidents and disruption of wildlife movement	No visible wildlife movement in the project road. However, project road passing through forest land shall be considered.	MI: budget allocation for rumble strips, cautionary and informatory sign boards, PT: Budget adequate to fulfill the installation of recommended facilities and structures	Review of bid documents and project budget plan/ during design stage	Covered under costs for F/S Consultant	NHIDCL, Design Consultant	NHIDCL in coordination with Forest Department
4.2 Forest Fires	▪ Measures to avoid accident followed by fuel accumulation ▪ Removal of maintenance slash or management by controlled burning. ▪ Plant fire-resistant species in RoW ▪ Thinning slashing during non-dry season ▪ No construction camp within 500m	To minimize forest fire	Throughout the	MI: Damage to roadside flora and spillage /fuel accumulation induced accident PT: Zero incidence of forest ire	During design stage	Covered under F/S consultant cost	concessionaire	NHIDCL/ Forest department
5. Shifting of Utilities								
5.1 Disruption of utility services to local community	▪ All telephone and electrical poles/wires and underground cables should be shifted before start of construction ▪ Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services ▪ Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any	To meet the legal requirements and maintain the utility services in the area	Near forest covers. corridor	MI: Number of complaints from local people, Shifting plan and status of utility services PT: No. of complaints should be zero. Minimal time for utility shifting	Interaction with concerned utility authorities and local public/ during per construction stage	Included under NHIDCL's costs	Contractor/ NHIDCL/utility company	NHIDCL/ CSC

B. Construction Stage								
1. Air Pollution								
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	▪ Concessionaire to submit location and layout plan for storage areas of construction materials agreed by CSC ▪ Transport, loading and unloading of loose and fine materials through covered vehicles. ▪ Paved approach roads. ▪ Storage areas to be located downwind of the habitation area. ▪ Water spraying on earthworks, unpaved haulage roads and other dust prone areas. ▪ Provision of PPEs to workers.	To minimize air pollution and meet the MORT&H Specifications for Road and Bridge works Air (P and CP) Act 1974 and Central Motor and Vehicle Act 1988 General Conditions of Bid Document	Throughout project corridor	MI: PM_{10} & $PM_{2.5}$ level measurements Complaints from locals due to dust PT: $PM_{2.5}$ level<60 g/m^3 & PM_{10} level < 100 g/m^3 Number of complaints should be zero.	Standards CPCB methods Observations Public consultation Review of monitoring data maintained by contractor/ during construction period of two yearsquarterly during dry season	Included in civil works cost	Concessionaire	NHIDCL
1.2 Emission of air Pollutants (HC, SO_2, NO_X, CO etc.) from vehicles due to traffic congestion and use of equipment and Machinery	▪ Regular maintenance of machinery and equipment. ▪ Batching, asphalt mixing plants and crushers at downwind (1km) direction from the nearest settlement. ▪ Only crushers licensed by the PCB shall be used ▪ DG sets with stacks of adequate height and use of low sulphur diesel as fuel. ▪ LPG should be used as fuel source in construction camps instead of wood ▪ Ambient air quality monitoring ▪ Contractor to prepare traffic management and dust suppression plan duly approved by NHIDCL (NH), Tripura	To follow the Air (Prevention and Control of Pollution) Act, 1981 (Amended 1987) and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	MI: Levels of HC, SO_2, NO_2, and CO. Status of PUC certificates PT: SO_2 and NO_2 levels are both less than 80ug/m^3. PUC certificate of equipment and machinery is upto date	Standards CPCB methods Review of monitoring data maintained by Contractor/ during construction period of two years quarterly during dry season	Included in civil works cost	Concessionaire	NHIDCL /CSC
2. Noise Pollution								
2.1 Disturbance to local residents and sensitive receptors due to excessive noise from construction activities and operation of equipment and Machinery	▪ All equipment to be timely serviced and properly maintained. ▪ Construction equipment and machinery to be fitted with silencers and maintained properly. ▪ Only IS approved equipment shall be used for construction activities. ▪ Timing of noisy construction activities shall be done during night time and weekend near schools, ▪ Implement noisy operations intermittently to reduce the total noise generated	To follow Legal requirement Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	Throughout project Specially at all sensitive receptors (As per Table 5.4 of Chapter 5.) like schools and hospitals falling along the project alignment.	MI: day and night Noise levels. Number of complaints from local people PT: Zero	As per Noise rule, 2000 Consultation with local people Review of noise level monitoring data maintained by contractor Observation of construction site/ during construction period once in two year	Included in civil works costs	Concessionaire	NHIDCL/CSC

	▪ Manage existing traffic to avoid traffic jams and accumulation of noise beyond standards. ▪ Restrict construction near residential, built up and forest areas construction to the night hours. ▪ Honking restrictions near sensitive areas ▪ PPEs to workers ▪ Noise monitoring as per EMoP.	+ Clause No 501.8.6. MORT&H Specifications for Road and Bridge works and minimize pollution		complaints or no repeated complaints by local people. Average day and night time noise levels are within permissible limits for work zone areas				
3. Land and Soil Pollution								
3.1 Landuse Change and Loss of productive / Topsoil	▪ Non-agricultural areas to be used as borrow areas to the extent possible. ▪ If using agricultural land, top soil to be preserved and laid over either on the embankment slope for growing vegetation to protect soil erosion. ▪ Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original Landuse	To minimize land acquisition and preservation of top soil	Throughout the project section and borrow areas Land identified for camp, storage areas etc.	MI: Borrow pit locations/Top soil storage area PT: Zero complaints or disputes registered against contractor by land owner	Review borrow area plan, site visits/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC

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3.2 Borrow area management	▪ Obtain EC from SEIAA before opening any new borrow area. ▪ Comply to EC conditions of SEIAA ▪ Non-productive, barren lands, upland shall be used for borrowing earth with the necessary permissions/consents. ▪ Depths of borrow pits to be regulated and sides not steeper than 25%. ▪ Topsoil to be stockpiled and protected for use at the rehabilitation stage. ▪ Transportation of earth materials through covered vehicles. ▪ Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation ▪ Borrow areas not to be dug continuously. ▪ To the extent borrow areas shall be sited away from habitat areas. ▪ Borrow areas shall be levelled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fish pond.	To follow IRC Guidelines on borrow areas and for quarries (Environmental protection Act and Rules, 1986; Water Act, Air Act)+Clause 305.2.2 MORTH Specifications for Road and Bridgeworks Guidelines for Borrow Areas management and propoer closing of borrow areas to avoid accidents & land stability	Borrow sites location	MI: Existence of borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Number of accidents. Complaints from local people. PT: No case of non-compliance to conditions stipulated by SEIAA in clearance letter. Zero accidents. Zero complaints No use of black cotton soil	Review of design documents and site observations/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC
3.3 Quarry Operations	▪ Aggregates will be sourced from existing licensed quarries. ▪ Copies of consent/ approval / rehabilitation plan for a new quarry or use of existing source will be submitted to NHIDCL. ▪ The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy of the approval to EA. ▪ Obtain environmental clearance from SEIAA in case of opening new quarry	To meet Clause No.111.3 MORT&H Specifications for Road and Bridge works Guidelines VI for Quarry Areas Management Environmental Protection Rules and to minimize the environmental damage	Existing quarries of project districts viz. Unakoti, Dhalai & Khowai Districts.	MI: Existence of licenses quarry areas from which materials to be sourced and Existence of a quarry redevelopment plan PT: Quarry license is valid.: No case of non-compliance to consent conditions and air quality meets the prescribed limit	Review of design documents, contractor documents and site observation Compliance to EC conditions in case of opening new Quarries/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC

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3.4 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	▪ Construction vehicles, machinery, and equipment to be stationed in the designated ROW to avoid compaction. ▪ Approach roads/haulage roads shall be designed along the barren and hard soil area to reduce the compaction. ▪ Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. ▪ Land taken for construction camp and other temporary facility shall be restored to its original conditions	To minimize environmental pollution due to utilization of haul roads	Parking areas, Haulage roads and construction yards.	MI: Location of approach and haulage roads Presence of destroyed/compacted agricultural land or land which has not be restored to its original condition PT: Zero occurrence of destroyed/compacted land and undestroyed land	Site observation/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC
3.5 Contamination of soil due to leakage/ spillage of oil, bituminous and non-bituminous debris generated from demolition and road construction	▪ Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. ▪ Fuel storage and refueling sites to be kept away from drainage channels. ▪ Unusable debris shall be dumped in ditches and low lying areas. ▪ To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas. ▪ Waste oil and oil soaked cotton/ cloth shall be stored in containers labelled 'Waste Oil' and 'Hazardous' sold off to MoEF/SPCB authorized vendors ▪ Non-bituminous wastes to be dumped in borrow pits with the concurrence of landowner and covered with a layer of topsoil conserved from opening the pit. ▪ Bituminous wastes will be disposed off in an identified dumping site approved by the State Pollution Control Board ▪ The contamination of soil will cause the water pollution → see water pollution	To minimize soil contamination due to spillage	Fueling station, construction sites, and construction camps and disposal location.	MI: Quality of soil near storage area Presence of spilled oil or bitumen in project area PT: Soil test conforming to no –contamination. No sighting of spilled oil or bitumen in construction site or camp site	Site observation/ during construction period of two years	Included in civil work cost.	Concessionaire	NHIDCL /CSC

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4. Water pollution								
4.1 Sedimentation caused by turbulating Water	▪ The sheets or covers	To prevent the soild to fell off.	Bridge areas	MI: Sediment level PT: Minimum	Sediment test	Included in civil works cost	Concessionaire	NHIDCL/ CSC
5. Topography and Geology								
5.1 Change in topography due to Construction activities, earthwork, and cut and fill, stockpiles etc. No change in geology is anticipated	▪ Side slopes of all cut and fill areas will be graded and covered, grass and shrub as per design specifications. Care should be taken that the slope gradient shall not be greater than2:1. ▪ The earth stockpiles to be provided with gentle slopes to soil erosion.	To meet IRC: 56 -1974 recommended practice for treatment of embankment slopes for erosion control Clause No. 306 and 305.2.2 MORT&H Specifications for Road and Bridge works Guidelines IX for Soil erosion and minimize slope failure and soil erosion	Throughout the entire project road	MI: Occurrence of slope failure or erosion issues PT: No slope failures. Minimal erosion issues	Review of design documents and site Observation/ during construction period of two years especially in rainy season	Included in civil works cost	Concessionaire	NHIDCL/ CSC
6. Hydrology								
6.1 Sourcing of water during Construction	▪ Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority. ▪ Arrangements shall be made by contractor that the water availability and supply to nearby communities remain unaffected. ▪ Water intensive activities not to be undertaken during dry season. ▪ Provision of water harvesting structure	To follow CGWA Guidelines and conservation of water resources	Throughout the project location	MI: Approval from competent authority Complaints from local people on water availability PT: Valid approval from competent authority. Zero complaints from local people.	Checking of documentation Talk to local People/ during construction period of two years	Included in civil work cost	Concessionaire	NHIDCL/C SC
6.2 Disposal of storm water during construction	▪ Provisions shall be made to connect road side drains with existing nearby natural drains.	To minimize water logging during rain and follow Clause No.1010 EP Act 1986 MORT&H Specifications for Road and Bridgeworks	Throughout the Project section	MI: Condition of drainage system in construction site. Presence /absence of water logging in project area. PT: Existence of proper drainage system. No water logging in project area	Standards methods Site observation and review of documents/ during construction period of two years	Included in civil work cost	Concessionaire	NHIDCL /CSC
6.3 Alteration in surface water hydrology	▪ Existing drainage system to be maintained and further enhanced. ▪ Provision shall be made for adequate size and number of cross drainage structures esp. in the areas where land is sloping	To meet design requirement, Clause No. 501.8.6. MORT&H Specifications and maintaining the existing	All the major streams and Nallahs flowing through the proposed road, all	MI: Proper flow of water in existing streams and rivers	Review of design documents Site observation/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC

	towards road alignment. ▪ Culverts reconstruction shall be done during lean flow period.	drainage system	the road side ponds (103nos) and Rivers mainly Khowai, And Gumti Crossing the project road.	PT: No complain of water shortage by downstream communities. No record of overtopping/ water logging				

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7. Ecosystem								
7.1 Vegetation loss due to site preparation and construction activities	▪ Restrict tree cutting upto toe line considering safety to road users. ▪ Roadside trees to be removed with prior approval of competent authority. ▪ Mandatory compensatory plantation at norms fixed by State Forest Department ▪ Additional plantation as per the IRC guidelines to be carried out by concessionaire ▪ Regular maintenance trees planted. ▪ Provision of LPG in construction camp as fuel source to avoid tree cutting. ▪ Plantation of trees on both sides of the road where technically feasible. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance. ▪ Controlled use of pesticides/ fertilizers ▪	To follow Forest Conservation Act1980 + IRC:SP:21 and IRC:SP:66 and minimize vegetation loss	Roadside plantation throughout the project road with survival rate of minimum 75% Additional Plantation norms fixed by state forest dept. for diversion of forest cover as 'Compensatory Afforestation' in the designated location notified by state forest department	MI: ROW width Number of trees for felling Compensatory plantation plan Number of trees replanted. PT: Additional compensatory afforestation done on norms fixed by state forest department.	Review of relevant documents – tree cutting permit, compensatory plantation plan. and additional plantation strategy Field observations/ during construction period of two years	Mandatory Compensatory afforestation cost is included in project costs under NHIDCL-NH. Additional compensatory afforestation costs included in civil works costs	Mandatory Compensatory plantation by forest Department and additional plantation by concessionaire	NHIDCL-NH/CSC/ State Forest Department
8. Construction Camps/Working conditions								

