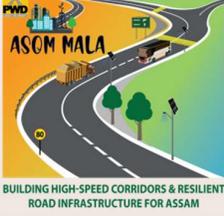


অসম চৰকাৰ



GOVERNMENT OF ASSAM



**ASOM MALA PROGRAM**  
**Government of Assam**  
**Public Works Roads Department (PWRD)**



**Project Title:** Improvement and Upgradation of  
Moran Naharkatia Road  
[Deesang Kinar Bangali to Kathalguri]  
under Asom Mala  
[From Ch. 0+000 to Ch. 23+958]  
(Draft)  
(Revision 2)

# Detailed Project Report

(Environmental Impact Assessment and  
Environmental & Social Management Plan)

September, 2021



## ABBREVIATIONS

AADT	-	Annual Average Daily Traffic
AAQM	-	Ambient Air Quality Monitoring
AIIB	-	Asian Infrastructure Investment Bank
BDL	-	Below Detectable Limit
BOD	-	Biological Oxygen Demand
CGWA	-	Central Ground Water Authority
CO	-	Carbon monoxide
CPCB	-	Central Pollution Control Board
CSC	-	Construction Supervision Consultant
DFO	-	Divisional Forest Officer
DG	-	Diesel generating set
DO	-	Dissolved oxygen
DPR	-	Detailed Project Report
EA	-	Executing Agency
EAC	-	Expert Appraisal Committee
EIA	-	Environmental Impact Assessment
EFP	-	Environment Focal Person
EHS	-	Environmental Health and Safety
EMOP	-	Environmental monitoring plan
ESMP	-	Environmental and Social Management Plan
ESP	-	Environmental and Social Policy
ESS	-	Environmental and Social Standards
FHWA	-	Federal Highway Authority
GHG	-	Greenhouse gas
GIS	-	Geographic information system
GOI	-	Government of India
GRC	-	Grievance redress committee
GRM	-	Grievance redress mechanism
IA	-	Implementing Agency
IMD	-	Indian Meteorological Department
IRC	-	Indian Road Congress
IUCN	-	International Union for Conservation of Nature
MDR	-	Major District Road
MOEF&CC	-	Ministry of Environment, Forests and Climate Change
MORTH	-	Ministry of Road Transport and Highways
NH	-	National Highway
NOC	-	No Objection Certificate
NO <sub>2</sub>	-	Nitrogen Dioxide
PAH	-	Project Affected Households
PAP	-	Project Affected Persons
PAs	-	Protected Areas
PCR	-	Public Community Resources
PCU	-	Passenger Car Units
PD	-	Project Director
PM	-	Particulate Matter
PIU	-	Project Implementation Unit
PMC	-	Project Management Consultant
PMU	-	Project Management Unit
PPM	-	Parts per million



PPTA	-	Project Preparedness Technical Assistance
PUC	-	Pollution under Control
PWRD	-	Public Works Roads Department
R & R	-	Rehabilitation and Resettlement
ROB	-	Road Over Bridge
ROW	-	Right of Way
RSPM	-	Respiratory suspended particulate matter
SEIAA	-	State Environmental Management Unit
SH	-	State Highway
SO <sub>2</sub>	-	Sulphur Dioxide
SOE	-	Safeguard Officer Environment
SOI	-	Survey of India
SPCB	-	State Pollution Control Board
SPL	-	Sound Pressure Level
SPM	-	Suspended Particulate Matter
TA	-	Technical assistance
TDS	-	Total dissolved solids
TSS	-	Total suspended solids
TNM	-	Traffic Noise Model
WB	-	World Bank
WHO	-	World Health Organization
ZSI	-	Zoological survey of India

## WEIGHTS AND MEASURES

dB (A)	-	A-weighted decibel
ha	-	hectare
km	-	kilometer
µg	-	microgram
m	-	meter
MW	-	megawatt
PM 2.5 or 10	-	Particulate Matter of 2.5 micron or 10-micron size



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## Executive Summary

### A. Introduction

This report summarizes the findings and results of the Environmental Impact Assessment (EIA) study carried out for the **A30\_2 Moran Naharkatia Road (Deesang Kinar Bangali to Kathalguri)** road under Axom Mala Program. The report describes existing environmental conditions in the project area, anticipated environmental and social impacts and corresponding mitigation measures, public consultation process, environmental and social management plan (ESMP), and its monitoring plan.

The program is envisaged to improve the SH & MDR network in the next 15 years for fuelling economic growth and bringing the state road infrastructure at par with Southeast Asian countries; provide quality inter-linkage roads between the National Highways and the rural roads network as well as facilitate seamless multi-modal transportation; interconnect economic growth centres with quality developing quality transportation corridors and improve inter-state connectivity. The proposed project is designed to improve transport connectivity in Assam by improvement and upgradation of 1268 Km of State Highways and Major District Roads, out of which 8 project road corridors of 245.7 Km length is proposed under Assam Secondary Road Network Improvement Program (ASRIP) for Asian Infrastructure Investment Bank (AIIB) financing.

This EIA report has been prepared to meet requirements of Asian Infrastructure Investment Bank (AIIB) for financing the project road and it complied with AIIB's Environmental and Social Policy (ESP) and Environmental and Social Standards (ESS).

### B. Description of the Sub-Project

The Project Road **A30\_2 Deesang Kinar Bangali to Kathalguri** is located in the district of **Dibrugarh**, passes through various junctions and spreads over various locations of the district. As per the topographic survey and alignment design the total length of the road is **23.958 Km**. The project road from Deesang Kinar Bangali to Kathalguri traverses through settlements of Deesang Kinar Bangali, Mohamari gaon no.1, Duliajan, Da-Hukuta, Joloni, Padumoni gaon and ends at Bhadoi Panchali in Kathalguri. The roads coming from nearby villages of Thengal, Tiloi Nagar, Sukani, Barbam, Kadamoni, and many others meet the route. The project road has a single lane configuration with conditions varying from poor to fair and certain sections of the road has non-motorised roads. The existing carriageway varies between 5 to 5.4 meters. The Existing RoW varies between 8 meters to 27 meters. It is single lane with paved and earthen shoulders. The proposed RoW varies between 17 to 23 meters.

### C. Categorization of Project

The Project is categorized as Category "B," in accordance with the Bank's Environmental and Social Policy (ESP) and Environmental and Social Standards (ESS). The potentially adverse environmental and social impacts are limited in number and they are limited to the Project area, and can be successfully managed using good practice in an operational setting. As per



AIIB ESP for Category B project an Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) is required. However, in this case an Environmental Impact Assessment (EIA) Report and Environmental and Social Management Plan (ESMP) has been prepared since a separate Social Impact Assessment (SIA) is prepared. The EIA report will examine the project's potentially negative and positive environmental impacts and recommends any measures needed to avoid, minimize, mitigate, or compensate for adverse impacts and improve environmental performance of the Project.

## D. Description of Environment

**Meteorological Conditions:** Dibrugarh has a humid subtropical climate with extremely wet summers and relatively dry winters. Rainfall starts normally in April and continues up to October. As per Statistical Handbook, 2012 it is seen that total rainfall is recorded as 3603.5 mm as against the state total rainfall of 2296.3 mm. The highest rainfall 463.4 mm is recorded in April and July 2011 in the district. The lowest rainfall 20 is recorded in December in the district. The coldest month is January, with an average high-temperature of 22.8°C (73°F) and an average low-temperature of 9.2°C (48.6°F). The warmest month in Dibrugarh is August, with an average high-temperature of 31.8°C (89.2°F) and an average low-temperature of 24.9°C (76.8°F).

**Topography:** The area comprises mainly of plain areas dotted by small hillocks in the extreme southern end. There is no such high hill in the mainland of the region. The region, though has a large number of tea gardens with a flourishing business and several industries based on its rich natural resources the economy of the people is mainly dependent on agriculture. The land which was very much abundant once is now shrinking with the increase of population.

**Soil:** The soil of the district is fertile, acidic, and alluvial. Acidic phosphorous are good for tea cultivation. On the other hand, heavy clays with a high percentage of nitrogen in low lying areas of the district give a better yield of rice. Abundant rainfall and high humidity throughout the year favor the cultivation of tea and rice in the district.. Soil is mostly found as sandy clay loam soil in the sampling locations and it is loaded with a sand percentage which varies from 50.25% to 52.31%. Nitrogen content varies from 1790 mg/1000g to 1860 mg/1000g and is poor in organic carbon content.

**Land use:** The existing land use along the subproject road is mostly semi built-up and patches of rural residential areas. The land use abutting the project road is majorly semi built-up (48.75%). The Built-up and agricultural area is 5.83% and 39.17% respectively.

**Water Resources and Hydrology:** The whole of the drainage of the district ultimately finds its way into the Brahmaputra which flows along the northern boundary of the district. A large number of rivers and their tributaries, streams, and streamlets, locally called Jans flow through the district. The Brahmaputra, Buridihing, Deesang with its tributaries Sessa and Dimna are the important rivers of the district. The project road crosses the Deesang river at Ch. 0+718, Buri Dehing river at Ch. 6+890, Tipling river at Ch. 14+168, and some streams are also observed crossing the alignment.



**Air Quality:** Ambient air quality for particulate matters ( $PM_{10}$  and  $PM_{2.5}$ ),  $SO_2$ ,  $NO_x$  & CO were monitored at Nahorkatia, Chalakataki No. 1, and Padumoni gaon. Ambient air quality parameters are well within the NAAQ standards prescribed by MoEF&CC and WHO air quality guidelines for residential areas and WHO Ambient Air Quality Guidelines (IFC EHS). The maximum concentration of  $PM_{10}$  is  $48.3 \mu\text{g}/\text{m}^3$  found at Padumoni gaon, whereas the maximum concentration of  $PM_{2.5}$  is  $18.2 \mu\text{g}/\text{m}^3$  found at Padumoni gaon. These levels are well within the standards prescribed by MoEF&CC & WHO for  $PM_{10}$  and  $PM_{2.5}$  respectively. Other parameters monitored i.e.  $NO_x$ ,  $SO_2$ , and CO were found within the permissible limits (NAAQS & IFC EHS). Overall, the air quality along the subproject road is not an issue.

**Noise Quality:** Ambient noise levels were monitored at Nahorkatia, Chalakataki No. 1, and Padumoni gaon and are well within the permissible limits for residential areas prescribed by CPCB and World Bank EHS standards of 55 dB(A) and 45 dB(A) for day time and night time respectively. The maximum recorded daytime noise level is 45.3 dB(A) at Chalakataki No. 1 and the night time noise level is 33.4 dB(A) recorded at Padumoni gaon.

**Water Quality:** To represent the true profile of the subproject area, samples from major surface water sources through which the subproject road runs were collected and analyzed as per IS- 3025. Surface water and groundwater samples were analyzed as per IS: 10500-2012.

The pH of the drinking water in the region is well within permissible limits (6.5–8.5). The level of total dissolved solids is found well within permissible limits, which varies from 186.09 mg/l to 194.72 mg/l at Nahorkatia and Duliajon No. 2 respectively. Other parameters analyzed like chloride, sulphate, fluorides are found well within standards. Overall, the groundwater and surface water quality in the project area is good.

**Biological Environment:** The subproject district, in general, have a moderate to low percentage of forest cover. Field surveys have been carried out to identify the number and type of trees to be affected by the proposed improvement work. It is envisaged that **1515** trees existing within the proposed formation width of the subproject road will be felled. Subproject road sections do not pass through any protected area such as Wildlife Sanctuary, National park, or bio-reserve. The nearest protected area from the project road is the Dihing Patkai National Park (recently declared) which is at a distance of 3.6 km (approx.) from the project road. No rare or endangered species are found in the corridor of impact along the subproject road.

**Socio-economic Environment:** As per details from Census 2011, Assam has a population of 3.12 Crores, an increase from figure of 2.67 Crore in the 2001 census. The total population of Assam as per the 2011 census is 31,205,576 of which males and females are 15,939,443 and 15,266,133 respectively. Dibrugarh district has a population of 1,326,335; out of which male constitutes 676,434 and female 649,901 of the total population.

The project road traverses through the settlements of Deesang Kinar Bangali, Mohamari gaon no.1, Duliajan, Da-Hukuta, Joloni, Padumoni gaon and ends at Bhadoi Panchali in Kathalguri. Agriculture is the mainstay of the people. No archaeological and historical monuments are located along the project road. 9 schools and 11 religious structures lie in



the vicinity of the project road; however, these structures will not be affected due to proposed improvement activities under the project.

## E. Key Environmental Impacts

- It is envisaged that 1515 trees within the proposed formation width of the subproject road need to be felled.
- The project road crosses the Deesang river at Ch. 0+718, Buri Dehing river at Ch. 6+890, Tipling river at Ch. 14+168, and some nallahs are also observed crossing the alignment which may get polluted to some extent during the construction stage.
- The project road passes through settlement areas which may cause minor disturbance to the local public due to construction activities.
- There are several sensitive receptors along the project road which may face minor inconvenience due to increased noise because of construction activities.
- The Proposed road widening activities will have an impact on 451 structures.
- The number of projects affected people are 1860 out of which 953 are male and 907 are female.

## F. Public Consultation

In accordance with AIIB's ESP and ESS and Environment Impact Assessment Notification of Gol (2006), public consultations were conducted, as part of the environmental impact assessment study. Public Consultations were carried out at **Golipari** and **No. 1 Salakataki** on **18<sup>th</sup> January 2020** and **Joloni, Da Hukuta, 2 No. Cholakotoki**, and **Deesang Kinar Bangali** on **8<sup>th</sup> November 2020** along the proposed road alignment. A total of **30** participants (**26 Male & 4 Female**) attended the consultation sessions.

Public consultation has been conducted in the project area during the feasibility study as well as during the detailed design stage details is given in Chapter 7. Key issues raised during the consultation are:

- Heavy traffic flows from Digboi and Duliajan
- Accident prevention on critical locations
- Loss of agricultural land
- Safety measures to be implement along the project road
- Safety provisions for road passing near school and hospitals
- Employment opportunities for the locals
- Provision of modern-day facilities
- Road widening activities and loss of shops and homes of the people
- Tree cutting and plantation activities
- Safety provision for road passing through town section
- Bridge maintenance activities to be done in future
- Precautionary measures to be taken during construction activities near river
- Compensation to the project affected people
- Necessity of providing the Naharkatia bypass
- Solution for loss of vegetation
- No wild animal crossing observed along or in near vicinity of the project road
- No migratory birds observed in vicinity of the project road



Most of the people interviewed strongly support the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, boost economic development, and thereby provide direct, or indirect, benefits to themselves. The Draft EIA will be disclosed publicly and communicated to the communities.

## G. Environmental and Social Management Plan

The project road-specific Environmental and Social Management Plan has been formulated which consists of mitigation, monitoring measures, and training to effectively execute the management plan. The detailed ESMP is given in **Chapter 9** of this report. An ESMP budget of **INR 27,002,417** has been estimated in **Table 86 & Table 87** for the implementation of the environmental and social management plan. The project will have one grievance redressal mechanism for social and environmental issues comprising a village level and district level committee. The nodal officer under a project implementation unit will be the key person to coordinate the receiving of complaints and addressing them.

Road aesthetics will be improved after tree plantation, landscaping of embankment slopes, improving the road cross-sections, side drains, installation of safety signage, crash barriers, and road markings. The aesthetics will further be improved due to the enhancement of ponds and a few schools and hospitals along the road.

### Environmental and Social Monitoring Programme

A comprehensive monitoring plan has been prepared for all stages of the project. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost, and responsibility for implementation and supervision. Construction Stage Monitoring to be carried out by the contractor under the supervision of the construction supervision consultant (CSC).

Monitoring will focus on air, water, noise and soil erosion, drainage congestion, and compensatory tree plantation. For tree plantation, the survival rate of re-plantation shall be monitored for one year of the operation phase.

### Institutional Arrangement and Capacity Building

The Government of Assam's Public Works Roads Department (PWRD) will be the executing agency. The Chief Engineer (EAP) will be the Project Director (PD) of state level Project Management Unit (PMU). PD PMU will be assisted by an Assistant Executive Engineer as Nodal Officer of Asom Mala Program.

The PMU will oversee overall execution and technical supervision, monitoring, and financial control of the project. The PMU will be supported by CSE and/ or Program Coordination and Management Consultant (PCMC). The institution Arrangement and Capacity building is discussed in Chapter – 9, Section 9.7.

To enable PWRD officials to implement environmental safeguard requirements effectively, a training program will be conducted for the PWRD Environmental and Social Safeguard expert to improve environmental and Social awareness, construction practices, legislative compliance requirements, ESMP, and EMoP requirements, and roles and responsibilities.



## H. Conclusions and Recommendation

The findings of the Environment Assessment show that overall, the project has limited and short term adverse Environmental Impacts. Effective ESMP implementation will ensure the elimination and minimization of identified adverse impacts. PWRD shall ensure that ESMP and EMoP are included in the Bill of Quantity (BOQ) and will form a part of the bid document and works contract. If there is any change in the project design the ESMP and EMOP will be accordingly modified. PWRD officials shall need capacity building and practical exposure. Adequate training shall be imparted as proposed under the environmental and social management plan to enhance the capability of concerned PWRD officials.



# 1. Introduction

## 1.1 Sub-Project Background and Rationale

The state of Assam is one of the seven North-eastern states of India located at the south of eastern Himalayas along the Brahmaputra and Barak river valleys. Assam has an area of about 78,443 sq. km and a population of about 3.09 crores. The state of Assam has about 2,530 km of State Highways (SH) and 4,379 km of Major District Roads (MDR) which are being maintained and managed by the Public Works Roads Department (PWRD), Government of Assam (GOA). The GOA has embarked upon the ASOM MALA to objectively develop the SH & MDR network of the State and is planned to be an umbrella program that would have several projects under it funded from various sources.

Public Works Roads Department, Assam has undertaken the project for improvement of State Highways and Major District Roads in the next 15 years under Asom Mala. The road network development work will involve reconstruction and widening of roads with long design life, geometric improvement to bring it to proper standards, improved drainage along the roads, improving shoulders and providing paved shoulders wherever necessary, road safety improvement, etc.

The proposed project is designed to improve transport connectivity in Assam by rehabilitating and upgrading 1268 Km of State Highways and Major District Roads, out of which 8 project road corridors of length of 245.7 Km is proposed under ASRIP for AIIB financing.

The project road is located in Dibrugarh District and proposed for improvement and upgradation by GoA under AIIB funding. It is an important road connecting NH 37 (at Moran), NH 315A (at Duliajan), NH 38 (at Digboi), important towns and settlements, tea estates (*Dibrugarh is known as the Tea City of India*), Kathalguri Gas base Power Plant and Digboi Refinery. The project road is important for socio-economic development of the region, connectivity with districts of Dhemaji, Jorhat, Tinsukia, Sivasagar and further connectivity to the states of Nagaland. The project road is related to overall objectives of Asom Mala Program and AIIB financing. It is proposed for geometric improvements and widening to two lanes. The roads will have a top width of 12m, consisting of 7m carriageway with 1.5m paved shoulder on either side, along with 1m earthen shoulder on each side.