8.1 Impact associated with location	▪ All camps should be established with prior permission from PCB. Camps to maintain minimum distance from following: # 500 m from habitation # 500 m from forest areas where possible # 500 m from water bodies where possible # 500 m from traffic route # 500 m from identified wildlife crossing areas	To meet the design Requirement The Water (Prevention and Control of Pollution) Act,1974and its amendments thereof and minimize the environmental impacts due to construction camps activities, discharges and emissions	All construction camps	MI: Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and construction camps PT: Distance of campsite is less than 500m from listed locations	On site observation Interaction with workers and local community/ during construction period of two years	Included in civil works cost	Concessionaire and EO	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
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8.2 Worker's Health in construction camp	▪ The location, layout and basic facility provision of each labor camp will be submitted to CSC and approved by NHIDCL (NH). The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner. ▪ Adequate water and sanitary latrines with septic tanks with soak pits shall be provided. ▪ Preventive medical facilities in camp ▪ Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste The Contractor will take all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides which should comply with local regulations. ▪ No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. ▪ Awareness raising to immigrant workers/local community on communicable and sexually transmitted diseases.	To make sure that the Building and Other Construction workers (Regulation of Employment and Conditions of service) Act 1996 and The Water (Prevention and Control of Pollution) Act,1974 and amendments thereof shall be followed and hygiene in camp shall be maintained	All construction camps	MI: Camp health records Existence of proper first aid kit in camp site Complaints from workers. PT: No record of illness due to unhygienic conditions or vectors. Zero cases of STD. Clean and tidy camp site conditions.	Camp records Site observation Consultation with contractor workers and local people living nearby/ during construction period of two years	Part of the civil works costs	Concessionaire	NHIDCL /CSC
9. Management of Construction Waste/Debris								
9.1 Selection of Dumping Sites	▪ Contractor to submit a waste/spoil disposal plan and get it approved by CSC and EA. ▪ Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality ▪ Unproductive/wastelands shall be selected for dumping sites away from residential areas and water bodies ▪ Dumping sites must be having adequate capacity equal to the amount of debris	To meet design Requirement, MORT&H guidelines and General Conditions of Contract Document and to follow construction & Demolition waste rule, 2016	At all Dumping/Disposal Sites	MI: Location of dumping sites Number of public complaints. PT: No public complaints. Consent letters for all dumping sites available	Field survey and interaction with local people. Review of consent Letter/ during construction period of two years	Included in civil works cost.	Concessionaire .	NHIDCL /CSC

	generated. ▪ Public perception and consent from the village Panchayats has to be obtained before finalizing the location.			with contractor				

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9.2 Reuse and disposal of construction and dismantled waste	▪ The existing bitumen surface shall be utilized for paving of cross roads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. ▪ All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. ▪ Unusable and non-bituminous debris materials should be suitably disposed off at pre-designated disposal locations, with approval of the concerned authority. ▪ The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. ▪ Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.	To meet design Requirement, MORT&H guidelines and General Conditions of Contract Document and to follow construction & Demolition waste rule, 2016	Throughout the project corridor	MI: Percentage of reuse of existing surface material Method and location of disposal site of construction debris PT: No public complaint and consent letters for all dumping sites available with contractor or CSC	Contractor records Field observation Interaction with local people/ during construction period of two years	Included in civil works cost.		
10. Accidents, Traffic Management and Safety								
10.1 Management of existing traffic and safety	▪ Traffic Management Plan shall be submitted by the contractor and approved by the CSC. ▪ The traffic control plans shall contain	To meet design requirement and IRC: SP: 27 -1984, Report Containing	Throughout the project road corridor	MI: Traffic management plan. Presence/ absence of safety signs,	Review traffic management plan Field observation of traffic management	Included in civil works cost.	Concessionaire	NHIDCL /CSC

	details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. ▪ The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.	Recommendation of IRC Regional Workshops on Highway Safety IRC:SP: 32 -1988 Road Safety for Children (5-12 Years Old) in Construction Zones IRC:SP:55-2014 and avoid traffic congestion and safety of workers/road users during construction		traffic demarcations, flag men etc. on site. Complaints from road users. No of accidents PT: No complaints. No accidents due to poor traffic management. Traffic signs, demarcation lines etc. present in appropriate locations on site	and safety system Interaction with people in vehicles using the road/ during construction period of two years			

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
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	▪ On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. ▪ Restriction of construction activity to only one side of the existing road ▪ The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "Engineer". ▪ Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	The Building and other Construction workers Act 1996 and Cess Act of 1996 Factories Act 1948+Section 6 of Employer's Requirement of Bid Document						
10.**2** Pedestrians, animal movement	▪ Temporary access and diversion, with proper drainage facilities. ▪ Access to the schools, temples and other public places must be maintained when construction takes place near them. ▪ Fencing wherever animal movement is expected. ▪ Large number of box culverts has been proposed. .All structures having vertical clearance above 2m and not catering to perennial flow of water may serve as underpass for animals	Same as above	Near habitation on both sides of schools, health centres, religious centres, graveyards, construction sites, haulage roads, diversion sites.	MI: Presence/ absence of access routes for pedestrians. Road signage Number of complaints from local people PT: Easy access to schools, temples and public places. Zero complaints	Field observation Interaction with local people/ during construction period of two years	Included in civil works cost.	Concessionaire	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
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10.3 Safety of Workers and accident risk from construction activities	▪ Contractors to adopt and maintain safe working practices. ▪ Usage of fluorescent and retro refectory signage, in local language at the construction sites ▪ Training to workers on safety procedures and precautions. ▪ Mandatory appointment of safety officer. ▪ All regulations regarding safe scaffolding, ladders, working platforms, gangway, stair wells, excavations, trenches and safe means of entry and egress shall be complied with. ▪ Provision of PPEs to workers. ▪ Provision of a readily available first aid unit including an adequate supply of dressing materials. ▪ The contractor will not employ any person below the age of 18years ▪ Use of hazardous material should be minimized and/or restricted. ▪ Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies. ▪ Accident Prevention Officer must be appointed by the contractor.	Same as above	Construction sites	MI: Availability of Safety gears to workers Safety signage Training records on safety Number of safety related accidents PT: Zero fatal accidents. Zero or minor non-fatal accidents.	Site observation Review records on safety training and accidents Interact with construction Workers/ during construction period of two years	Included in civil works cost	Obligation of Concessionaire	NHIDCL /CSC
10.4 Accident risk to local community	▪ Restrict access to construction sites only to authorized personnel. ▪ Physical separation must be provided for movement of vehicular and human traffic. ▪ Adequate signage must be provided for safe traffic movement ▪ Provision of temporary diversions and awareness to locals before opening new construction fronts.	Same as above	Construction sites	MI: Safety signs and their location Incidents of accidents Complaints from local people PT: Zero incident of accidents. Zero complaints.	Site inspection Consultation with local people/ during construction period of two years	Included in civil works cost	Concessionaire	NHIDCL /CSC

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
11. Site restoration and rehabilitation								
11.1 Clean-up Operations, Restoration and Rehabilitation	▪ Contractor will prepare site restoration plans, which will be approved by the 'Engineer'. ▪ The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. ▪ All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the Environmental officer. ▪ All the opened borrow areas will be rehabilitated and 'Engineer' will certify	To restore the original condition in surrounding	Throughout the project corridor, construction camp sites and borrow areas	MI: Condition of camp, borrow areas and construction sites, Presence/ absence of construction material/debris after completion of construction works on site. PT: Clean and tidy sites. No trash or debris left on site. Site restored and leveled.	Site observation Interaction with locals Issue completion certificate after restoration of all sites are found Satisfactory/ immediately after construction is over	Included in civil works cost.	Concessionaire	NHIDCL /CSC
Operation and Maintenance stage								
1. Ecosystem								
1.1 Anticipated risk of vehicle-animal collision and human-animal conflict	▪ Effectiveness of mitigative measures (rumble strips, informative hoarding /cautionary signage, clearance of shrubs from right of way, maintaining 15m distance between 2 trees during avenue plantation etc.) recommended in design stage shall be monitored. ▪ NHIDCL, Tripura to keep record of all accidents. ▪ Fresh assessment in case of future widening	To minimize vehicle-animal collision and human-animal conflict	No wildlife movement corridor in the project road. However, provision shall be undertaken in the forest area along the project road.	MI: No. of vehicle - animal collision. Time (day or night, season/month and location of collision. Cause of collision. No of incidence of human – animal conflict. PT: minimum vehicle – animal collisions. No of consultation done with forest department	Site Observation Discussion with local People Collection of information from Forestry Department/ during operation period	Included in Operation / Maintenance cost	NHIDCL field offices/Forest Department	
1.2 Vegetation	▪ Planted trees, shrubs, and grasses to be properly maintained. ▪ The tree survival audit to be conducted at least once in a year to assess the effectiveness	To follow Forest Conservation Act 1980 and make sure survival of trees/green cover	Project tree plantation sites	MI: Tree/plants survival rate PT: Minimum rate of	Records and field observations. Information from Forestry Department/ during operation period	Included in Operation / Maintenance cost	NHIDCL /Forest Department	

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
2. Air Pollution								
2.1 Air pollution due to vehicular movement	▪ Roadside tree plantations shall be maintained at least with 70% survival rate. ▪ Regular maintenance of the road will be done to ensure good surface condition ▪ Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken. ▪ Signages shall be provided reminding them to properly maintain their vehicles to economize on fuel consumption. ▪ Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipment's	To meet the requirement of Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981 and minimize the air pollution	Throughout the project road corridor	MI: Ambient air quality ($PM_{2.5}$,PM_{10}, CO,SO_2 ,NO_2) PT: Levels are equal to or below baseline levels given in the IEE report	As per CPCB requirements Site inspection/ during operation period quarterly during dry season	Included in Operation / Maintenance cost	NHIDCL	
3. Noise Pollution								
3.1 Noise due to movement of traffic	▪ Effective traffic management and good riding conditions shall be maintained ▪ Speed limitation to 20 km/hour and honking restrictions near sensitive receptors ▪ Construction of noise barriers near sensitive receptors with consent of local community ▪ The effectiveness of the multi layered plantation should be monitored and if need be, solid noise barrier shall be placed. ▪ Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building near road.	To meet the requirement of Noise Pollution (Regulation and Control) Rules,2000 and amendments Thereof and minimize the noise pollution	All Sensitive receptors (As per Table 5.4 of Chapter 5.) along the project alignment	MI: Noise levels PT: Levels are equal to or below baseline levels given in the IEE report	Noise monitoring as per noise rules ,2000 Discussion with people at sensitive receptor sites/ quarterly during operation period	Included in Operation / Maintenance cost	NHIDCL	

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
4. Land and Soil Pollution								
4.1 Soil erosion at embankment during heavy rainfall.	▪ Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. ▪ Necessary measures to be followed wherever there are failures	To minimize soil erosion during strom	At bridge locations and embankment as well as highland slopes and other probable soil erosion areas.	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site Observation/ during operation period in rainy season	Included in Operation / Maintenance cost	NHIDCL	
5. Water resources/Flooding and Inundation/Sedimentation								
5.1 Siltation	▪ Regular checks shall be made for soil erosion and turfing conditions for its effective maintenance.	To check erosion and minimize siltation	Near all the surface Water bodies	MI: Water quality PT: No turbidity of surface water bodies due to the road	Site observation/ during operation period in rainy season	Included in Operation / Maintenance cost	NHIDCL	
5.2 Water logging due to blockage of drains, culverts or streams	▪ Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams. ▪ Monitoring of water borne diseases due to stagnant water bodies	To meet IRC: SP:21-2009 and avoid water logging	Near surface Water bodies/cross drains/side drains	MI: Presence/ absence of water logging along the road PT: No record of overtopping/ Water logging 70% tree survival	Site observation/ during operation period in rainy seson	Included in Operation / Maintenance cost	NHIDCL	
6. Maintenance of Right of Way and Safety								
6.1 Accident Risk due to uncontrolled growth of vegetation	▪ Maintain shoulder completely clear of vegetation. ▪ Minimum offset as prescribed in IRC:SP:21-2009 to be maintained ▪ Regular maintenance/trimming of plantation along the road side ▪ No invasive plantation near the road.	To meet IRC: SP:21-2009 and improve visibility	Throughout the Project route	MI: Presence and extent of vegetation growth on either side of road. Number of accidents. PT: No accidents due to vegetation growth	Visual inspection Check accident records/ during operation period	Included in Operation / Maintenance cost	NHIDCL	

Source of potential impact	Remedial Measure	Objective	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods/period of management	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
6.2 Accident risks associated with traffic movement.	▪ Traffic control measures, including speed limits, will be enforced strictly. ▪ Further encroachment of squatters within the ROW will be prevented. ▪ Monitor/ensure that all safety provisions included in design and construction phase are properly maintained ▪ Highway patrol unit(s) for round the clock patrolling. Phone booth for accidental reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. ▪ Tow-way facility for the breakdown vehicles if possible.	To meet IRC:SP:55-2014 and provide traffic control measures to minimize accidents	Throughout the Project route	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road Presence/absence of sensitive receptor structures inside the stipulated planning line as per relevant local law PT: Fatal and non-fatal accident rate is reduced after improvement	Review accident Records Site observations/ during operation period	Included in Operation / Maintenance cost	NHIDCL	
6.3.Transport of Dangerous Goods	▪ Existence of spill prevention and control and emergency responsive system ▪ Emergency plan for vehicles carrying hazardous material	To prepare emergency plan for vehicle carrying hazardous chemical/materials	Throughout the project stretch	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records/ during operation period	Included in Operation / Maintenance cost	NHIDCL	

Source: DPR and EIS

Annexure 3

ENVIRONMENTAL MONITORING PLAN

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Purpose of the monitoring	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Air **Pollution**	Construction stage	SPM, PM_{10} $PM_{2.5}$ SO_2, NOX, CO	High volume sampler to be located 50 m from the selected locations in the downwind direction. Use method specified by CPCB	To assess the ambient air quality during the construction stage for comparison with baseline values	Sampling per built up area during active construction as per given numbers of samples- Batching Plant (1), Mahadevtila/Chebri village Dwarikapur, Kalyanpur, Teliamura , BSF camp area, Taidu, Jantrana Para, Tingharia, Rangamati, Chelagangmung, Suknachari Rupachari, Harina Total=**15 locations** (Batching and hot mix plants sampling part of SPCB annual renewal of permits)	**Thrice in a year during construction for 2 years**	Air quality standard by CPCB	15 locations X 3 X 2 X Rs. 10000/sample = Rs. 9,00,000	Concessionaire through approved monitoring agency	NHIDCL/ CSC
	Operation stage			To assess the ambient air quality during the operation stage for confirming improvement in ambient air quality	Representative sample three each for residential, commercial and sensitive (**9 Locations**)-	24 hr continuous, 3/year for 1 year (Total 3 times in a year baring monsoon)	Air quality standard by CPCB	3 X Rs. 10000/sample X 9 locations = Rs. 2,70,000	NHIDCL through approved monitoring agency	NHIDCL /CSC
Water Pollution	Construction stage	Drinking Water (as per IS: 10500-1991)	Ground water criteria for freshwater classification	To assess the water quality during the construction stage for comparison with baseline values	water from **13 locations** including each at construction camps (drinking water) Grab sample collected from source and analysis as per Standard Methods for Examination of Water and Wastewater	3 times in year (except monsoon) for 2years	Water quality standard by CPCB	13 locations x Rs. 5000/sample x 3 x 2 = Rs. 3,90,000	Concessionaire through approved monitoring agency	NHIDCL /CSC

	Operation stage			To assess the water quality during the operation stage for changes if any	Drinking water from **10 locations** (representative)	3 times in a year (except monsoon) for one year	Water quality standard by CPCB	10 locations X 3 X Rs. 5000/sample = Rs. 1,50, 000	NHIDCL through approved monitoring agency	NHIDCL/CSC
	Construction stage	Drinking Water (as per IS: 10500-1991)	Surface water criteria for freshwater classification	To assess the water quality during the construction stage for comparison with baseline values	Water from **8 locations** including each at construction camps (drinking water) Grab sample collected from source and analysis as per Standard Methods for Examination of Water and Wastewater	3 times in year (except monsoon) for 2years	Water quality standard by CPCB	8 samples x Rs. 5000/sample x 3 x 2 = Rs. 2,40,000	Concessionaire through approved monitoring agency	NHIDCL /CSC
	Operation stage			To assess the surface water quality during the operation stage for changes if any	water from **5 locations** (representative)	3 times in a year (except monsoon) for one year	Water quality standard by CPCB	5 locations X 3 X Rs. 5000/sample = Rs. 75, 000	NHIDCL through approved monitoring agency	NHIDCL/CSC
Noise levels	Construction stage	Equivalent Noise levels on dB (A) scale for day and	IS:4954-1968 as adopted by CPCB for Identified Study	To assess the ambient noise level during the construction stage for comparison with baseline values	Same as air quality at **13 locations**	Once in a year for Two years	National Ambient Noise Standard	13 locations X 2 X Rs. 5000/sample = Rs. 1,30,000	Concessionaire through approved monitoring agency	NHIDCL /CSC
	Operation stage	night	Area CPCB/IS:4954-1968Using Noise level meter	To assess the noise level during the operation stage for confirming improvement if any	Same as air quality at **9 locations**	One time per year for 1 year (9 locations)	specified in Environment Protection Act, 1986	Rs. 5000/sample X 9 locations = Rs. 45,000	NHIDCL through approved monitoring agency	NHIDCL /CSC
Soil Quality	Construction Stage	NPK (ICAR standard) and heavy metals	As specified by the site engineer SHAJ/ supervision consultant	To assess soil quality during the construction stage for comparison with baseline values	Labour Camp, Dumping/storage areas and HMP sites **(13 locations)**	Once during whole construction stage	ICAR standard	Rs. 8000/sample X 13 locations = Rs. 1,04,000	Concessionaire through approved monitoring agency	NHIDCL/CSC
	Operation stage	Oil and grease		To assess the soil quality during the operation stage if any spillage occurred	At oil spillage locations and other probable soil contamination location **(Max. 6 locations)**	Once for the first year of operation	CPCB standard	Rs. 8000/sample X 6 locations = Rs. 48,000	NHIDCL through approved agency	NHIDCL /CSC

Soil Erosion	Construction Stage	Visual check for Soil erosion and siltation		To identify the erosion location if any so that corrective action shall be taken appropriately	Cut and fill locations	After first rain	Visual Checks	Included in Engineering Cost	Concessionaire	NHIDCL /CSC
	Operation Stage			To identify the erosion location if any so that corrective action shall be taken appropriately		Once during operation of 1st year	Visual Checks	Routine Engineering Work	Engineering Team of NHIDCL	

Env. Indicators	**Project Stage**	**Parameters**	**Method/ Guidelines**	**Purpose of the monitoring**	**Location**	**Frequency and Duration**	**Standards**	**Approximate cost (₹)**	**Implementation**	**Supervision**
Drainage Congestion	Construction stage	Visual Checks		To identify the drainage congestion location if any so that corrective action shall be taken appropriately	Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	None Specific	Included in Engineering Cost	Concessionaire'	NHIDCL /CSC
	Operation Stage			To identify the drainage congestion location if any so that corrective action shall be taken appropriately		Once in a year before rainy season	None Specific	Routine Engineering Work	NHIDCL	
Borrow Areas	Construction Stage	Visual Checks	IRC guidelines	To follow the IRC guidelines	Borrow areas to be operated	Once in a month	IRC guidelines	Part of the Concessionaire' s quote	Concessionaire with approval from NHIDCL	NHIDCL /CSC
	Operation Stage	Visual Checks	Rehabilitation as per IRC guidelines	To follow the IRC guidelines	Closed Borrow Areas	Quarterly for 1 year			NHIDCL /CSC	
Construction Sites and Labor Camp	Construction stage	Hygiene, drainage Medical Facilities Etc.	Rapid audit as per reporting format	To provide hygienic condition at labour camp	Construction Sites and Camp	Quarterly during construction period	IRC guidelines	Part of the regular monitoring	Concessionaire with approval from NHIDCL	NHIDCL /CSC
Tree Plantation	Construction Stage	Surveillance monitoring of trees felling		To check the number of trees to be felled	Throughout the Project Section	Compensatory Afforestation for 126.2014 ha forest land	As suggested by Forest Dept.	As decided by forest dept.	Compensatory: NHIDCL /Local Forest Departments Additional Plantation: Concessionaire	
	Operation stage	Audit for survival rate of trees plantation		To make sure survival rate shall be maintained	Throughout the Project Section				The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period NHIDCL through Concessionaire will be responsible for monitoring	

Env. Indicators	Project Stage	Parameters	Method/ Guidelines	Purpose of monitoring	Location	Frequency and Duration	Standards	Approximate cost (₹)	Implementation	Supervision
Record of Accident	Construction Stage	Type, nature and cause of accidents. Methodology as suggested by CSC and approved by SHAJ		To maintained the accidents records	Throughout the stretch including construction sites, crusher, diversions, HMP, earthwork, demolition site etc.	occurrence of accidents	As suggested by CSC	Part of the regular monitoring	Concessionaire	NHIDCL /CSC
	Operation stage			To maintained the accidents records	Throughout the stretch	occurrence of accidents	-	-	Road Safety unit of NHIDCL with support from local police	
Wildlife Vehicle Collisions	Construction Stage	Nature and cause of collision, season, Month and time of collision.		To maintained the records	Project road passing through forest land	occurrence of collision	As suggested by forest department	Civil Cost	Concessionaire	NHIDCL/CSC
	Operation stage	1. Success of road furniture's viz. rumble strip, cautionary signages etc. designed for safe movement 2. Nature and cause of collision, season, Month and time of collision 3. Monitoring of movement path based on information available with forest department and local people.		To maintained the records and provide information if any further improvement will be required	Project road passing through forest land	Random all through the year		Operation and Maintenance Cost	NHIDCL in coordination with forest department or through an specialized wildlife expert team	

Source: DPR and EIS

Annexure 4

National Ambient Air Quality Standards

Pollutants	Concentration in ambient Air			
	Average	Industrial, Residential and other rural area	Ecologically Sensitive Area (Notified by Central Government)	Methods of Measurement
SO2 ug/m^3	Annual*	50	20	- Improved West and Geake
	24 hours**	80	80	- Ultraviolet Fluorescence
NO_x ug/m^3	Annual*	40	30	- Modified Jacob and Hochheiser
	24 hours**	80	80	- Chemiluminescence
PM10 ug/m^3	Annual*	60	60	- Gravimetric - TEOM
	24 hours**	100	100	- Beta Attenuation
PM2.5 ug/m^3	Annual*	40	40	- Gravimetric - TEOM
	24 hours**	60	60	- Beta Attenuation
Ozone (O3) ug/m3	8 Hours**	100	100	- UV Photometric - Chemiluminescence
	1 Hour**	180	180	- Chemical Method
Lead ug/m^3	Annual*	0.50	0.50	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
	24 hours**	1.0	1.0	- ED-XRF using Teflon filter
CO ug/m^3	8 Hours**	2000	2000	- Non Dispersive Infra-Red
	1 Hour**	4000	4000	
NH3 ug/m^3	Annual*	100	100	- Chemiluminescence - Indophenol blue method
	24 hours**	400	400	
Benzene (C6H6) ug/m^3	Annual*	05	05	- Gas Chromatography based Continuous Analyzer - Adsorption followed by GC Analysis
Benzo Pyrene-Particulate Phase only ug/m^3	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
Arsenic ng/m^3	Annual*	06	06	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel ng/m^3	Annual*	20	20	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

Source: Gazette of India, Part II-Section -3-Subsection (i)

* Annual Arithmetic Mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval.

** 24-hourly / 8-hourly values or 0.1 hourly monitored values shall be complied with 98% of the time in the year.
However, 2% of the time, it may exceed but not on two consecutive days.

Annexure 5

Drinking Water Quality Standards (as per IS: 10500-1991)

Sl. No.	Parameter and Unit	Desirable Limit	Permissible Limit in Absence of Alternate Source
1.	Colour (Hazen units)	5	25
2.	Odour	Unobjectionable	-
3.	Taste	Agreeable	-
4.	Turbidity (NTU)	5	10
5.	pH	5-8.5	No relaxation
6.	Total Coliforms (MPN/100 mL)	nil	-
7.	Pathogenic Organisms or Virus	nil	-
8.	TDS (mg/L)	500	2000
9.	Mineral Oil (mg/L)	0.01	0.03
10.	Free Residual Chlorine (mg/L)	0.2	-
11.	Cyanide (mg/L as CN)	0.05	No relaxation
12.	Phenol (mg/L C6H5OH)	0.001	0.002
13.	Total Hardness (mg/L as CaCO3)	300	600
14.	Total Alkalinity (mg/L as CaCO3)	200	600
15.	Chloride (mg/L as Cl)	250	1000
16.	Sulphate (mg/L as SO4)	200	400
17.	Nitrate (mg/L as NO3)	45	100
18.	Fluoride (mg/L as F)	1	1.5
19.	Calcium (mg/L as Ca)	75	200
20.	Magnesium (mg/L as Mg)	30	100
21.	Copper (mg/L as Cu)	0.05	1.5
22.	Iron (mg/L as Fe)	0.3	1
23.	Manganese (mg/L as Mn)	0.1	0.3
24.	Zinc (mg/L as Zn)	5	15
25.	Boron (mg/L as B)	1	5
26.	Aluminium (mg/L as AL)	0.03	0.2
27.	Arsenic (mg/L as As)	0.05	No relaxation
28.	Mercury (mg/L as Hg)	0.001	No relaxation
29.	Lead (mg/L as Pb)	0.05	No relaxation
30.	Cadmium (mg/L as Cd)	0.01	No relaxation
31.	Chromium (VI) (mg/L as Cr)	0.05	No relaxation
32.	Selenium (mg/L as Se)	0.01	No relaxation
33.	Anionic Detergents (mg/L MBAS)	0.2	1
34.	PAH (mg/L)	nil	-
35.	Pesticides (□g/L)	Absent	0.001
36.	Alpha Emitters (10^{-6}□c/mL)	nil	0.0001
37.	Beta Emitters (10^{-6}□c/mL)	nil	0.001

Drinking Water Quality Standards (as per WHO)

Parameter	**World Health Organization**
pH	6.5-8.5
Electrical Conductivity	1500 µs/cm
TDS	1000 mg/l
Total Hardness as CaCO3	500 mg/l
Calcium	75-200 mg/l
Magnesium	30-150 mg/l
Sodium	200-400 mg/l
Potassium	12 mg/l
Sulphate	200-400 mg/l
Chloride	200-600 mg/l
NO_3-	10-45 mg/l
Arsenic	10µg/l
Barium	700µg/l
Benzene	10µg/l
Boron	2.4 mg/l
Cadmium	3 µg/l
Chromium	50µg/l
Fluoride	1.5 mg/l
Mercury	6 µg/l
Nitrate	50 mg/l
Selenium	40 µg/l
Tetrachloroethene and Trichloroethene	40µg/l

Annexure 6

Water Quality Criteria and Standards for Freshwater Classification (CPCB, 1979)

Parameters	BOD mg/l	pH	D.O. in mg/l	Oil & Grease mg/l
CPCB standard Class A (drinking water without conventional treatment but after disinfections)	d 2.0	6.5 — 8.5	e 6.0	--
CPCB standard Class B (for outdoor bathing)	d 3.0	6.5 - 8.5	5.0	--
CPCB standard Class C (drinking water after conventional treatment and disinfections)	d 2.0	6 - 9	e 4.0	--
CPCB standard Class D (for propagation of wild life, fisheries)	--	6.5 - 8.5	e 4.0	d 0.1
CPCB standard Class E (for irrigation)	--	6.0-8.5	--	--

'--' Indicates not applicable/relevant

Annexure 7

National Ambient Noise Standards

Area Code	Category of Zones	Limits of Leq (equivalent continuous sound level)in dB(A)	
		Day time*	Night time*
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zone **	50	40

Gazette Notification dated 26th December 1989. It is based on the weighted equivalent noise level (Leq).

* Day time is from 6 am to 9 pm whereas night time is from 9 pm to 6 am

** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and
courts. Use of vehicles horns, loud speakers and bursting of cracking are banned in these zones

These noise standards have been given the status of statutory norms vide Noise Pollution (Regulation and Control) Rules, 2000. However, these rules have changed the periods for 'Day Time' and 'Night Time' to 6 a.m. to 10 p.m. and 10 p.m. to 6 am respectively.

Annexure 8

MANAGEMENT OF CONSTRUCTION PLANTS, EQUIPMENT AND VEHICLES PLANT MANAGEMENT

Purpose

- To ensure that statutory / regulatory requirements are complied with
- To ensure that safeguard measures are taken to avoid / mitigate / minimize environmental impacts

Site selection criteria

Following criteria are to be met wherever possible for crusher and HMP:

- 1.5 km away from settlement, school, hospital on downwind directions
- 1.5 km from any archaeological site
- 1.5 km from ecologically sensitive areas i.e. forest, national park, sanctuary etc.
- 1.5 km from rivers, streams and lakes
- 500 m from ponds
- 250 m from State and National Highway boundary
- away from agricultural land
- preference to barren land

Concrete batching plant should be located at least 200 m from the settlement, preferably on leeward side, whenever possible.

The format for submission of details to the Engineer during finalisation of plant site is given as follows (**Site identification for Plants)**.

Statutory Requirements

- Obtaining Consent-for-Establishment (CFE) under Air and Water Acts from the State Pollution Control Board (SPCB) before start of installation
- Obtaining Consent-for-Operation (CFO) under Air and Water Acts from the State Pollution Control Board (SPCB) before start of commissioning and trial run
- Complying with the terms and conditions laid down in the CFE and CFO, which generally include providing metallic road inside plant campus for movement of vehicles, plantation, periodic (monthly) pollution monitoring i.e. ambient air, noise and stack emission
- The suspended particulate matter contribution value at a distance of 40 m from a controlled isolated as well as from a unit located in a cluster should be less than 600 □g/m^3 or as shall be prescribed by SPCB.
- Obtain certificates from manufacturer for Type Approval and Conformity of Production for Diesel Generator (DG) set/s.
- For DG sets of capacity up to 1000 kVA, the noise level at 1 m from the enclosure surface shall not exceed 75 dB (A).