The project road is aimed at improving connectivity facilitating safer and more efficient access to livelihood and socio-economic opportunities for the local communities in the region. It will promote equitable growth through sustainable agriculture and rural development. The existing single-lane facility is inadequate to cater to the traffic demand and satisfactory user experience. The mentioned road stretch passes through major junctions and spreads through the remote location of the Dibrugarh District. The project road traverses through the settlements of Deesang Kinar Bangali, Mohamari gaon no.1, Duliajan, Da-Hukuta, Joloni, Padumoni gaon and ends at Bhadoi Panchali in Kathalguri. The improvement works will provide better access to the residents of the nearby villages to market places in Nahorkotia and Duliajan and better connectivity to NH2, NH215, Nh315A,



SH24, and SH27. The project road corridors proposed under ASRIP for AIIB financing is given in **Table 1** and the location of these project road corridors is shown in **Figure 1**.

**Table 1: Project Road under ASRIP proposed for AIIB Funding**

Sr. No.	Corridor	Road improvement and upgradation works	District Name	Length (km)
1	A31	Balichapori, Majuli to Bhogalmara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river	Lakhimpur & Majuli	19.2
2	A15	Dhodar Ali (Kamargaon to Kamarbandha)	Golaghat	42.1
3	A07	Sarthebari Rampur Pathsala Raipur Road	Barpeta & Bajali	17.7
4	A22	Dhakuakhana Butikur Tiniali Telijan	Lakhimpur & Dhemaji	32.7
5	A30_1	Moran Naharkatia Road (Moran to Deesang Kinar Bangali)	Dibrugarh	46.6
6	A30_2	Moran Naharkatia Road (Deesang Kinar Bangali to Kathalguri)	Dibrugarh	24
7	A20_1	Sivasagar to Chumoni	Sivasagar	18.4
8	A20_2	Balighat Tiniali to Nakachari	Sivasagar & Jorhat	45
<b>Total</b>				<b>245.7</b>



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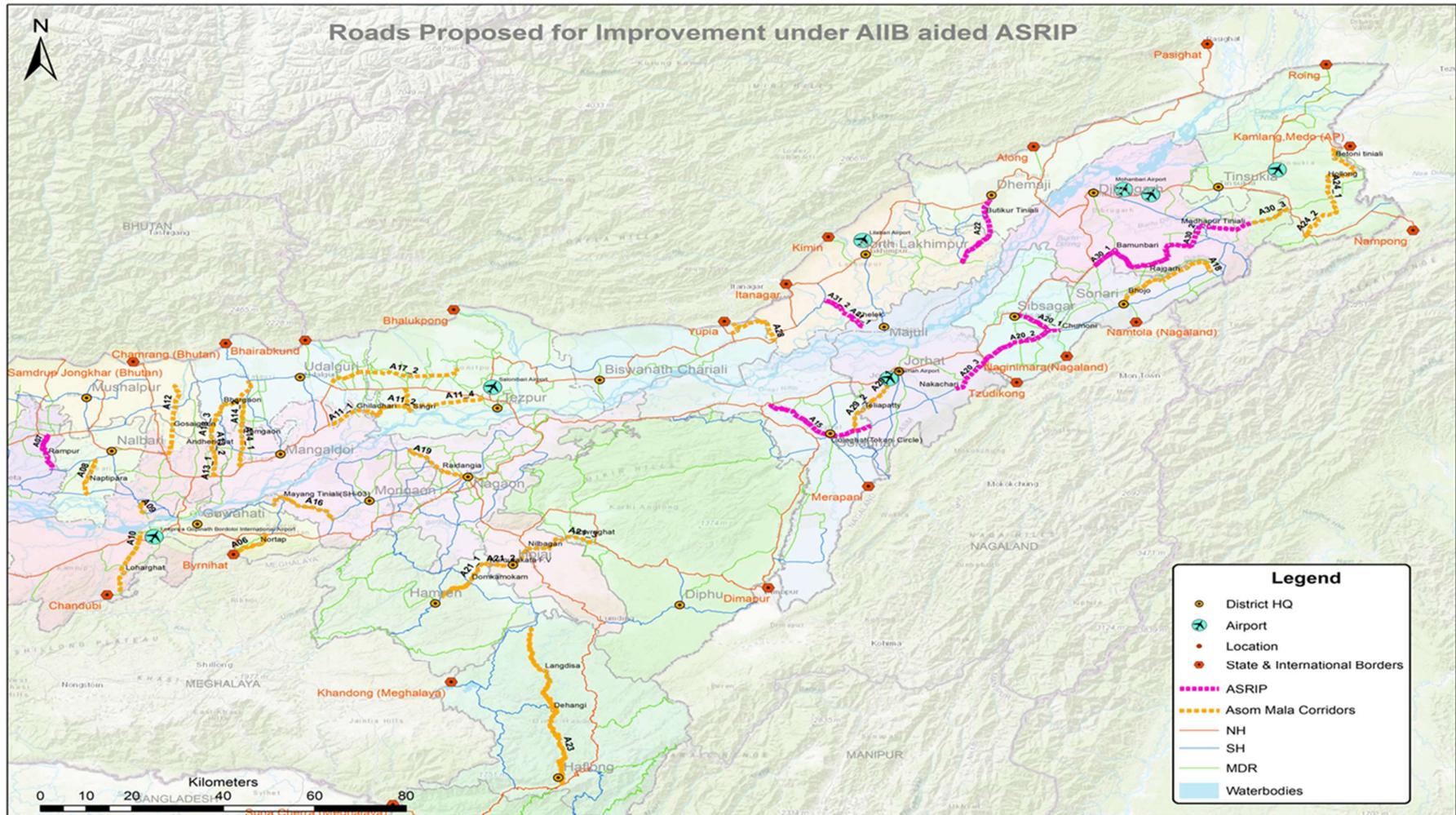


Figure 1: Location of Project Road under ASRIP proposed for AIIB Funding



## 1.2 Nature, Size and Location of the Project

The project road **A30\_2 (Deesang Kinar Bangali to Kathalguri)** originates at Deesang Kinar Bangali and ends at Bhadoi Panchali in Kathalguri. The Project Road is connected with the Assam Oil Company Limited (AOD) which is at Digboi. The Dehing river which is a large tributary of the Brahmaputra river, about 380 km long flows through the northern side of the project road and crosses the alignment through the proposed Bypass. The roads coming from nearby villages connect the proposed project road at various locations. There is a railway crossing between Duliajan and Naharkatia and it connects railway stations like Moran, Naharkatia, and Duliajan. There are also many other religious places, Tea Gardens, and schools alongside the proposed project road. Highways like NH2, NH215, Nh315A, SH24, and SH27 have connectivity to the project road. The alignment experiences a high number of agricultural activities. The entire stretch of the proposed project road is in the north-east direction.

The project road from Deesang Kinar Bangali to Kathalguri traverses through settlements of Deesang Kinar Bangali, Mohamari gaon no.1, Duliajan, Da-Hukuta, Joloni, Padumoni gaon and ends at Bhadoi Panchali in Kathalguri. The roads coming from nearby villages of Thengal, Tiloi Nagar, Sukani, Barbam, Kadamoni, and many others meet the route.

The existing carriageway varies between 5 to 5.4 meters. The Existing RoW varies between 8 meters to 27 meters. It is single lane with paved and earthen shoulders. The proposed RoW varies between 17 to 23 meters. It is proposed for geometric improvements and widening to two lanes. The roads will have a top width of 12m, consisting of 7m carriageway with 1.5m paved shoulder on either side, along with 1m earthen shoulder on each side. Footpath and concrete drains are provided in built-up areas.

## 1.3 Objective and Scope of the Study

Development of any road requires land acquisition; mainly agricultural land needs to be diverted for such projects. Therefore, any such change in land use patterns may result in deterioration of soil, water, and other environmental aspects. Such projects also cause air and noise pollution especially during the construction stage on account of heavy machinery and haul vehicles. The loss of ecology is an important impact of such projects.

The Environmental Impact Assessment (EIA) consists of the study, describing the current status of the environment in the project area (before the commencement of project), identification of potential impacts and its mitigation methods and formulation of an environmental and social management plan to be followed during construction and operation phase of the project. An Environment Impact Assessment study is hence an important tool to identify and handle the issues concerned with the environment that would arise due to such projects.

Preparation of EIA and implementation of all environment safeguards requirement is in accordance with relevant policies and regulation of the Government of India, Government of Assam, and the AIIB's Environmental and Social Framework.



This EIA addresses the environmental management requirements of the Government of India (GOI) and the Asian Infrastructure Investment Bank. Various agendas covered in this study are as follows.

- Provides information about the baseline environmental setting of the subproject;
- Provides information on potential environmental impacts of the proposed subproject activities with its magnitude, distribution, and duration.
- Provides information on required mitigation measures with cost to minimize the impacts.
- Analyses the alternative options considering alternative locations, designs, management approaches for selection of most feasible and environmentally acceptable options.
- Provides details of stakeholder's consultations.
- Designs an environmental and social management and monitoring plan with institutional measures for effective implementation of mitigation measures proposed and addressing grievances.

The environmental studies have been limited to the situation around the deemed areas of direct influence caused by constructional and operational facilities along the proposed road sections. The EIA was based on proposed road alignment and key construction activities such as site clearing, removal of trees, excavation, filling, grading and embankment formation, excavation for utility trenches, subgrade preparation, base course and asphalt overlay, shoulder, and construction of permanent structures like retaining walls, culverts, and drains. The EIA also covered ancillary activities like campsite establishment and maintenance, sourcing of materials, and operation of equipment like rock crusher and hot mix plant. The corridor of impact is taken as 10 meters on either side of the alignment. However, the study area impact zone is considered up to 5 km on both sides of road alignment to allow for coverage of indirect and induced impacts and a larger analysis of land use and other environmental features. Assessment is carried out on the following environment components: terrestrial and aquatic ecology, soil, water, air, noise, and socio-economic aspects.