Pollution control measures

- Dust control measures in stone crusher plant i.e. water sprinkling at primary crusher and secondary crusher, conveyor & return belts, covered conveyor system, chute at outfall of aggregates, cyclone separator, wind braking wall etc.
- For HMP, ensure adequate stack height as stipulated in CFE, install emission control devices such as bag house filters, cyclone separators, water scrubbers etc., as attached with the plant by the manufacturer or stipulated in CFE.
- Prefer bulk bitumen storage with mechanized handling facilities that storage in drums with manual operation at HMP to prevent / minimize bitumen spillage and thereby contaminating soil and ground water.
- Impervious platform for storage of bituminous and other liquid hazardous chemical
- Bag house filter / multi-cone cyclone for emission control. For bag house, cartridge filters reported to be more efficient than fabric filters
- Pollution control measures for Diesel Generator (DG) set i.e. stack height, acoustic enclosure etc.
- Greenbelt along the periphery of plant site.

SITE IDENTIFICATION FOR PLANTS

Construction Stage Report: **One Time** **Date:**

Installed Capacity: **Location of Plant (Ch. & offset):**

Sl. No.	Item / Requirement	Details as per Actual
1	Predominant wind direction	
2	Size and area of the proposed plant site (m xm & Sq.m)	
3	Present land use (barren or fallow land having no prominent vegetation should be preferred)	
4	No dwelling units within 1.5km from the plant boundary in downwind direction	
5	Distance of nearest boundary of State Highways and National Highways (should be at least 250 m from the plant boundary)	
6	Sensitive areas such as religious places, schools/educational institutions, reserved / protected forest, sanctuary etc. within 1.5 km (should be nil)	
7	River/Stream/Lake within 1.5 km and ponds within 500 m	
8	No other trees of girth>0.3m present and will be affected (no tree should be affected)	
9	Width of Haul road (m)	
10	Total Length of Haul Road (km)	
11	Length of non-metal Haul Road (km) (should be as minimum as possible)	

Documents to be attached:

I. Site plan showing wind direction, haul road and other environmental features.

Annexure 9

CAMPSITE MANAGEMENT

Purpose

Campsite of a contractor represents the single potentially most polluting location during implementation of any road project. Air pollution may be caused by emissions from Crushers, Hot-Mix, and Concrete Batching Plants. Water pollution may be caused by discharge of sediment, oil & grease, and organics laden run-off from these plants and their ancillary facilities as well as workshops, residential quarters for the labor. Land may be polluted due to indiscriminate disposal of domestic waste or (accidental) release of hazardous solids from storage areas.

While the installation and operation of Crushers and Hot-Mix Plants are regulated by the respective Pollution Control Boards, the other sources described above usually do not appear to be causes of significant concern. Items to be considered for labor camps are mentioned briefly in Clause 105.2 (as part of 105: Scope of Work) of the Ministry of Road Transport and Highways (MoRTH) publication: Specifications for Road and Bridge Works. Some specific requirements for labor accommodation and facilities are to be met by the Contractor in line with Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. Currently, there is no one-point guidance regarding the environmental management aspects of the Contractor's campsite. This guideline on Campsites is designed to fill this gap.

Scope

This guideline covers the Contractors' camp sites - whether used by in-house crew or by any subcontractors' crew. It covers siting, operation, maintenance, repair and dismantling procedures for facilities for labor employed on project (and ancillary) activities as well as equipment and vehicles. ***It does not include siting, operation, maintenance, repair and dismantling of major plants - Hot-mix Plant, Concrete Batching Plant, Crusher or Wet Mix Macadam Plant.***

Siting, Establishing, Operation and Closure of Construction

Camp Potential Environmental Impacts

Construction camps require large areas for siting facilities like major plants, storage areas for material, residential accommodation for construction labor and supervisors, and offices. Removal of topsoil and vegetation from the land to be utilized for camps is the first direct impact of any such establishment. In addition, local drainage may be impaired if proper drainage is not effected by grading. Other impacts may include damage to ecologically important flora and fauna, if campsites are located close to such areas. Water pollution because of discharge of sediment, fuel and chemicals is also a possibility. Pollution of land due to indiscriminate disposal of construction wastes including scarified pavement, concrete and even substantial quantities of domestic wastes from residential areas can also be potentially disastrous, especially if the site is reverted to its original use after the project (mostly agriculture).

Mitigation Measures

Siting of Construction Camps

The following guidelines will assist the Contractor to avoid any environmental issues while siting construction camps:

- Maintain a distance of at least 1.5 km from boundaries of designated Reserved Forests, Sanctuary or National Park area for locating any temporary or permanent camps.
- Maintain 1.5 km from river, stream and lake and 500m from ponds
- Maintain 250 m from the boundary of state and national highways
- Locate facilities in areas not affected by flooding and clear of any natural or storm water courses.
- Locate campsites in the (most prevalent) downwind direction of nearest village(s). The boundary of the campsite should be at least 1.5 km from the nearest habitation so that the incoming labor does not stress the existing local civic facilities.
- The ground should have gentle slope to allow free drainage of the site.
- Recorded consultations should be held with residents of the nearest settlement and/or their representatives to understand and incorporate where possible, what they would like to see within their locality.

Establishment, Operation, and Closure of Camps

- The facilities within the camp site should be laid out so that the separation distances suggested in other guidelines are maintained. A notional lay-out of the facilities except the major plants is included in this guideline.
- Topsoil from the area of the plant shall be stored separately for the duration of the operation of the camp and protected from being washed away, unless agreed otherwise in writing with the owner. If stored, it will be returned on to its original location at the time of closure of the site.
- The Contractor shall prepare, make widely available (especially to staff responsible for water and material management), and implement a Storm water Management Plan (SWMP) for (all) the site(s) following approval of the same by the Engineer. .
- The Contractor shall prepare an Emergency and Spill Response Plan as per the requirements of Appendix 1 to Clause 501 of Specifications for Road and Bridge Works to cover the spillage of bitumen and/or chemicals like retarders, curing compounds, etc.
- The Contractor shall prepare a Waste Management Plan describing the types and quantities that are likely to be generated from within the camp site, with the period and duration during the construction schedule; methods to be adopted to minimize these; methods of removal, treatment and (on-site or off-site) disposal for each type; as well as location of final disposal site, if any.
- The Contractor shall provide safe ingress and egress for vehicles from the site and public roads and shall not impact existing through traffic.
- Water tankers with sprayers must be available at the camp site at all times to prevent dust generation.

- In case of stockpiles of stored material rising higher than wind-breaking perimeter fencing provided, sprinklers shall be available to prevent dusting from the piles during windy days.
- On completion of works, the Contractor shall restore the site to the condition it was in before the establishment of the campsite, unless agreed otherwise in writing with the owner(s) of the site(s). If such a written agreement has been made, the Contractor shall hand over the site to the owner(s) in accordance with such an agreement.

Equipment and Vehicle-related issues

Potential Environmental Impacts

The maintenance and repair of equipment and vehicles in Contractor's camp are activities that can have significant adverse impacts if not carried out properly. The concern mainly arises from discharge of wash water contaminated with oil and grease, whether from washing of vehicles or degreasing of equipment and vehicle parts. Vehicle washing, especially dirt from tires, also gives rise to sediment-laden run-off. No such discharges should be directly allowed into surface water bodies since they can be harmful to aquatic species.

Mitigation Measures

1. Vehicles

- All vehicles used by the Contractor must have copies of currently valid Pollution Under Control Certificates displayed as per the requirement of the Motor Vehicles Department for the duration of the Contract.
- All vehicles and equipment will be fitted with silencers and/or mufflers which will be serviced regularly to maintain them in good working condition and conforming to the standard of 75dB (A) at 1m from surface of enclosure.

2. Workshop and Maintenance areas

- These areas must have impervious flooring to prevent seepage of any leaked oil & grease into the ground. The area should be covered with a roof to prevent the entry of rainwater.
- The flooring shall be sloped to from both directions to one corner where an oil-and-grease trap with sufficient capacity should be installed. All discharges from the workshop area must pass through the trap to remove the floating oil and grease before entering the drainage system of the site. The trap should be designed to provide a hydraulic residence time of about 20 minutes for the peak hourly discharge anticipated from the area (as per following figure).
- Alternatively, degreasing can also be carried out using mechanical spray type degreaser, with complete recycle using an enclosure with nozzles and two sieves, coarse above and fine below, may be used as shown in the adjacent photograph. This arrangement will require some initial investment and running cost for the pump, but the payback period, in terms of the use of diesel, under Indian conditions, has been reported to be less than 1 year.

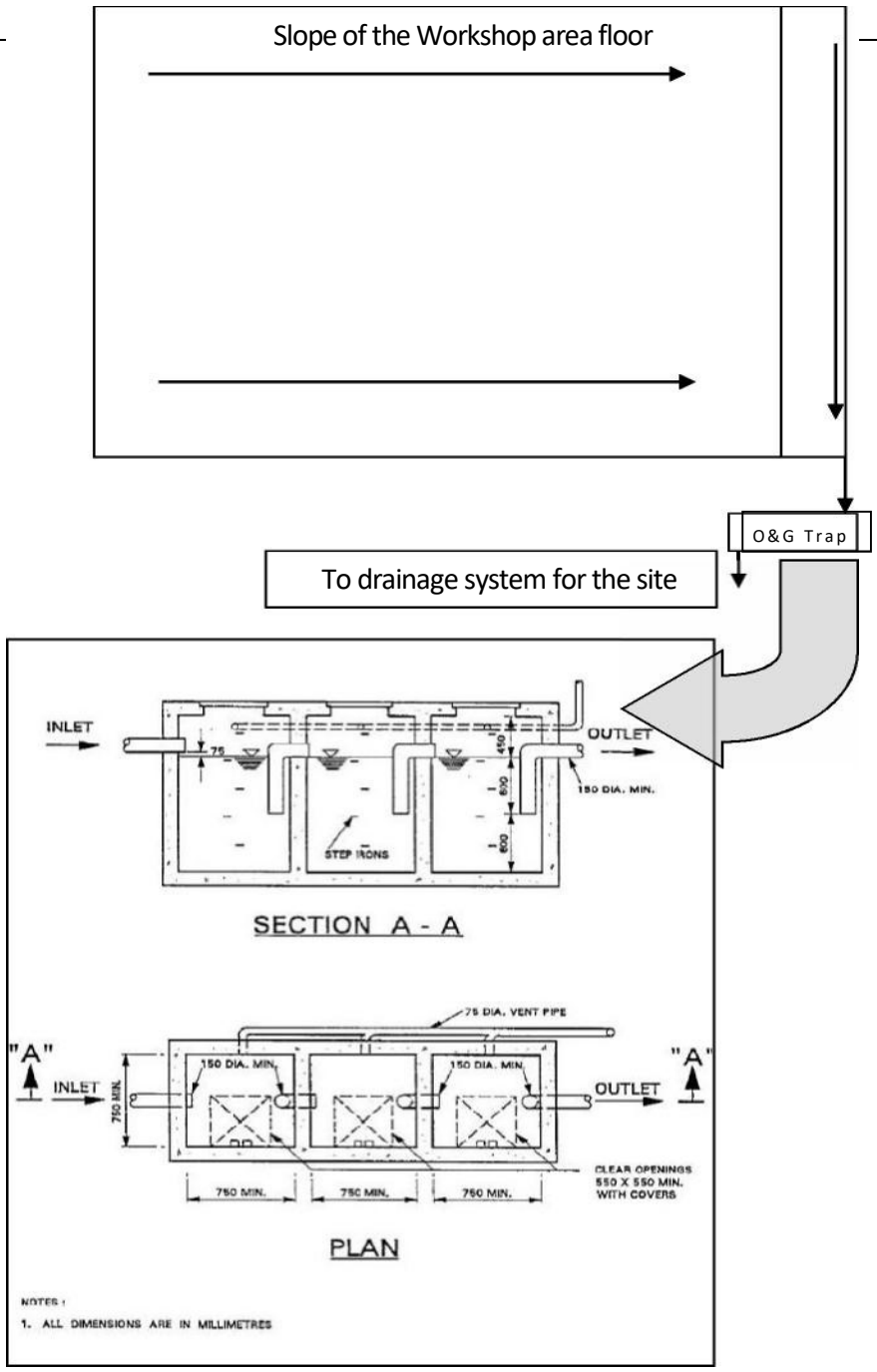
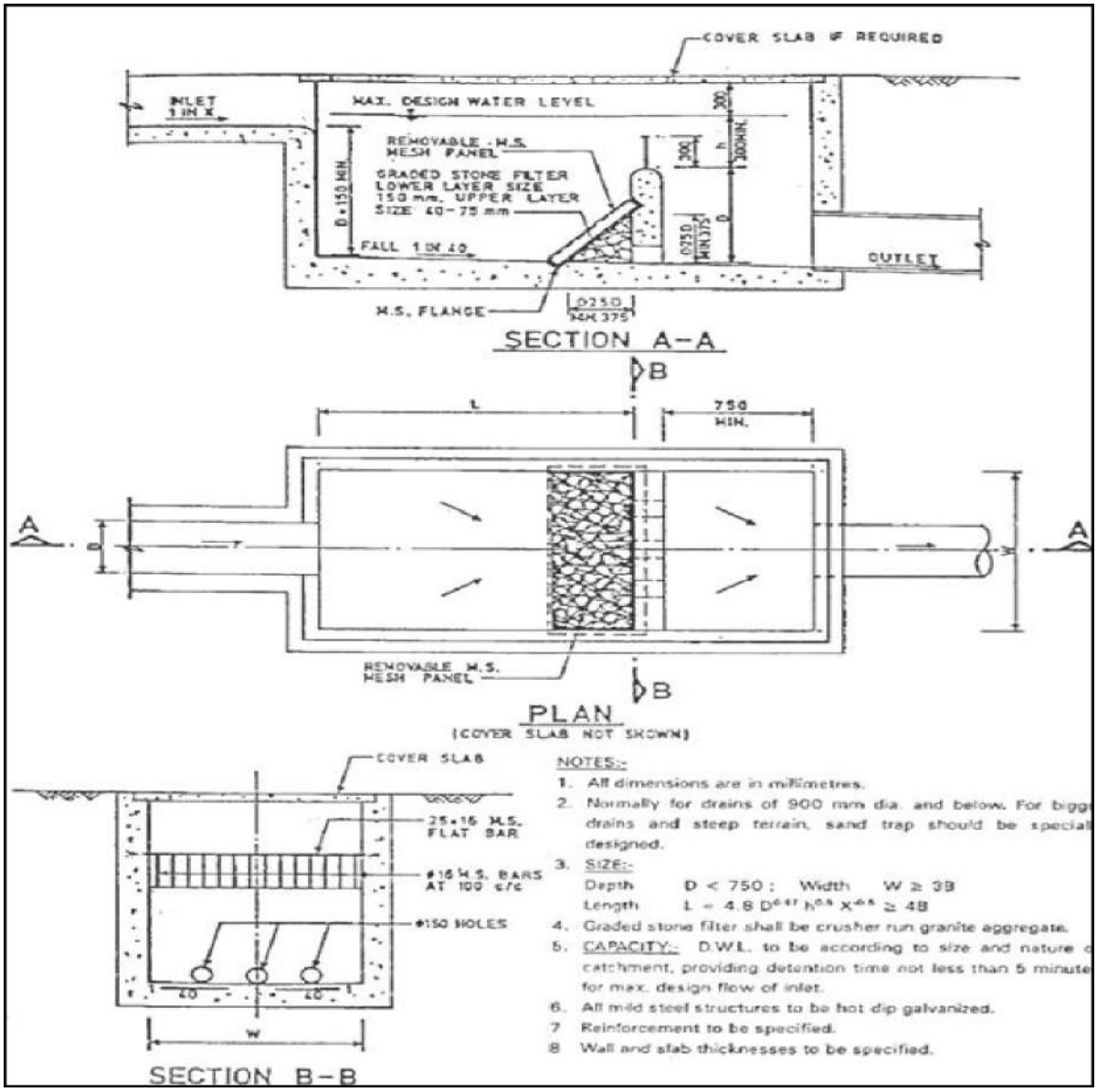


Figure: Workshop Area Pollution Control

- All the waste oil collected, from skimming of the oil trap as well as from the drip pans, or the mechanical degreaser shall be stored in accordance with the Environment Protection (Storage and Disposal of Hazardous Wastes) Rules, 1989. For this purpose, metallic drums should be used. These should be stored separately in sheds, preferably bunded. The advantage of this arrangement is that it allows for accurate accounting in case the waste material is sold to oil waste recyclers or other users like brick-kiln owners who can burn such inferior fuel.

- A separate vehicle washing ramp shall be constructed adjacent to the workshop for washing vehicles, including truck mounted concrete mixers, if any, after each day's construction is over, or as required. This ramp should have an impervious bottom and it should be sloped so that it drains into a separate chamber to remove the sediment from the wash water before discharge. The chamber should allow for a hydraulic residence time of about 10 minutes for discharge associated with the washing of each truck. Following figure shows an outline sketch for a sedimentation chamber.

Figure: Sedimentation Chamber for vehicle washing ramp discharge



Facilities for Labour

Potential Environmental Impacts

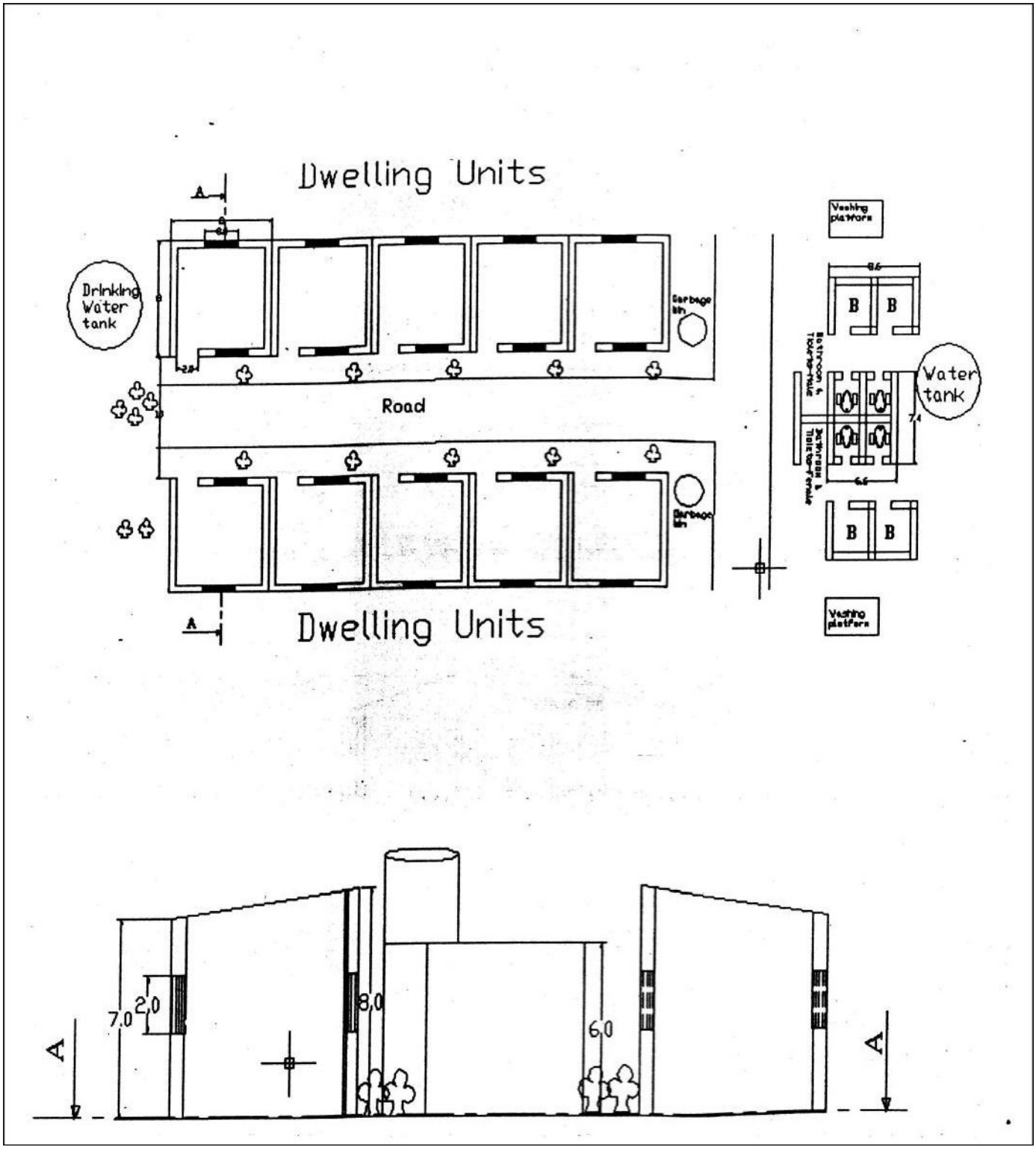
The sudden arrival and relatively longer duration of stay of construction crew can cause substantial strain on the existing infrastructure facilities like water supply, sanitation and medical care, especially in rural areas. Pollution from domestic wastes can affect local sources of water supply and may harm the crew themselves as well as local residents. Improper sanitation and inadequate health care also potential bottlenecks that the Contractor can eliminate with relatively little effort.

Mitigation Measures

It should be emphasized that the Indian Law requires that the Contractor provide several facilities to for the workers as per Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. Some of the provisions described herein are more stringent to act as benchmark for improved environmental performance of road projects:

- The contractor shall provide free-of-charge temporary accommodation to all the labour employed for the project. The accommodation includes separate cooking place, bathing, washing and lavatory facilities. At least, one toilet will be provided for every 35 people and one urinal will be provided for every 20 persons. More toilets and/or urinals may have to be provided if the Engineer decides that these numbers are insufficient. In case female labourers are employed, separate toilet and urinals will be provided in locations clearly marked "Ladies Toilets" in a language understood by most labourers.
- The contractor shall ensure the supply of wholesome water for all the labour, including those employed by any other agency working for the contractor. These locations will be marked "Drinking Water" in the language most commonly understood among the labour. In hot season, the contractor shall make efforts to ensure supply of cool water. No water point shall be located within 15 m of any washing place, urinal, or latrine.
- The contractor shall ensure that adequate cooking fuel, preferably kerosene or LPG, is available on-site. The contractor will ensure that wood/ coal are not used as fuel on the site. Workers need to be made aware of this restriction. In cases where more than 250 labours are employed, canteen facility should be provided by the Contractor.
- A crèche must be provided in each campsite where more than 50 female labourers are employed, whether directly or indirectly, for the project or its ancillary activities.
- Contractor must provide adequate facilities for first-aid treatment at the campsite. A doctor / ambulance should be available on call for the duration of project implementation.
- The contractor shall obtain the approval of the Engineer for these facilities within 30 days of mobilization.

TYPICAL DRAWING OF WORKERS' CAMP SANITARY FACILITY



Annexure 10

MANAGEMENT OF CONSTRUCTION WASTE DEBRIS DISPOSAL

Purpose

- To maximize re-use of material generated during construction and
- To avoid environmental hazards due to improper disposal of construction waste material.

Procedure

The following procedures should be followed for upkeep of storage and disposal sites;

- Contractor shall maintain register for keeping records on kilometer-wise quantities of material generated during grubbing, stripping, excavation and scarifying;
- Contractor shall re-use construction material to the extent possible based on engineering properties. Possible re-use areas are fill sections, embankment slope, village approach roads etc. Debris without bitumen could be used for backfilling of quarry / borrow areas as recommended by the Engineer. At locations identified for dumping of residual bituminous wastes, the dumping shall be carried out over a 60mm thick layer of rammed clay so as to eliminate the possibility of the leaching of the wastes into the ground water. The contractor shall ensure that the filled area is covered with a layer of preserved topsoil layer of preserved topsoil.
- Contractor shall estimate the chainage-wise quantities of various waste material to be disposed of;
- Contractor shall restrict waste disposal strictly at approved site/s only;
- Contractor shall prepare a plan including detailed lay out plan and cross-section for disposal of debris and bitumen waste and get approval of the same by the Engineer;
- Bentonite slurry or similar debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area;
- Contractor and Engineer shall ensure that disposal areas are properly treated as per agreed plan;
- Contractor and Engineer's representatives shall undertake joint weekly inspection to ensure compliance of various environmental requirements.
- Engineer's representatives shall issue non-compliance if disposal site is not managed as per agreed plan;
- All arrangement for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary will be considered incidental to the work and should be planned and implemented by the contractor as approved and directed by the SC.

Site Inspection

Weekly joint site inspection shall be undertaken for all the storage areas. The details of attributes, which are to be inspected, are given as follows. The Contractor shall ensure compliance of the requirements.

Details to be inspected for Monitoring Construction Material Reuse & Disposal

Attributes	Requirements
Construction material generation and re-use	1 Segregating debris and bitumen during generation; 1 Segregating re-usable portion of debris and bitumen and storing preferably near areas of re-use; and 1 Temporary storage of waste material at sites as directed by the Engineer.
Waste disposal	1 Disposal of waste material at approved disposal site within a week of generation; 1 Disposal site should be properly demarcated; 1 Proper leveling / grading at disposal site/s; 1 Recommended / agreed safeguard measures to avoid ground water contamination by leachate from disposal of scarified material are to be implemented; 1 Recommended / agreed safeguard measures to avoid soil erosion are to be implemented; 1 Recommended / agreed plan for surface treatment of waste disposal site/s are to be implement.

Annexure 11

EIA monitoring forms

Pre-construction Phase
1) Land Acquisition
- Including in LARAP
2) Others
- Interviewing affected people about their livelihood

Construction /Operation Phase

Monitoring Item	Monitoring Results during Report Period
ex.) Responses/Actions to Comments and Guidance from Government Authorities	

2 ・Mitigation Measures

- Air Quality（Emission Gas / Ambient Air Quality）

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards*1	Remarks (Measurement Point, Frequency, Method, etc.)
SO2	micro-g/m^3			80 micro-g/m^3/24 hours	
NO2	micro-g/m^3			80 micro-g/m^3/24hours	
CO	mg/m^3			4 mg/m^3/1 hour	
PM2.5	micro-g/m^3			60 micro-g/m^3/24 hours	
PM10	micro-g/m^3			100 micro-g/m^3/24 hours	

*1: National Ambien Air Quality Standard, 2009, The specified values are for Industrial, Residential, Rural and Other Area. 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

- Water Quality（Effluent/Wastewater）

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards*1	International standard*2	Remarks (Measurement Point, Frequency, Method, etc.)
pH	-			6-9	6-9	
SS (Suspended Solid)	mg/L			100	50	
COD	mg/L			250	125	
Total Nitrogen	mg/L			50	10	
Total Phosphorus	mg/L			5	2	
Chlorides	mg/L			1000	-	
Oil and Grease	mg/L			10	10	
Phenols	mg/L			1	-	
Zinc	mg/L			5	-	
Iron	mg/L			3	-	
Copper	mg/L			3	-	
Trivalent Chromium	mg/L			2	-	

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards*1	International standard*2	Remarks (Measurement Point, Frequency, Method, etc.)
Manganese	mg/L			2	-	
Nickel	mg/L			3	-	
Arsenic	mg/L			0.2	-	
Cyanide	mg/L			0.2	-	
Vanadium	mg/L			0.2	-	
Lead	mg/L			0.1	-	
Hexavalent Chromium	mg/L			0.1	-	
Selenium	mg/L			0.05		
Cadmium	mg/L			0.05	-	
Mercury	mg/L			0.01	-	
Temperature	^oC			Shall not exceed more than 5^oC above ambient water temperature	-	
Total coliform bacteria	MPN*3/100mL			-	400	

*1: Treated Effluent Quality Standard, Environment (Protection) Amendment Rule, 2015

Each value shows the maximum permissible value, into inland surface water.

*2: International Finance Corporation (IFC) Environmental Health and Safety (EHS) General Guide Lines, 2007

*3 MPN: Most Probable Number

- Water Quality（ Ambient Water Quality ）

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards*	Remarks (Measurement Point, Frequency, Method, etc.)
pH	-			6.0-9.0	
Temperature	^oC			-	
D.O	mg/L			4	
TSS	mg/L			-	
TDS	mg/L			1500	
Conductivity	µmhos/cm			-	
Turbidity	NTU			-	
Alkalinity	mg/L			-	
Total hardness	mg/L			-	
Calcium	mg/L			75	
Magnesium	mg/L			-	
Nitrate (as NO_3)	mg/L			50	

Chlorides	mg/L			600	
Sulphate	mg/L			400	
Fluoride	mg/L			1.5	
Oil & Grease	mg/L			0.03	
Phenol	mg/L			0.005	
BOD	mg/L			3	
Arsenic	mg/L			0.2	
Mercury	mg/L			-	
Lead	mg/L			0.1	
Cadmium	mg/L			0.01	
Chromium	mg/L			0.05	
Copper	mg/L			1.5	
Zinc	mg/L			15	
Selenium	mg/L			0.05	
Iron	mg/L			0.5	
Total coliform bacteria	MPN*2/100mL			5,000	

*1: Water Quality Standard (IS 2296:1992)

Class C (Drinking water source after conventional treatment and disinfection) is referred.