## **1.4 Methodology Adopted for Environmental Impact Assessment Study**

The methodology adopted complies with the Asian Infrastructure Investment Bank Environmental and Social Framework. The study was carried out using reconnaissance surveys, field visits, consultation with stakeholders, review of existing data, identification of adverse impacts, and preparation of environmental and social management and monitoring plans. The stepwise activities carried out include:

- Review of legal requirements
- Review of the feasibility study
- Reconnaissance survey for identification of key issues data requirement and preliminary consultation
- Primary and secondary data collection
- Consultation with stakeholders



- Identification of impacts and mitigation measures.

### **1.4.1 Data Collection**

Primary and secondary data on the Physical, Ecological, and Socio-economic resources were collected to provide baseline conditions to be used in impact assessment and monitoring plan design. The type and source of information compiled in this EIA are given in the following **Table 2**.

**Table 2: Primary and Secondary Information Sources**

<b>Information</b>	<b>Sources</b>
Technical information on existing road features and proposed Rehabilitation work. Inventory of road features; viz. water bodies community structures, environmentally sensitive location areas, congested locations, etc.	PWRD, Design Consultant, Ground physical surveys and graphics Consultants
Climatic Condition	Indian Meteorological Department, ENVIS Website, NIC, Primary data Collection
Geology, Seismicity, Soil, and Topography	Geological Survey of India, SOI Toposheets, Primary data collection
Land Use/ Land Cover	Survey of India (Sol) Toposheet, Observation during the survey.
Drainage Pattern	Survey of India Topo sheet and field Observation
Status of forest areas, Compensatory afforestation norms, etc.	Divisional Forest Office Dibrugarh District
Status of Fishing Activity	District Fisheries Offices at Dibrugarh District
Air quality Noise, Soil, and Water	Onsite monitoring and Analysis of Field samples during the field visit
Borrow Areas, Quarries and other construction material source	Observations from site inspection surveys, PWRD
River geomorphology, hydrology, drainage, flood Patterns	Feasibility report, field observations.
Social Survey	The Secondary data collected for the project and the project influence area are from reliable secondary sources such as websites of central and state government; published documents from various departments.  Initial social screening was conducted to identify the likely impacts and identify the potential impacted families and persons, Common Property Resources, agriculture



Information	Sources
	<p>land, access to services, etc.</p> <p>Using available RoW records with Revenue Department, the social team plotted the boundaries of private properties within the proposed RoW. A structured questionnaire was prepared to carry out the census survey covering all (100%) of the families displaced as a result of development of the project within the proposed RoW/ Col. To collect the information of socio-economic profile of the affected population, conventional sample of 25 percent of project displaced families was covered. Representativeness of the sample was ensured through random sampling method</p>

### 1.4.2 Public Consultation

Extensive consultations were held during different stages (reconnaissance, detailed design, and design review) with key stakeholders that includes local and beneficiary population, government departments/agencies, road users, and project-affected persons. These consultations allowed the interaction between the stakeholders and road designers to identify road features and construction methods that will enhance road upgrading and minimize potential impacts. Information gathered was integrated into the project design and formulating mitigation measures and environmental and social management plan. A detailed description of public consultation is presented in **Chapter 7**.

## 1.5 Structure of the Report

This EIA has been prepared as per requirements of the AIIB’s Environmental and Social Framework. The report will be organized into the following ten chapters, a brief of each chapter is described below:

- **Chapter 1 - Introduction:** This section describes the background information about the project and the Environmental Impact Assessment study.
- **Chapter 2 - Policy, Legal, and Administrative Frameworks:** This section summarizing the national and local legal and institutional frameworks that guided the conduct of the assessment.
- **Chapter 3 - Project Description:** This section presents the key features and components of the proposed project.
- **Chapter 4 - Description of the Environment:** This section discussing the relevant physical, biological, and socioeconomic features that may be affected by the proposed project.
- **Chapter 5 - Anticipated Environmental and Social Impacts and Mitigation Measures:** This section presents the environmental and social impact assessment of



likely positive and adverse impacts attributed to the proposed project and concomitant mitigation measures.

- **Chapter 6 – Climate Change Impacts and Risks:** This section presents the impact of project road on climate change and relevant mitigation measures.
- **Chapter 7 – Consultation, Participation and Information Disclosure:** This section describes the consultation process undertaken during the environmental examination and its results, their consideration in the project design, and manner of compliance to the AIIB's policy.
- **Chapter 8 - Grievance Redress Mechanism:** This section describing the formal and informal redress procedures for registering, resolving, and reporting complaints.
- **Chapter 9 - Environmental and Social Management Plan:** This section discussing the lessons from the impact assessment and translated into action plans to avoid, reduce, mitigate, or compensate for adverse impacts and reinforces beneficial impacts. This plan is divided into three sub-sections; mitigation, monitoring, and implementation arrangements.
- **Chapter 10 - Conclusion and Recommendation:** This section stating whether there is a need for further detailed environmental studies/assessments and highlights key findings and recommendations to be implemented by the borrower.



## 2. Policy, Legal and Administrative Framework

India has well defined institutional and legislative framework. The legislation covers all components of the environment viz. air, water, soil, terrestrial and aquatic flora, and fauna, natural resources, and sensitive habitats. India is also a signatory to various international conventions and protocols. The environmental legislation in India is framed to protect the valued environmental components and comply with its commitment to the international community under the above conventions and protocols. Asian Infrastructure Investment Bank has also defined its Environmental and Social Framework. This assessment is about the applicability of the above laws and regulations, conventions, protocols, and frameworks. This section summaries the following:

- National (India) Environmental Legislation and Legal Administrative Framework,
- Social Safeguard Regulatory Requirements,
- AIIB policies and categorization of the project,
- Summary of international treaties and applicability to the project

### 2.1 National (India) Environmental Policies and regulatory Framework

The Government of India's Environmental Legal Framework comprises a set of comprehensive acts and regulations aimed at conserving various components of the biological and physical environment including environmental impact assessment procedures and requirements for public consultation. The policies and requirements which are most relevant in the context of this project are provided in **Table 3**.



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**Table 3: Summary of Relevant Environmental Legislation**

Sr. No.	Act/ Rules	Objectives/Relevance	Authority	Applicable	Reason for Application
1	Environment (Protection) Act (1504) and Rules (1504)	To protect and improve the overall environment	MoEF&CC	Yes	It is umbrella legislation and notifications, rules and schedules are promulgated under this act.
2	The 14 <sup>th</sup> September 2006 EIA notification, under sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1504. And amendment made on 22 <sup>nd</sup> August, 2013; S.O. 2559 (E).	Environmental clearance for proposed project prior to starts of construction work	MoEF&CC/ SEIAA/ SEAC	No	The project road does not require Environmental Clearance as it is neither a new State Highway nor a State Highway Expansion project in hilly areas (above 1000 AMSL) and or ecologically sensitive areas.  The maximum altitude of the project road is 128.7 m.
3	The 14 <sup>th</sup> September 2006 EIA notification, under sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1504. Environmental Clearance under EIA notification dated 15 <sup>th</sup> January 2016 issued by MoEF&CC, Letter No. 125, S.O 141E.	Permission will be required for opening new quarry or for extraction of river bed sand	0-5 Ha. Category (B2) – DEAC/DEIAA >5 Ha and <25 Ha (B2) – SEAC/SEIAA ≥25 Ha and <50Ha. Category (B1) – SEAC/SEIAA ≥50 Ha. Category (A) – MoEF&CC	Yes/No	<b>Yes:</b> If the contractor open quarries site/ Mining site to meet the Material Requirement. <b>No:</b> If the source of construction material is from authorized vendor. Environmental Clearance is exempted for sourcing or borrowing of ordinary earth for linear projects as per notification S.O. 1224 (E) dated 28 <sup>th</sup> March, 2020
4	Wildlife Protection Act (1972 and amended in 1993)	To restrict project activities within National Park/ Wildlife Sanctuary/ Game Reserve/ Conservation Reserve or within its Eco Sensitive Zone (ESZ) which are declared protected under the WLP-1972.	SBWL	No	The Deesang Kinar Bangali to Kathalguri road does not pass through any notified protected area. The nearest protected area from the project road is the Dihing Patkai National Park (recently declared) which is at a distance of 3.6 km (approx.) from the project road.
4	The Water (Prevention and	Establishment/Operation of stone	Consent to Establish	Yes	This act will be applicable during