*2 MPN: Most Probable Number

- Waste

Monitoring Item	**Monitoring Results during Report Period**

- Noise / Vibration

Item		**Unit**	**Measured Value (Mean)**	**Measured Value (Max.)**	**Country's Standards*1**		**International Standard*2**	**Remarks (Measurement Point, Frequency, Method, etc.)**
					Day time (6am-10pm)	Night time (10pm-6am)		
Noise Level	Industrial area	dB (A) Leq			75	70	-	
	Commercial area				65	55	-	
	Residential area				55	45	-	
	Silence zone				50	40	-	

Vibration Level	Category 1: Buildings where vibration would interfere with interior operations	VdB (VdB ref=25.4 micro-mm/S)			-	-	65	
	Category 2: Residences and buildings where people normally sleep				-	-	72	
	Category 3: Industrial land uses with primarily day time use				-	-	75	

*1: Noise: Noise Pollution (Regulation and Control) Rules, 2000

*2: Vibration: Recommended Criteria for Ground-borne Vibration, Federal Transport Authority (FTA), USA, 2006

- Odor

Monitoring Item	Monitoring Results during Report Period

3 · **Natural Environment**

- Ecosystem

Monitoring Item	Monitoring Results during Report Period
ex.) Negative effects/Actions to Valuable species	

4 · **Social Environment**

- Resettlement

Monitoring Item	Monitoring Results during Report Period

- Living / Livelihood

Monitoring Item	Monitoring Results during Report Period

Annexure 12

RAP monitoring forms

Resettlement and Rehabilitation Monitoring Form

TBD

Public consultation attendance sheet **Annexure 13**

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 4/09/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Bachai Bari

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
1.	chandrakumar Munda	Bachaibari	Shop	891 409 6289
2.	Lilmani dev Barma	Bachai Bari	Govt. Job	9857225860
3.	Padha Kuma Dev Barma	Bachai Bari	farmar	—
4.	Bishon Nayek	Bachai Bari	student	—
5.	Bishwambar Dev Barma	"	farmar	8974255229
6.	Bimal Dev Barman	Bachai Bari	Retiremen Govt Job	- 8974938770
7.	Rajkumar Dev Barma	Bachai Bari	Labour	—
8.	Santosh Dev Barma	Bachai Bari	Driver	9402553155
9.	Bindubasi Devnath	parobagai	house wife	—
10	Srimati Munda	Bachai bari	house wife	8914096284
11	Mrinal saha	"	Govt job	9862556319
12	Bishu Munda	Bachai Bari	Labour	—
13.	Jonchon Dev Barma	Bachai Bari	Grossary shop	8807353161
14.	Deep Dev Barma	Bachai Bari	Labour Work	6009773310
15	Birendra Sobar	"	Agriculture work	9366588730
16	Anujan dev Barma	"	Business	9862995018
17	Madan dev Barman	"	Govt Job	8729827737
18	Beer manidev Barma	"	farmar	—
19	Makhon Dev Barman	"	farmar	—
20	Shanti Dev Barma	"	Work	8972333861
21	Subash Nayek	"	Labour-Work	8974353411

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 4/09/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Bachai Bari

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
22	Kalyan Dev Barma	Bachai Bari	Self emply	7085 174757
23	Bisarod Dev Barma	"	Lobour	–
24	Nilkanta Dev Barma	"	Shop	9436919453
25	Kirid Dev Barma	"	Govt. employ	9612632498
26	Nantu Der Barma	"	Self employe	6009576352
27.	Amalendu pal	"	Shop	9612960432
28.	Suren Dev Barma	"	Shop	9612313283
29	pratish Shill	"	Shalon	8974160879
30	Manoran Namashudra	"	Lobour (Rubber)	–
31	Kamal Nayek	"	Self employe	6909038059
32.	Swapan Shill	"	Shalon	8131092787
33.	Manoj Dev Barma	"	work (rubber)	9366960850
34.	Khirud Sabor	"	"	9366102778
35	Ajayrama Das	"	Driver	6033027001

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 4/9/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Community Hall Kalyanpur

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
1	Nilay Sutradhar	Kalyanpur	fast food Shop	7085306037
2	Deepak dey	〃	Student	9862200244
3	Sourik Chandra	〃	〃	8731079619
4	Jairi Kap Chakma	〃	TSR	9862645448
5	Samir Sarkar	〃	TSR	600977[illegible]738
6	Vishvajeet Kar	〃	Govt Servic	8794656625
7	Akul Da Varma	〃	〃	-
8	Sunder dev	〃	P. Job	7640825668
9	Himan Sarkar	〃	Student	8257831546
10	Sanjoy das	〃	〃	7629910021
11	Subrata dev Nath	〃	P. Job	7005825355
12	Chandan Kumar	〃	TBR	9485331560
13	Beena Dev Nath	〃	Housewife	-
14	Maya Rani Dev	〃	〃	-
15	Sushil Da Varma	〃	Govt Job	8787669779
16	Vishvajeet Sheel	〃	farmer	8837343655
17	Manmar Dev Nath	〃	〃	8794111517
18	Reena dev Nath	〃	Shop	6909772992
19	Arti Dey	〃	housewife	-
20	Vishva Jeet Malakar	〃	Bussines	9862439824
21	Rajen Das	〃	P. Service	7641852402

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 4/9/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Kalyanpur

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
22	Radhey Shyam Majumdar	Kalyanpur	Labour	7641805820
23	Bojo Bala majumdar	housewife	housewife	"
24	milan Dev	"	"	
25	kripesh Pal	"	Hardwaer Shop	8014136711
26	Hari Pada Pal	"	vegitabal shop	9089406021
27	Roshan Das	"	Shop	9402575957
28	Nripendra das	"	Shop	
29	Sudhin Pal	"	shop	9862708327
30	manik dev Nath	"	"	8257959524
31	Sudarshan das	"	"	7630937828
32	Sridam das	"	"	8257934131
33	kanudev Nath	"	"	8257959524
	Vijit Pal	"	Shop	7630937942

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 5/09/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Lalgiri

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
1	Indra sadhan Jamatia	Lalgiri	fermar	700567[illegible]541
2.	Gurudayal Jamatia	"	"	6009965092
3.	Bidhan chandra Jamatia	"	"	600908803394
4.	Charan Kumar Jamatia	"	farmar	9606860936
5.	Muni chandra Jamatia	"	Tea shop	6009005229
6.	Rajohari Jamatia	"	Labour	–
7.	Amar Manik Jamatia	"	Meat shop	9863119445
8.	Kwolwi Jamatia	"	Labour	9362086385
9	Amit Jamatia	"	Labour	6909858441
10.	Hriday Jamatia	"	pvt. Job	8353510318
11	Mangal Jamatia	"	Labour	6909468379
12.	Chandra mani Jamatia	"	fermar	7619568718

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 5/09/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Suknachari

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
1	Nurawan Mokhri	Suknachari	Work (Ruber	9378042411
2.	Rajchandra Tripura	"	politics	8730093149
3.	Shibu chakma	"	study	7085575018
4.	Ripon chakma	"	Business	7630035780
5.	Rafru Mog	"	"	81198 10250
6.	Sadhan Tripura	"	Labour	—
7.	Sukamal chakma	"	Shop	9862 7941292
8.	Kalyan Kumar Talukdar	"	study	9612255753
9.	Sudhaong Mog	"	Shop	8974680409
10.	Samir chakma	"	Govt. Job	9862032124
11.	pratul Bikar chakma	"	Work	—
12.	Konchari Mog	"	farmar	—
13.	Krishna Tripura	"	"	—
14.	Gopal Krishna Tripura	"	"	8119937311
15.	Kaja Mog	"	Driver	6909979549
16.	Tarima Mog	"	House Wife	—
17.	Melabu Mog	"	"	—
18	Santa Jibon chakma	~~Vegitables shop~~ "	Vegitable shop	69099846 1
19.	Thingya Mog	"	farmar	8974678868
20.	Konika Mog	"	house wife	—
21.	Sulochona Mog	"	"	—

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 5/09/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Rupaichari. RD Block

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
1.	Apu Adich	Rupaichari	Shop	9862459720
2.	Ranjit Barik	"	Shop	9862890028
3.	Narayan Tripura	"	Auto Driver	9612925240
4.	Anil Tripura	"	Labour Work	8413814800
5.	Seema chuni	"	"	—
6.	Kishor Mokh	"	"	6009058406
7.	Rashal Mokh.	"	"	9366589719
8.	Paritosh Debnath	Sunaichari	"	8837009507
9.	Suktal Debnath	"	"	9612132395
10.	Jagan Chandra deb Barma	"	Sweet shop	8732831404
11.	Bikram Debnath	"	"	9862892504
12.	Sadhan Das	Mohamoni	PWD Contractor	8974652364
13.	Akash Debnath	Rupaichari	Study	9862963691
14.	Liton Debnath	"	Business	9366100958
15.	Nirmal Shill	Chatak chari	"	9615913806
16.	Piroa Lal Debnath	Sonaichari	Farmer	—
17.	Jaulon Debnath	"	Shop	—
18.	Nepal Malla	Chatakchari	cycle shop	8732073584
19.	Nitai jagan Das	Rupaichari	shop	9366792503
20.	Arotie Das	Chatachari	house wife	—
21	Amal Debnath	Rubaichari	Labour	—

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 06/09/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Rupaichari R.D Block

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
1.	Bipul Debnath	Rupaichari	shop	6009125896
2.	Khokon Shaha	"	"	8792039621
3.	Narayan Debnath	Goripath	Govt retirement job	9383268360
4.	Gobindanath Debnath	Rupaichari	shop	9366585823
5.	Suman Debnath	Rupaichari	shop	9366288977
6.	Diptti Nath	Goripah	house wife	7640883630
7.	Jwid Debnath	Rupaichari	shop	9612619498
8	protap Debnath	Goripah	Labour work (Rubber)	9366308212
9.	Hriday Debnath	"	study	–
10.	Bhaktaranjan DeNath	Rupaichari	Business	9366386787
11.	Gautam Bhowmik	chatokhil	"	5612150831
12	Tapan Debnath	Rupaichari	"	9366933435
13.	Arnava Das	Bijay Nagar	Study	8974 197178
14	Dilip Debnath	Harina	Business	9615 758315
15.	Bipul Baidya	Rupaichari	Job (Block)	9862565720
16.	Bikash Lodh	"	Study	8732891935
17	Sanjoy Tripura	Ghatakchari	"	6009692359
18	Dipankar Roy	Rupaichari	Labour	9366202285
19	Rigaj Tripura	Sonaichari	"	8974397137
20	Sukan Badya	Rupaichari	farmer (Rubber)	9383137096
21	Niti Badya	"	house wife	"

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 06/09/20

Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Harina

List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
1	Nikhil chandra Dey	Harina	Shop	7627957053
2.	Ujit Bhumik	Harina	Shop	9862 777 162
3.	Bajon Mallik	Harina	PVt Job	8132008576
4.	Utpal Baidya	"	Work (hardware)	8974980102
5.	Jaganth Bal	"	fermar	8131032095
6.	Haradhan Das	"	"	9610694267
7	Biswajit Debnath	Katatori	Work (Hardware)	6909078399
8.	Hemolal Das	Melagarh	"	—
9.	Debatul Debnath	"	"	—
10.	Abhijit Chakrabarti	Goachar	Hardwareshop	9612071691
11.	Asish Bhaumik	E. Harina	Auto Driver	8794095566
12.	Bishna Karmakar	Udai pur	Business	—
13.	Saikat Dey	Harina	shop	7630071951
14	Basanti Debnath	Sonaichari	house wife	8915808749
15.	Hriday Roy	"	Study	7085859918
16.	Chiranjit Das	Harina	Driver	8787197515
17.	Susanta Das	"	"	8731895477
18	Arati Debnath	"	house work	—
19.	Raki Kumar Tripura	Barkar	Govt Job	—
20.	Sumon Debnath	Harina	Labour Work	8732009903
21.	Dipankar Shill	Harina	Shallon	9562319738

Public Consultation/Stake Holder Meeting Attendance Sheet

Date: 06/09/20

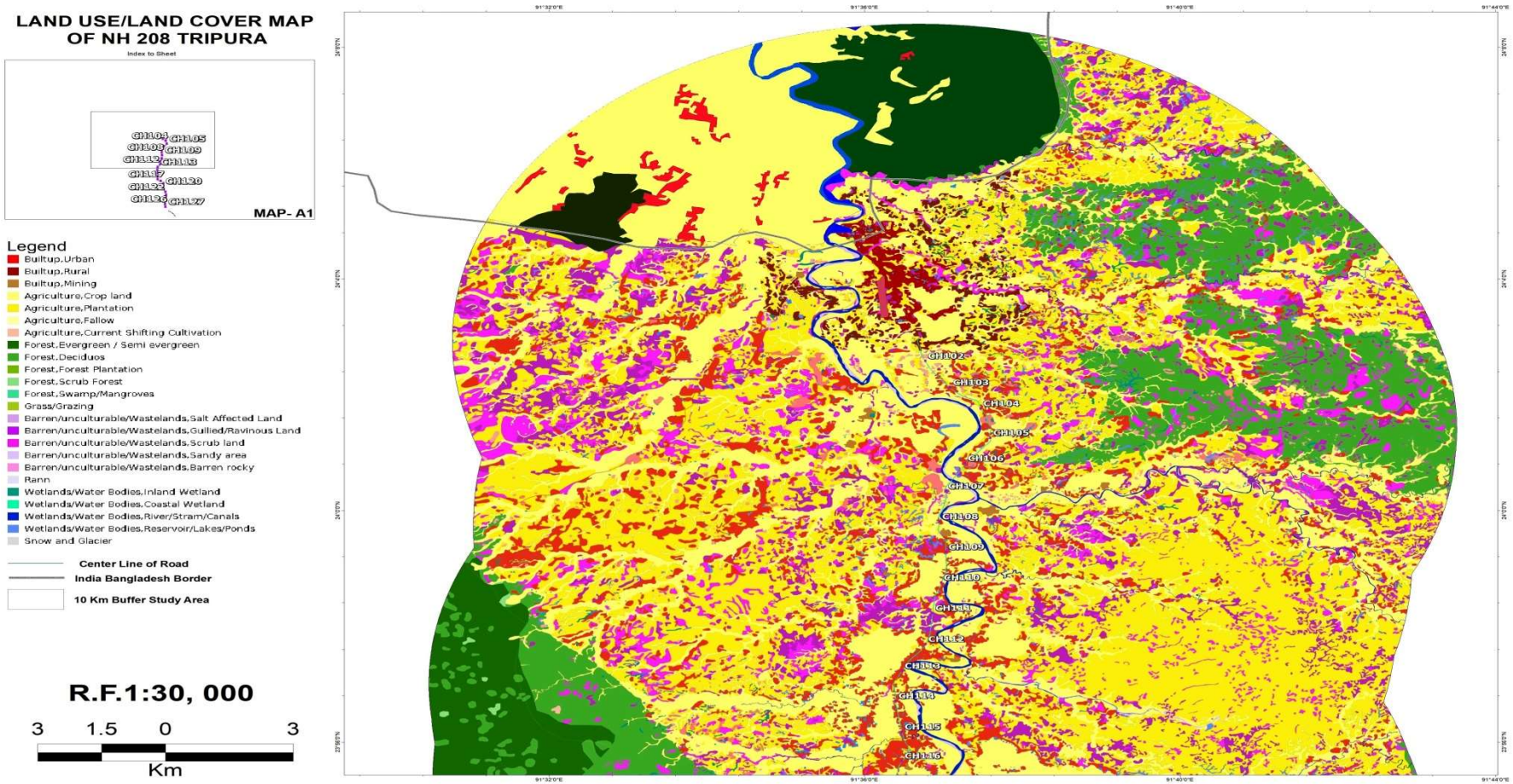
Name of Project: Improvement/Widening of two lane with paved shoulder of Khowai to Sabroom section of newly declared NH – 208.

Location: Harina

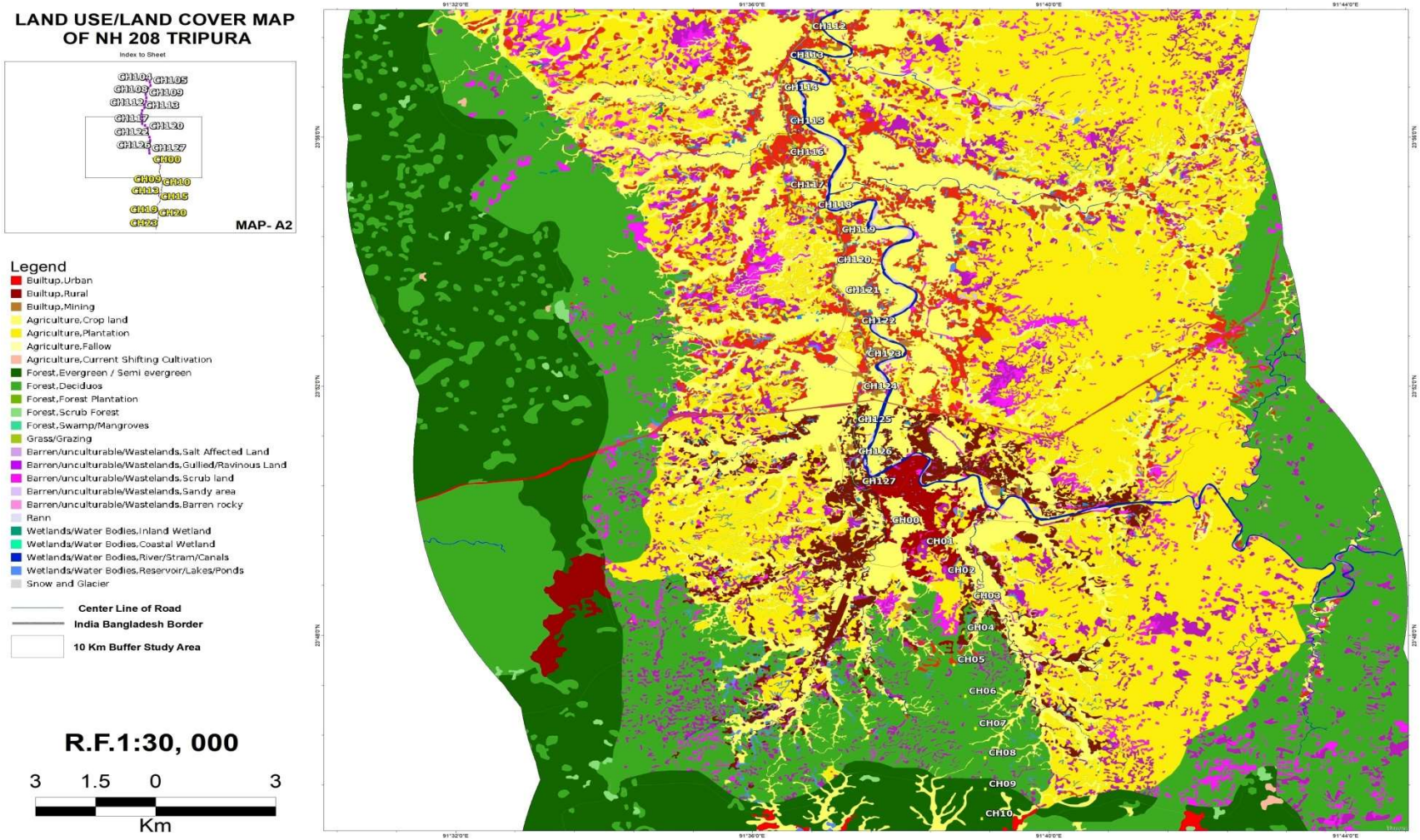
List of Stakeholders/Participant at Public Consultation/ Stake Holder Meeting

S. No.	Name & Father's Name	Address	Occupation	Mobile No./ID detail
22	Joydev Das	Harina	Gov Job.	7628820299
23	Ashim Roy	"	PVT Job.	9862831324
24	Raju Shil	"	Shop	9101106369
25	Nilratan Biswas	"	Driver	9612177710
26.	Sujit Shil	"	Shop	8731075034
27	Anupam Bhowmik	"	Student	9366831278
28	Dinesh Dev nath	"	Shop	9366642764
29	Shajali chakraborty	"	Hotel owner	9862793273
30	Kartik chakraborty	"	Ag	"
31	Gautam Dev nath	"	Shop	8974[illegible]349284
32	Muna Mia	Sonamoda	fish Shop	8575936164
33	Baishar Mia	Udaipur	fish shop	6909266014
34	Nimeiddadda	Sabroom	Shop	8414073564
35	Nakul Debnath	Sabroom	Shop	8974691859
36	Nitusaha	Agartala	Driver	9612494854
37	Pintu Gope	"	Driver	7005348118
38	Kabik Son	Sabrum	Shop	9672346897
39	Amal Dev Nath	"	Ag	—
40	Dulal lodh	Subrum Harina	Shop	9862724152

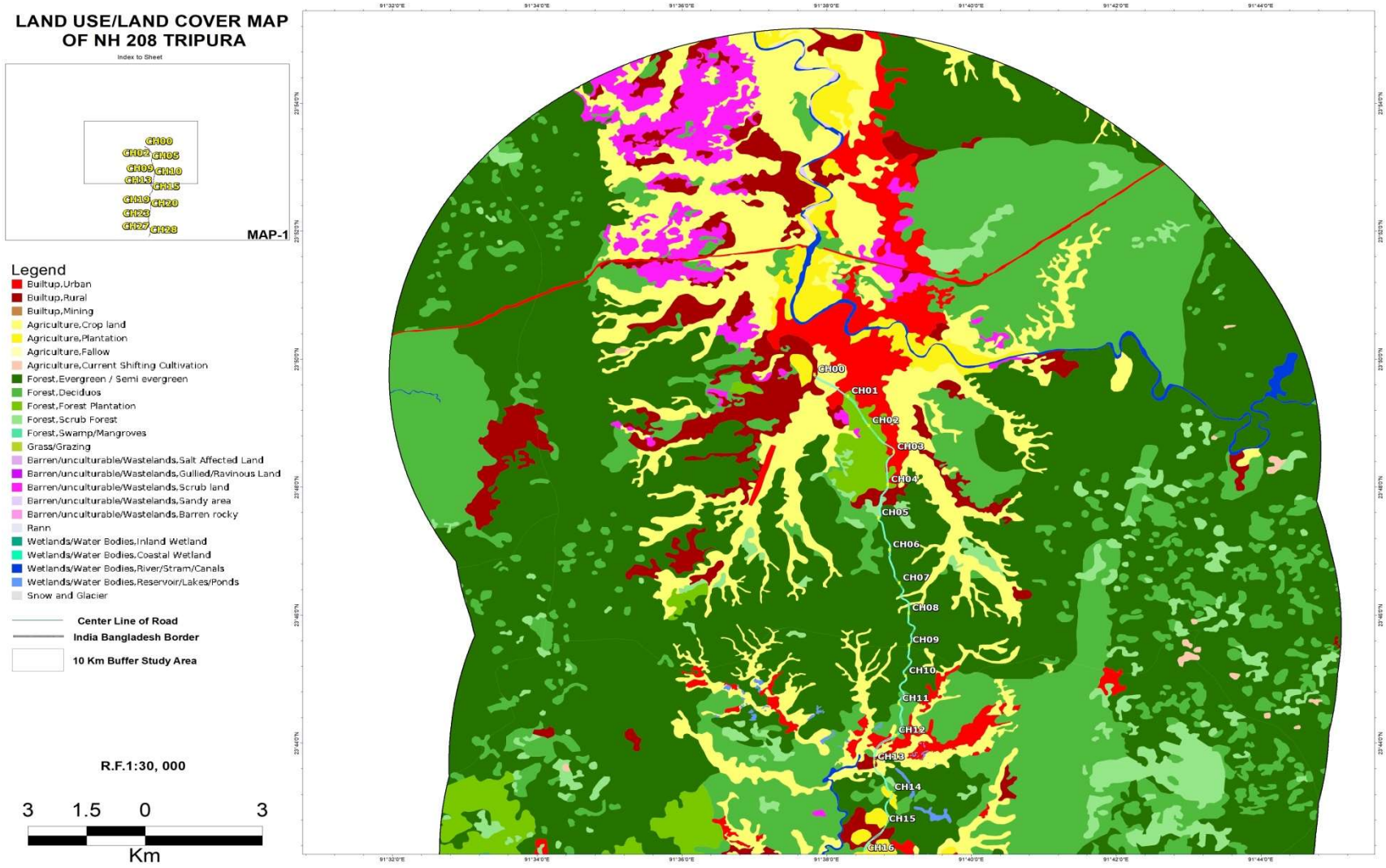
Land use map Breakup **Annexure 14**



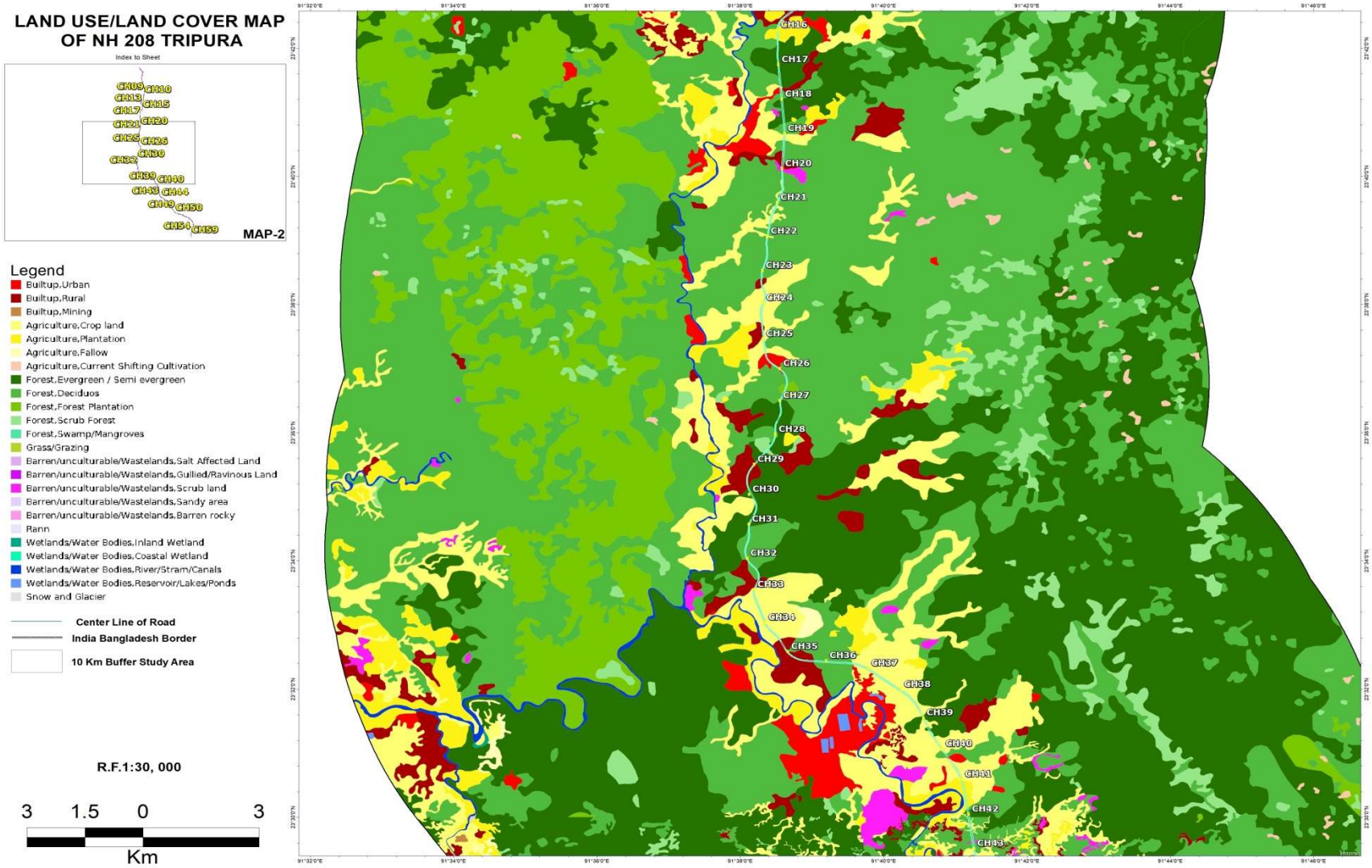
Land use map from CH. 102.00 to CH. 116.00 of section I