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Sr. No.	Act/ Rules	Objectives/Relevance	Authority	Applicable	Reason for Application
	Control of Pollution) Act 1972 (Amended 1988) and Rules 1974	crusher, Hot Mix Plant, RCC Plant and D.G sets	(CtE) and Consent to Operate (CtO) under water Act 1974 from SPCB		construction for establishments of hot mix plants, construction camps, workers' camps, etc.
5	The Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Rules 1982	Establishment/Operation of stone crusher, Hot Mix Plant, RCC Plant and D.G sets	Consent to Establish (CtE) and Consent to Operate (CtO) under water Act 1974 from SPCB	Yes	To control the emission and air pollutants which might be expected during operation of stone crusher, Hot Mix Plant, RCC Plant and D.G sets
6	Noise Pollution (Regulation and Control) Act, 2000	Establishment/Operation of stone crusher, Hot Mix Plant, RCC Plant and D.G sets	Consent to Establish (CtE) and Consent to Operate (CtO) under Noise Rules, 2000. Authority SPCB	Yes	To control the noise emission generated from operation of D.G sets, Hot Mix Plant, Stone crushers, WMM Plants etc.
7	The Hazardous and Other Wastes (Management, Handling and Trans-boundary Movement) Rules 2016	To protection the general public against improper handling, storage, and disposal of hazardous wastes	State Pollution Control Board	Yes	Used of Hazardous material and handling for construction of roads
8	The Forest (Conservation) Act 1980 (Amended 1988) and Rules 1981 (Amended 2003)	To protect and manage forests	MoEF&CC	No	No diversion of forest land is required for the sub-project road.
9	Central Motor Vehicle Act (1988) and Rules (1989)	To control vehicular air and noise pollution. To regulate the development of the transport sector, check and control vehicular air and noise pollution.	State Transport Department	Yes	These rules will apply to road users and construction Machinery.
10	Ancient Monuments and Archaeological Sites and Remains Act (1958)	For construction of road falling within prohibited or regulated area of notified Ancient Monuments and Archaeological Site and Remains Act.	Archaeological Dept. GOI/State	No	No monuments and archaeological sites as listed by Central Government & State Government is reported within 100 meters (restricted Zone) and beyond 200 meters (Regulated Zone) from PROW Boundary
11	Building and Other Construction Workers (Regulation and the	To regulate the employment and conditions of service of building and	Ministry of Labour and Employment	Yes	A large number of construction workers skilled, semiskilled or unskilled will be



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Sr. No.	Act/ Rules	Objectives/Relevance	Authority	Applicable	Reason for Application
	Employment and conditions of service) Act, 1996	other construction workers and to provide for their safety, health and welfare measures			employed temporarily during Construction Phase of the project
12	Child labour (Prohibition and Regulation) Act, 1504	To regulate the employment of children including age limits, type of employment, the timing of work, information disclosure, and health and safety.	Ministry of Labour and Employment	Yes	This act will be applicable to prohibit employment to children below the age of 14.
13	Public Liability & Insurance Act, 1991	Regulate the employment and conditions of construction workers and provide for their safety, health and welfare measure and other matters incidental thereto.	District Collector	Yes	The contractor needs to stock hazardous materials like diesel, Bitumen, Emulsions, etc.
14	Chemical Accidents (Emergency Planning, Preparedness, and Response) Rules, 1996	To prevent the occurrence of a chemical accident involving a fortuitous, or sudden or unintended occurrence while handling any hazardous chemical resulting in continuous, intermittent or repeated exposure to death, or injury to, any person or damage to any property	MoEF&CC	Yes	This law will be applicable as the project will involve transport and storage of hazardous chemicals.
15	Fly Ash Notification, 25th January, 2016.	Use of fly ash for road filling and for other construction works if Thermal Power Plant are located within 300 km from PROW.	MoEF&CC	No	The project road is not located within 300 km from any Coal based Thermal Power Plant.



## 1. Requirement of Environmental Clearance

As per provisions of Environmental Impact Assessment Notification 2006 amended (2009, 2011 and 2013), and its amendments, vide notification S.O.3067(E), dated 1st December 2009 and S.O. 2559 (E), dated 22nd August 2013; all New State Highway Projects and State Highway expansion projects in hilly terrain (above 1000 m above MSL) and or ecologically sensitive areas require Environmental Clearances from MoEF&CC.

Since the project road is neither an existing state highway nor proposed as a New State Highway and the maximum elevation of the project road is 128.7m Environmental Clearance from MoEF&CC is not required.

## 2. Forest Clearance

As per the Indian Forests Conservation Act (1980), any project requiring diversion of forest land for non-forestry purposes require forest clearance from MoEF&CC for the same.

As per the approved Protected Areas & Reserve Forests map received from the PCCF office, Guwahati vide Letter No. FG 69/REWP/GIS/PART-1/7032 (**Annexure 21**) during the initial survey, no diversion of forestland is involved in the A30\_2 (Deesang Kinar Bangali to Kathalguri) road. As per the Assam (Control of Felling and Removal of trees from Non-forest lands) Rules, 2002, the felling of trees from the Non-forest area will require prior approval of the Forest Department.

## 3. Wildlife Clearance

As per the approved Protected Areas & Reserve Forests map received from the PCCF office, Guwahati vide Letter No. FG 69/REWP/GIS/PART-1/7032 (**Annexure 21**) during the initial survey, the project road does not pass through any notified protected area in the state. The nearest protected area from the project road is the Dihing Patkai National Park (recently declared) which is at a distance of 3.6 km (approx.) from the project road.

## 4. Permission to Withdraw Ground Water

As per the power Granted under Environmental Protection Act, 1986, Permission from Central Ground Water Authority is required for extracting groundwater for construction purposes, from areas declared as critical or semi-critical from the groundwater potential prospective point of view.

## 5. Required Clearances/Permissions

For the up-gradation of the project road, required clearances/permissions related to the environment have been summarized in **Table 4**.



**Table 4: Permissions/Clearances Required for the Subproject**

Sr. No.	Permissions/Clearances	Acts/Rules/Notifications/Guidelines	Concerned Agency	Responsibility	Time required
<b>A. Pre-Construction Stage</b>					
1	Permission for cutting of trees	Forest Conservation Act (1980) Procedural Guidelines developed by the Department of Environment, Government of Assam under the orders of the Honorable High Court Tree removal will be guided as per state government rules	State Forest Department for trees felling in forest areas and non-forest Areas (Compensatory tree plantation to be done as per the direction of Forest Department)	Public Works Roads Department, Assam	Permission has been granted by DFO Digboi & Dibrugarh
<b>B. Implementation Stage</b>					
2	Consent to establish and operate hot mix plant, Crushers, Batching plant	Air (Prevention and Control Pollution) Act of 1981	Assam State Pollution Control Board (To be obtained before installation)	Contractor	Approx. 3 months
3	Authorization for disposal of hazardous waste	Hazardous Waste (Management and Handling) Rules 1989	Assam State Pollution Control Board (To be obtained before installation)	Contractor	Approx. 3 months
4	Consent for Disposal of sewage from labor camps	Water (Prevention and Control of Pollution) Act 1974	Assam State Pollution Control Board (Before setting up the camp)	Contractor	Approx. 3 months
5	Pollution Under Control Certificate	Central Motor and Vehicle Act of 1988	Department of Transport, Government of Assam authorized testing centers	Contractor	Can be obtained instantly from verified PUC centers
6	Employing Labour/Workers	The Building and Other Construction Workers (Regulation and Employment Conditions of Service) Act, 1996	District Labour Commissioner	Contractor	Approx. 3 months



## 2.2 Social Regulatory Requirements of India and State

There are many rules and regulations framed by the Government of India for the protection of workers. Most of these legislations will apply to contractors in charge of construction. The executing agency will ensure compliance with these social legislations through contractual obligations and regular checks & penalties. Applicable Acts and Policies relevant in the context of the project have been reviewed and their relevance to the project are listed down below which will ensure that project activities implemented are consistent with the following regulatory/legal framework.

- Code of Social Security, 2020
- The Occupational Safety, Health and Working Conditions Code, 2020
- Child Labour (Prohibition and Regulation) Act, 1986
- Minimum Wages Act, 1948
- Workmen Compensation Act, 1923
- Payment of Gratuity Act, 1972
- Employee State Insurance Act; Employees P.F. and Miscellaneous Provision Act, 1952
- Maternity Benefit Act, 1951
- Payment of Wages Act, 1936
- Equal Remuneration Act, 1979
- Inter-State Migrant Workmen's (Regulation of Employment & Conditions of Service) Act, 1979
- Equal Remuneration Act, 1979, Factories Act 1948 (including rules for health and safety of workers), etc.
- Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARR), 2013, Govt. of India
- RFCTLARR (Removal of Difficulties) Order, 2015
- The Assam Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2015
- Scheduled Caste and Scheduled Tribes Orders (Amendment) Act, 2002
- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
- National Tribal Policy, 2006
- The Assam Panchayat Act, 1994
- The Right to Information Act, 2005

## 2.3 International Treaties and Relevance to the Sub-Project

India has signed most international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation and climate change, including the RAMSAR Convention, the Rio de Janeiro Convention on Biodiversity Diversity, and the Kyoto Protocol on Climate Change. There are 20 major global Multilateral Environmental Agreements (MEAs) to which India is a signatory. There are three MEA related to Nature Conservation that are applicable to the project as listed in **Table 5**.



**Table 5: Applicable MEAs Related to Nature Conservation for the Asom Mala Project**

Sr. No	Nature Conservation	Relevancy to Project
1	Ramsar Convention on Wetlands	Yes, Protection of significant wetland and prevention of draining or filling during construction
2	CBD (Convention on Biological Diversity)	Yes, Conservation of biological diversity (or biodiversity) and sustainable use of its components.
3	IUCN (International Union for Conservation of Nature)	Yes

## 2.4 AIIB Environmental & Social Framework Requirements

The Bank determines the Project's category by the category of the Project's component presenting the highest environmental or social risk, including direct, indirect, cumulative and induced impacts, as relevant, in the Project area. The Bank conducts a review of environmental and social risks and impacts associated with the Project, regardless of the categorization being considered. As an element of the categorization process, the Bank may conduct a field-based review of the Project to provide for a refined understanding of the environmental and social risks and impacts and support the Client's preparation of a site-specific approach to the assessment of these risks and impacts. The Bank may adjust the categorization during the life of the Project if warranted by changes in the environmental and social risks and impacts.

- **Category A:** A Project is categorized A if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works and may be temporary or permanent in nature. The Bank requires the Client to conduct an environmental and social impact assessment (ESIA) or equivalent environmental and social assessment, for each Category A Project and to prepare an ESMP or ESMPF, which is included in the ESIA report for the Project. The ESIA for a Category A Project examines the Project's potentially negative and positive environmental and social impacts, compares them with those of feasible alternatives (including the "without Project" situation), and recommends any measures needed to avoid, minimize, mitigate, or compensate for adverse impacts and improve environmental and social performance of the Project.
- **Category B:** A Project is categorized B when: it has a limited number of potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are limited to the Project area; and can be successfully managed using good practice in an operational setting. The Bank requires the Client to conduct an initial review of the environmental and social implications of the Project. On the basis of this review, the Bank, in consultation with the Client, determines the appropriate instrument for the Client to assess the Project's environmental and social risks and impacts, on a case-by-case basis. The Bank may determine that an environmental and social assessment or another similar instrument is appropriate for the Project. The scope of the assessment may vary from Project to Project, but it is narrower than that of the Category A ESIA. As in the



case of a Category A Project, the assessment examines the Project's potentially negative and positive environmental impacts and recommends any measures needed to avoid, minimize, mitigate, or compensate for adverse impacts and improve environmental performance of the Project.

- **Category C:** A Project is categorized C when it is likely to have minimal or no adverse environmental and social impacts. The Bank does not require an environmental and social assessment, but does require the Client to conduct a review of the environmental and social implications of the Project.
- **Category FI:** A Project is categorized FI if the financing structure involves the provision of funds to or through a financial intermediary (FI) for the Project, whereby the Bank delegates to the FI the decision-making on the use of the Bank funds, including the selection, appraisal, approval and monitoring of Bank-financed subprojects. The Bank requires the FI Client, through the implementation of appropriate environmental and social policies and procedures, to screen and categorize subprojects as Category A, B or C, review, conduct due diligence on, and monitor the environmental and social risks and impacts associated with the Bank-financed subprojects, all in a manner consistent with this ESP. A Project categorized as FI is also subject to: (a) the Environmental and Social Exclusion List and applicable host country national laws for all the Bank-financed subprojects; and (b) the applicable ESSs for the Bank-financed subprojects that are classified as Category A subprojects (and if the Bank so determines, some or all of the Bank-financed subprojects that are classified as Category B subprojects).

## 2.5 Category of the Project as per AIB's Framework & MOEF&CC Notification 2006 and amendments

As per provisions of Environmental Impact Assessment Notification 2006 amended (2009, 2011 and 2013), and its amendments, vide notification S.O.3067(E), dated 1st December 2009 and S.O. 2559 (E), dated 22nd August 2013; all New State Highway Projects and State Highway expansion projects in hilly terrain (above 1000 m above MSL) and/or ecologically sensitive areas require Environmental Clearances from MoEF&CC/SEAC/SEIAA.

The proposed project is widening and curve improvement road project of total length 23.958 km. Based on the topographic survey it has been reported that the maximum elevation is 128.7m meters above mean sea level (MSL).

The project road has been evaluated and categorized as Category B project in accordance with the Bank's Environmental and Social Policy (ESP) and Environmental and Social Standards (ESS). This categorization was primarily based on the following considerations:

- Project road is an existing road for most of the stretch and upgrading activities are limited to the available RoW with land acquisition at some locations,
- Anticipated impacts from road upgrading on relatively flat terrain along agricultural land are mostly site-specific and easily mitigated through proper design and good



construction practices, majority of the activities have short-term duration co-terminus with the construction phase, and

- Project road does not fall in the core zone of any protected areas in the state. The nearest protected area from the project road is the Dihing Patkai National Park (recently declared) which is at a distance of 3.6 km (approx.) from the project road.
- Impact on local and regional biodiversity i.e. habitat fragmentation, degradation and loss, endemic and invasive species, over exploitation of biological resources, hydrological changes, increase in pollution load in water bodies, tree felling involve and induced climate impact.
- Impact involving social issues i.e. involuntary resettlements, loss of livelihoods, impact on indigenous peoples, impact on community and households, Vulnerable groups, etc
- Impact on land and natural resource, change in land-use patterns, Cultural resource, land acquisition, structure affected, etc.



## 3. Project Description

### 3.1 The Sub Project

The Project Road **A30\_2 Deesang Kinar Bangali to Kathalguri** located in the district of Dibrugarh, passes through various junctions, and spreads over various locations of the district. As per the topographic survey and alignment design, the total length of the road comes out to be 23.958 km. Dibrugarh is the administrative district in the state of Assam also known as the Tea City of India. Dibrugarh derived its name from Dibarumukh which is a renowned encampment of Ahoms during the Ahom Sutiya war. Dibrugarh is situated in the eastern part of Assam. The district is surrounded by Dhemaji district in the north, part of Sivasagar, Tinsukia district in the east and Sivsagar district and a part of Jorhat district in the west. In terms of area, the district occupies the 8th rank among the district of the state.

Several Common Property Resources (schools, colleges, temples, hospitals), anganwadi centers and rice mills were observed along the project road. Water bodies (ponds) were also observed along the project corridor. The project road has a single lane configuration with conditions varying from poor to fair and certain sections of the road have a Non-motorized road.

### 3.2 Location and Features of the Sub-Project Road

The project road **A30\_2 Deesang Kinar Bangali to Kathalguri** originates at Deesang Kinar Bangali and ends at Bhadoi Panchali in Kathalguri. The Project Road is connected with the Assam Oil Company Limited (AOD) which is at Digboi. The Dehing river which is a large tributary of the Brahmaputra river, about 380 km long flows through the northern side of the project road and crosses the alignment through the proposed Bypass. The roads coming from nearby villages connect the proposed project road at various locations. There is a railway crossing between Duliajan and Naharkatia and it connects railway stations like Moran, Naharkatia, and Duliajan. There are also many other religious places, Tea Gardens, and schools alongside the proposed project road. Highways like NH2, NH215, NH315A, SH24, and SH27 have connectivity to the project road. The alignment experiences a high amount of agricultural activities. The entire stretch of the proposed project road is in the north-east direction.

The project road from Deesang Kinar Bangali to Kathalguri traverses through settlements of Deesang Kinar Bangali, Mohamari gaon no.1, Duliajan, Da-Hukuta, Joloni, Padumoni gaon and ends at Bhadoi Panchali in Kathalguri. The roads coming from nearby villages of Thengal, Tiloi Nagar, Sukani, Barbam, Kadamoni, and many others meet the route.



Figure 2: Map of Deesang Kinar Bangali to Kathalguri Road

The salient features of the Road are given in Table 6.

Table 6: Summary of Road Components, Design Standard and Associated Facilities

<b>Road Length</b>	23.958 Km.
<b>Alignment</b>	Following the existing road alignment. Except some of the locations where geometric improvements is required.
<b>Flyovers/overpasses/ROB</b>	Nil
<b>Bridges</b>	Existing: 6 Minor Bridges Proposed: 1 Major and 4 Minor Bridges
<b>Embankment Design</b>	Embankment height established is having a 1m freeboard on 20 years frequency HFL Embankment height up to 3.0 m with 2H: 1V slope for embankment height from 3.0 m to 6.0 m with 1.5H: 1V slope. Construction of embankment of height more than 3.0 m, using borrow soil is recommended. However high embankment has been restricted within Row by providing retaining walls
<b>Design Standard</b>	As per IRC Codes and MORTH Guidelines. Vertical Clearance 0.60 m above HFL for bridges up to 30 m length 0.90m above HFL for bridges above 30 m length the discharges for which the bridge has been designed is the maximum flood discharge on record for 100 years for major bridges and 50 years for minor bridges.
<b>Speed</b>	65Kmph to 80Kmph.
	Permissible: 80 km/h
<b>Horizontal Curves</b>	As per IRC: 73 -1980



<b>Super Elevations</b>	The maximum value of 7% for superelevation and 15% for side friction factor, the minimum radius for horizontal curves is 230m for design speed 80Km/hr.
<b>Vertical Curves</b>	Grade break of 0.5%, vertical curves will be provided. Length of the vertical curve will be restricted to minimum 50m
<b>Carriageway</b>	7 m wide carriageway with 1.50 m to 2.50 m Earthen Shoulder.
<b>Associated/Linked Facilities</b>	4 Bus Shelter with Rest area has been proposed

### 3.3 Engineering Surveys and Investigations

Following surveys and investigations had been carried out on the subproject road for collection of data for incorporation in the Detailed project report (DPR) and evolve the design for improvement and up-gradation.

- Topographic surveys;
- Traffic surveys;
- Road and pavement condition survey and inventory;
- Culverts and bridges condition survey and inventories;
- Material surveys;
- Hydrology studies for new bridge structures;
- Geotechnical investigations & subsoil exploration for structures; and
- Existing utility surveys.

These surveys had been carried out in accordance with the guidelines in IRC SP: 19-2001 to fulfill the requirement in the TOR.

### 3.4 Current and Projected Daily Traffic

Based on the Classified Volume Count (CVC), Turning Movement Count (TMC), Origin-Destination, and Axle Load Surveys conducted for the project and consistent with applicable IRC Guidelines the average annual daily traffic at the monitoring stations is shown in the table below. The Traffic Volume/Day (Base Year 2019-2020) data has been provided in **Table 7**. The present and projected traffic for future years is shown in **Table 8**.