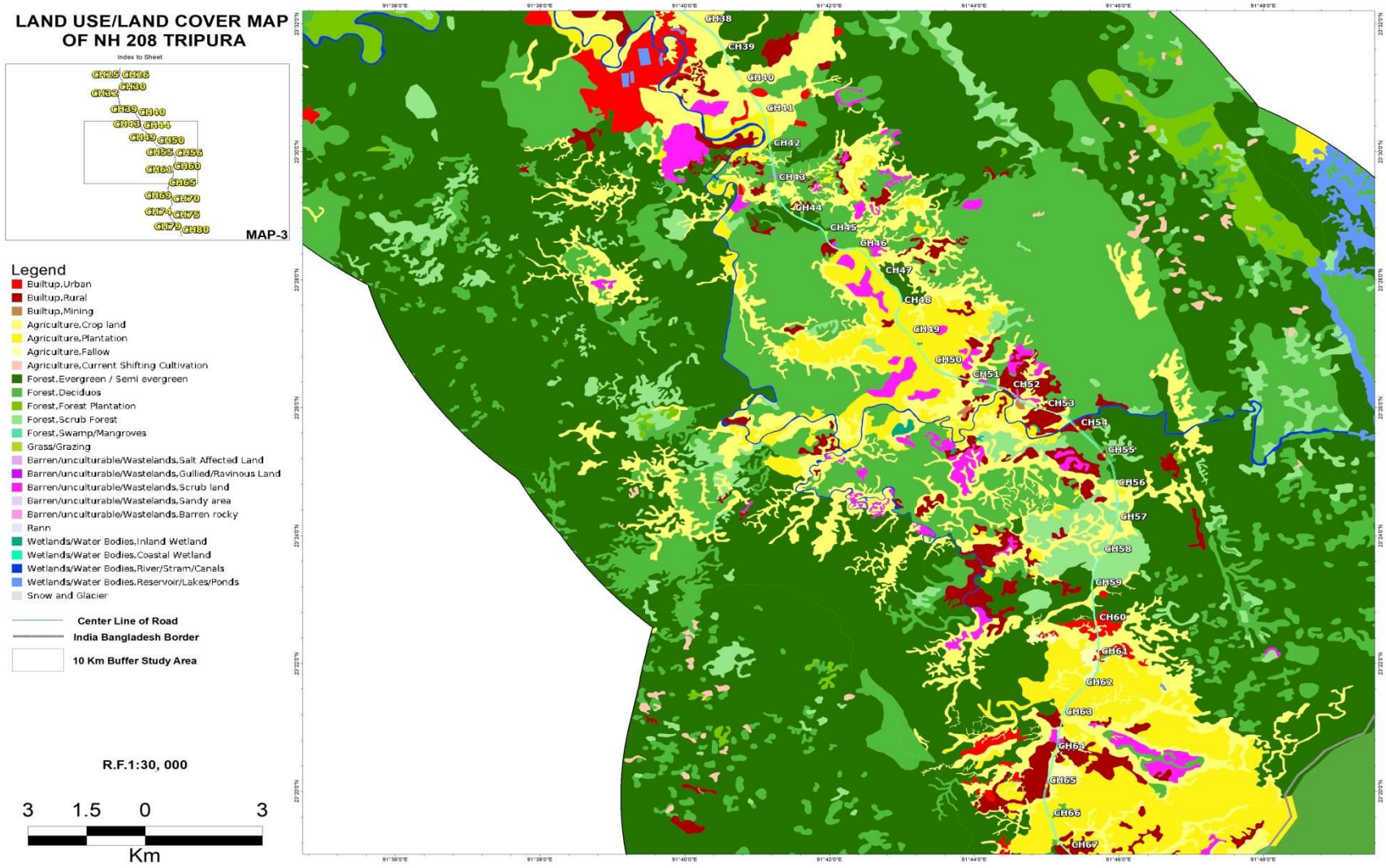
Land use map from CH. 116.00 to CH. 127.00 of section I



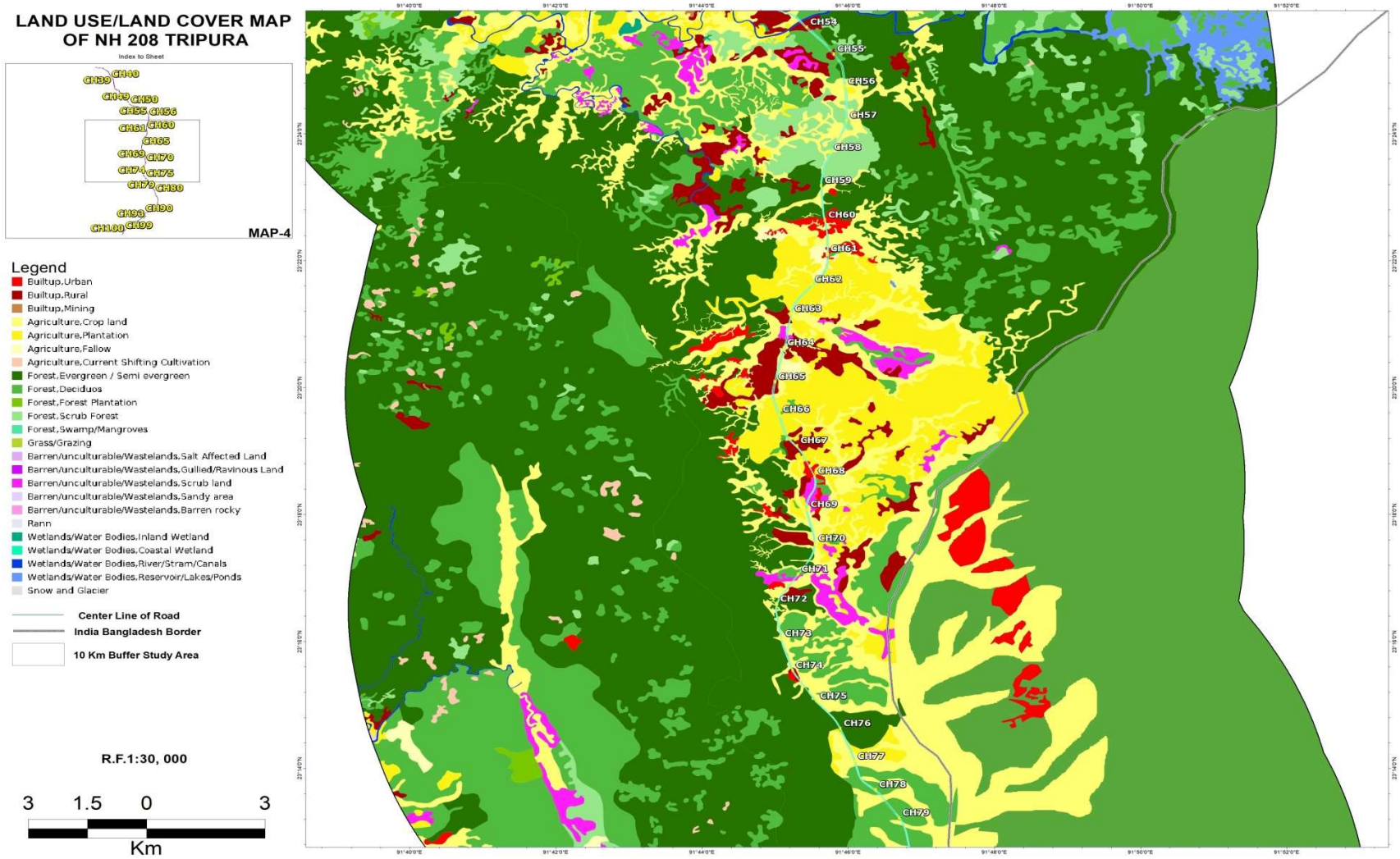
Land use map from CH. 0.000 to CH. 16.00 of section II



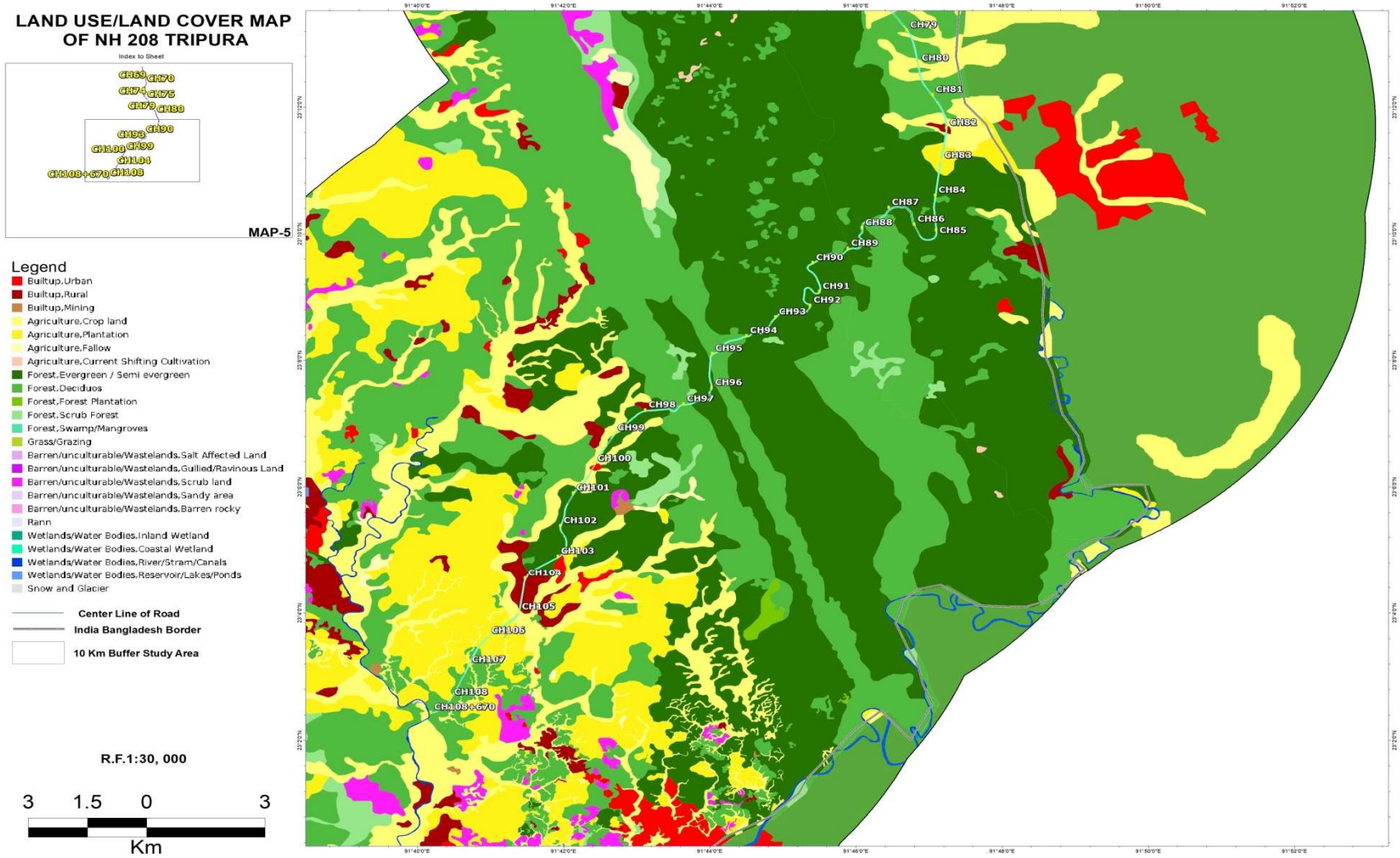
Land use map from CH. 16.00 to CH. 43.00 of section II



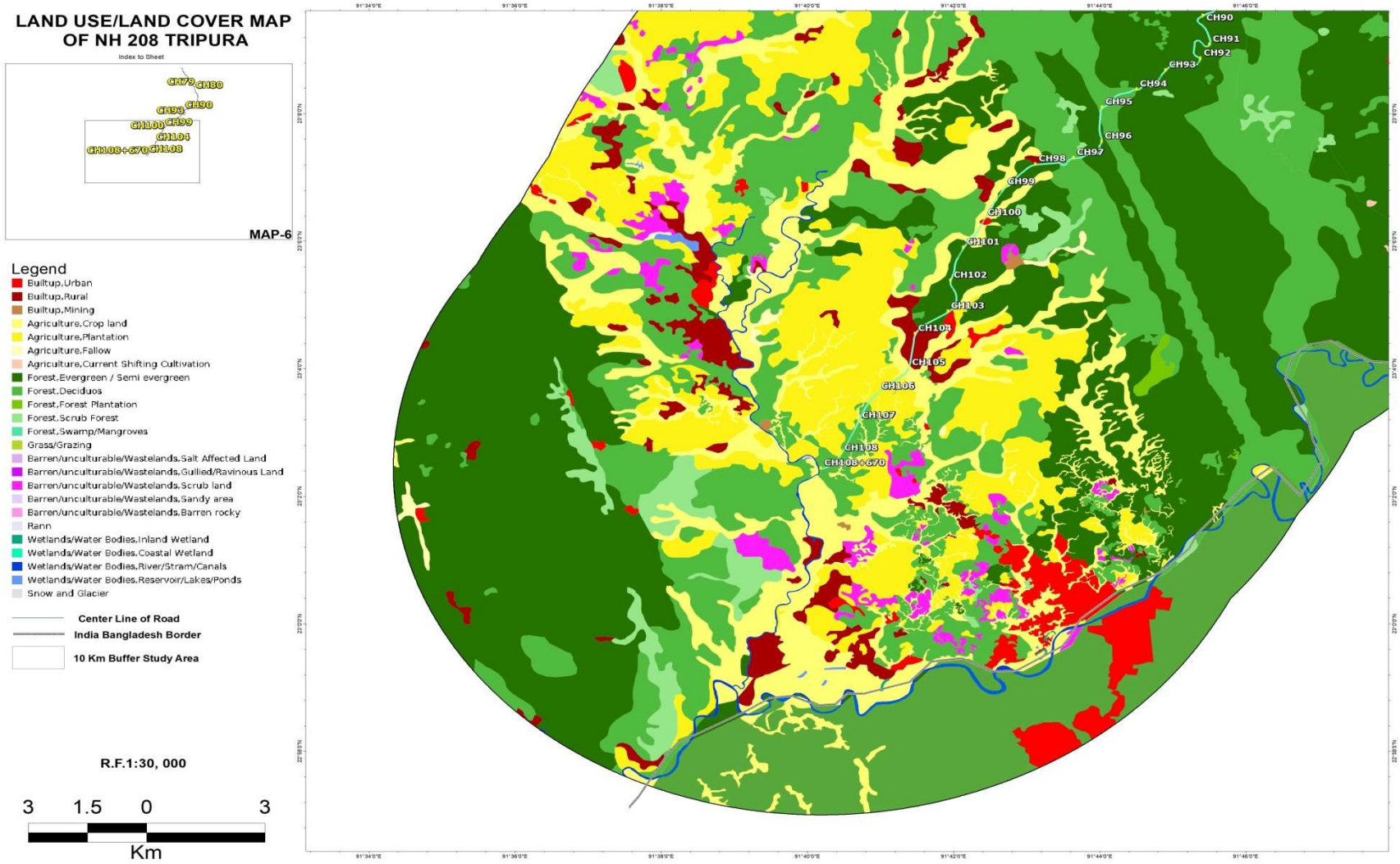
Land use map from CH. 43.00 to CH. 67.00 of section II



Land use map from CH. 43.00 to CH. 79.00 of section II



Land use map from CH. 79.00 to CH. 108.670 of section II



Land use map showing end point of section II