**Table 7: Traffic Volume/Day: (Base Year 2019-2020)**

Sr. No.	Types of Vehicles	Annual Average Daily Traffic (AADT) (in Vehicles)	Annual Average Daily Traffic (AADT) (in PCU's)
1	Two Wheelers	2393	1197
2	3 Wheelers	016	016
3	Car/ Vans/ Jeeps	1497	1497
4	Mini Buses	016	024
5	Standard Buses	027	081
6	Tempo	259	389
7	LCV's (Goods)	53	80
8	2-Axle Trucks	61	183
9	3-Axle Trucks	8	24



Sr. No.	Types of Vehicles	Annual Average Daily Traffic (AADT) (in Vehicles)	Annual Average Daily Traffic (AADT) (in PCU's)
10	Multi-Axle Trucks	7	32
11	Tractors with Trailer	1	5
12	Tractors Without Trailer	1	2
13	Cycle	406	203
14	Cycle Rickshaw	1	2
15	Animal Drawn	0	0
16	Others	4	4
<b>Total Traffic</b>		<b>3509</b>	<b>4750</b>
<b>Motorized (MT)</b>		<b>2794</b>	<b>4339</b>
<b>Non-Motorized (NMT)</b>		<b>715</b>	<b>411</b>

Source: Traffic Study

**Table 8: Present and Projected Traffic in the road section**

Sr. No.	Year	Total Vehicles	Total PCUs
1	2019-2020	5370	4230
2	2020-2021	5712	4502
3	2021-2022	7088	5587
4	2022-2023	7544	5949
5	2023-2024	8041	6340
6	2024-2025	8573	6758
7	2025-2026	9143	7204
8	2026-2027	9753	7682
9	2027-2028	10406	8193
10	2028-2029	11020	8669
11	2029-2030	11672	9174
12	2030-2031	12365	9710
13	2031-2032	13100	10278
14	2032-2033	13882	10881
15	2033-2034	14637	11460
16	2034-2035	15436	12071
17	2035-2036	16280	12716
18	2036-2037	17172	13397
19	2037-2038	18115	14116
20	2038-2039	19062	14833
21	2039-2040	20060	15588
22	2040-2041	21112	16384
23	2041-2042	22221	17223
24	2042-2043	23391	18107
25	2043-2044	24623	19037
26	2044-2045	25923	20018
27	2045-2046	27293	21052
28	2046-2047	28738	22141
29	2047-2048	30261	23288



Sr. No.	Year	Total Vehicles	Total PCUs
30	2048-2049	31867	24496
31	2049-2050	5370	4230
32	2050-2051	5712	4502

Source: Traffic Study

### 3.5 Proposed Improvement

Project Road will receive the following up-gradation under the project:

- Curvature improvement and realignment
- Widening
- Flexible pavement
- Rearrangement of junctions
- Roadside drains
- Bridge and cross drainage structures
- User facilities
- Traffic control and safety measures

#### 3.5.1 Realignment and Curvature Improvement

Based on approved geometric standards the alignment plan of the existing road requires correction of existing sub-standard geometry at various locations. In plain or rolling terrain, a minimum curve radius as per design has been attempted to achieve design speed, however, an absolute minimum radius as per design is used at a location with space constraints like urban areas, structure approach, and other areas.

On sections with substandard geometry, improvements will require merging two or more existing curves resulting in a minor geometric realignment to achieve the desired geometric standards. Horizontal will be modified to accommodate the required rate of super-elevation and provide smooth riding quality. However, at locations with space constraints design speed has been restricted.

#### 3.5.2 Proposed Cross Section Details

**Carriageway Width:** The carriageway configuration of two lanes with a paved and hard/earthen shoulder is proposed for the project road having a 7.0 m carriageway width (Except TCS Type IV having 14m carriageway width).

**Shoulder:** Paved Shoulder and Earthen shoulders are proposed to be 1.5m and 1.0m respectively on both sides of the Carriageway.

**Footpath:** The minimum width of footpath in urban stretches is proposed to be 1.5m. The side drain in such stretches may be accommodated under the footpath.

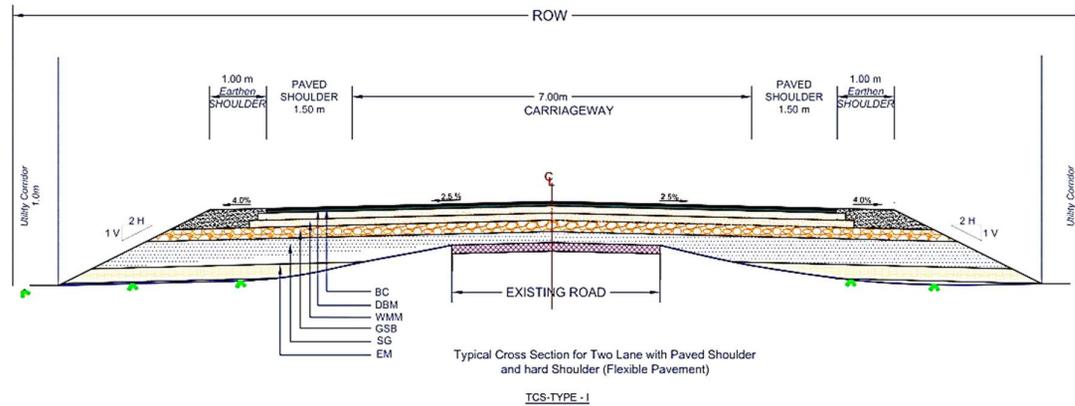
**Utility Corridor:** The minimum width of the utility corridor will be 1.0m.

**Embankment Slopes:** Side slopes shall not be steeper than 2H:1V.

The typical Cross Sections for the proposed project road are shown in the following figures.



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASCM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

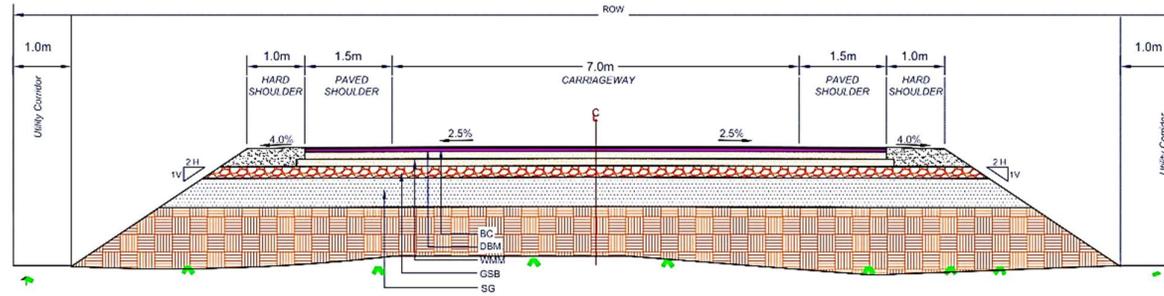


Sr No	Chainage		Length(m)	Proposed carriage way(m)	Paved shoulder (m)		Earthen Shoulder(m)		Paver Block (m)		Utility Corridor(m)		TCS	Remark	PROW (m)	PR. Road Type
	From	To			Left	Right	Left	Right	Left	Right	Left	Right				
1	0+000	0+200	200.00	7	1.5	1.5	1	1	-	-	1	1	I	Open Area	20	BT
2	0+650	0+720	70.00	7	1.5	1.5	1	1	-	-	1	1	I	Open Area	20	BT
3	0+720	0+765	45.00				<i>Retained Bridge</i>						I	Open Area	20	BT
4	0+765	0+800	35.00	7	1.5	1.5	1	1			1	1	I	Open Area	20	BT
5	10+250	11+550	1300.00	7	1.5	1.5	1	1			1	1	I	Open Area	20	BT
6	11+550	12+600	1050.00				<i>ROB Including Approaches</i>				1	1	I	Open Area	20	BT
7	14+950	15+300	350.00	7	1.5	1.5	1	1			1	1	I	Open Area	20	BT
8	15+300	15+753	453.00	7	1.5	1.5	1	1			1	1	I	Open Area	20	BT
9	15+753	15+765	12.00				<i>Retained Bridge</i>				1	1	I	Open Area	20	BT
10	15+765	16+155	390.00	7	1.5	1.5	1	1			1	1	I	Open Area	20	BT
11	16+155	20+250	4095.00	7	1.5	1.5	1	1			1	1	I	Open Area	20	BT
12	20+850	21+750	900.00	7	1.5	1.5	1	1			1	1	I	Open Area	20	BT
13	22+000	22+950	950.00	7	1.5	1.5	1	1			1	1	I	Open Area	20	BT
	<b>Total</b>		<b>9850</b>													

Figure 3: Typical Cross Section (Type-I)



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASCM MALA  
[FROM CH. 0+000 TO CH. 23+958]**



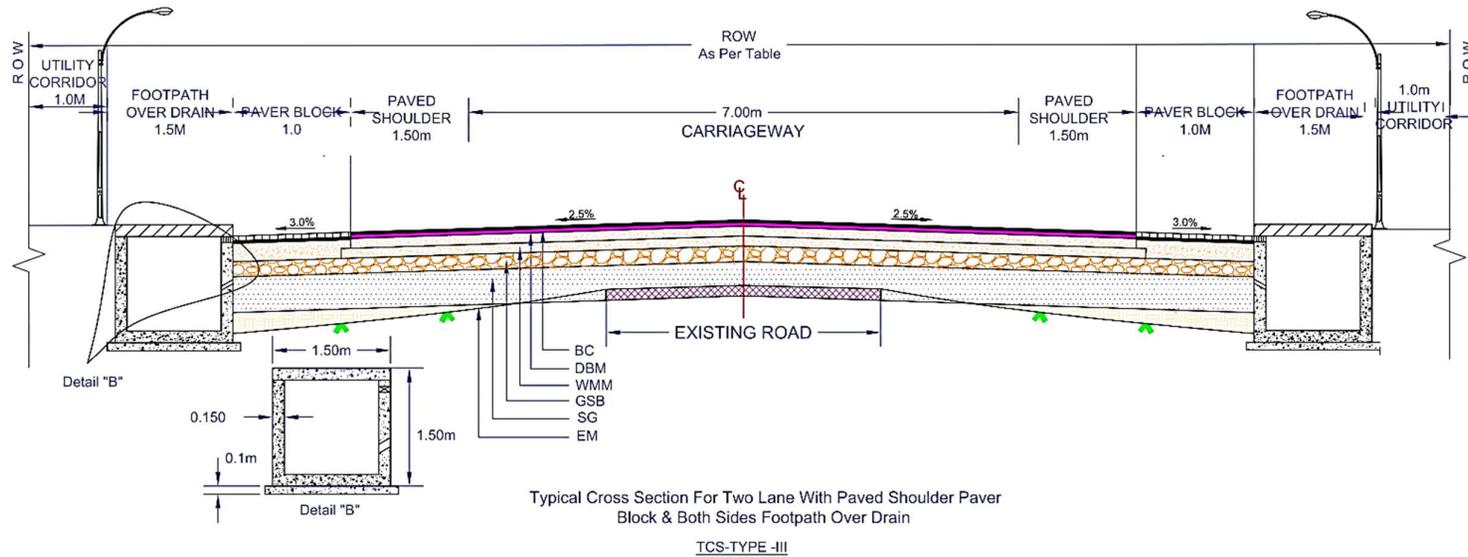
Typical Cross Section for Two Lane with Paved Shoulder and Earthen Shoulder (for Realignment /new road)  
TCS-TYPE II

Sr No	Chainage		Length(m)	Proposed carriage way(m)	Paved shoulder (m)		Earthen Shoulder(m)		Paver Block (m)		Utility Corridor(m)		TCS Type	Remark	PROW (m)	PR. Road Type
	From	To			Left	Right	Left	Right	Left	Right	Left	Right				
B																
1	0+200	0+650	450.00	7	1.5	1.5	1	1	-	-	1	1	II	Open Area	20	BT
2	0+800	6+770	5970.00	7	1.5	1.5	1	1	-	-	1	1	II	Open Area	20	BT
3	6+770	7+020	250.00				New Bridge				1	1	II	Open Area	20	BT
4	7+020	10+250	3230.00	7	1.5	1.5	1	1	-	-	1	1	II	Open Area	20	BT
5	14+120	14+350	230.00				Bridge				1	1	II	Open Area	20	BT
6	20+250	20+850	600.00	7	1.5	1.5	1	1	-	-	1	1	II	Open Area	20	BT
7	21+750	22+000	250.00				Bridge				1	1	II	Open Area	20	BT
	<b>Total</b>		<b>10980</b>													

Figure 4: Typical Cross Section (Type-II)



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

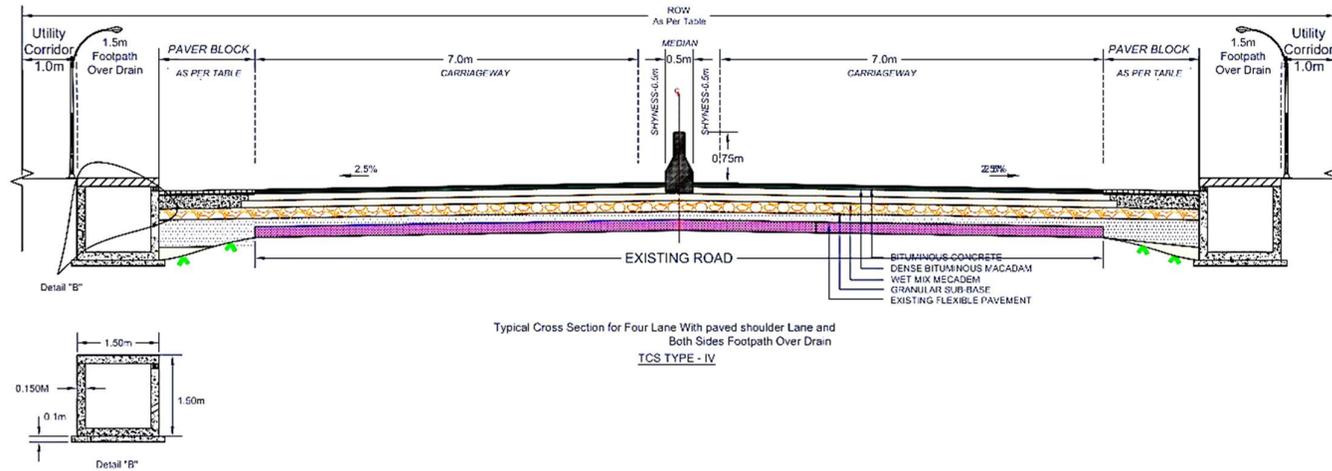


Sr No	Chainage		Length(m)	Proposed carriage	Paved shoulder (m)		Drain (m)		Paver Block (m)		Utility Corridor(m)		TCS	Remark	PROW (m)	PR. Road Type
	From	To			Left	Right	Left	Right	Left	Right	Left	Right				
1	12+600	13+200	600.00	7	1.5	1.5	1.5	1.5	1	1	1	1	III	Buit Up Area	17	
2	13+200	13+213	13.00				Bridge						III	Buit Up Area		BT
3	13+213	13+600	387.00	7	1.5	1.5	1.5	1.5	1	1	1	1		Buit Up Area	17	
4	13+600	14+120	520.00	7	1.5	1.5	1.5	1.5	1	1	1	1	III	Buit Up Area	17	BT
5	14+350	14+950	600.00	7	1.5	1.5	1.5	1.5	1	1	1	1	III	Buit Up Area	17	BT
6	22+950	23+700	750.00	7	1.5	1.5	1.5	1.5	1	1	1	1	III	Buit Up Area	17	BT
			2870	7												

Figure 5: Typical Cross Section (Type-III)



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**



Sr No	Chainage		Length(m)	Proposed carriage	Paved shoulder (m)		Earthen Shoulder(m)		Paver Block (m)		Utility Corridor(m)		TCS	Remark	PROW (m)	PR. Road Type
	From	To			Left	Right	Left	Right	Left	Right	Left	Right				
D	23+700	23+958	258.00	14	-	-	1.5	1.5	2	2	1	1	IV	Butt Up Area	23	

Figure 6: Typical Cross Section (Type-IV)



### 3.5.3 Design of Road Side Drains

In built-up areas, to facilitate proper drainage of surface run-off, road-side covered RCC drains will be constructed as per IRC guidelines.

### 3.5.4 Pavement Design

The project road envisages two-lane carriageways with hard shoulders and upgrading of the existing pavement to carry the anticipated traffic over the design period. This would involve the construction of new pavement on the widened side and strengthening and rehabilitation of the existing pavements. Flexible asphalt pavement is proposed for the major part of the project road. The applicable IRC Guidelines would be used for this purpose, but using another internationally accepted design method (s) to ensure that the recommended design is the most appropriate.

### 3.5.5 Traffic Control and Safety Measures

In addition to adequate provisions for roadway width, geometric elements, and junction improvement, the following provisions will enhance the safety of road users. Due consideration has been made for the provisions contained in IRC: SP 44-1996, "Highway Safety Code". Also, other various measures have been proposed to increase traffic control for the High-speed road.

#### 3.5.5.1 Road Markings

Road markings perform the important function of guiding and controlling traffic on a highway. The markings serve as psychological barriers and signify the delineation of traffic paths and their lateral clearance from traffic hazards for the safe movement of traffic. Road markings are therefore essential to ensure a smooth and orderly flow of traffic and to promote road safety. The Code of Practice for Road Markings, IRC: 35-2015 will be used in the study as a design basis.

The location and type of marking lines, material, and the color is followed using IRC: 35-2015 – "Code of Practice for Road Markings".

The road markings are carefully planned on carriageways, intersections, parking, and bridge locations.

#### 3.5.5.2 Road Signages - Cautionary, Mandatory and Informatory Signs

Cautionary, Mandatory, and Informatory signs are provided depending on the situation and function they perform in accordance with the IRC: 67-2012 guidelines for Road Signs. Overhead and Cantilever gantry signboards are proposed at appropriate locations.

#### 3.5.5.3 Kilometre Stone Details

The details of kilometre stones are in accordance with IRC: 8-1980 guidelines. Kilometre stones are located on the left-hand side of the road as one proceeds from the station from which the Kilometre count starts. On divided roads with a central median, kilometre stones should be provided at the left on both sides of the road i.e., independently for each direction of travel. Kilometre stones shall be fixed at right angles to the centre line of the carriageway.



#### 3.5.5.4 200 m Stones and Boundary Stones

The details of 200m stones and boundary stones conform to IRC: 26-1967 and IRC: 25-1967 respectively. 200m stones are located on the same side of the road as the kilometre stones. The inscription on the stones shall be the numerals 2,4,6 and 8 marked in ascending order in the direction of increasing kilometerage away from the starting station. The numerals shall be 80mm high. The colour of the numerals shall be black on a white background. Boundary stones shall be located on either side of the road opposite every 200m stone and kilometre stone. In addition, these shall be fixed at all angular points of the boundary. Where the boundary is on a curve or the land is of significant value and likely to be encroached upon, the boundary stones, as required, shall be installed at closer intervals.

#### 3.5.5.5 Crash Barrier

Metal Beam Crash Barrier is proposed at locations where the embankment height is more than 3.0m, at horizontal curves of radius less than 230m, and also at major bridge approaches.

#### 3.5.5.6 Rumble Strips

The Road Humps are formed by providing a rounded hump of 3.7m width (17m radius) and 0.15m height for the preferred advisory crossing speed of 25kmph for general traffic as per the IRC: 99–1988 guidelines. The basic construction material is open premix bituminous surfacing on minor roads or perpendicular arms about 25m away from the inner edge of the carriageway. Proper signboards and markings are provided to caution the drivers in advance of the situation. Road humps are extended across the carriageway up to the edge of the paved shoulder.

Rumble Strips are formed by a sequence of transverse strips laid across a carriageway. A maximum permitted height of 15mm provided no vertical face exceeds 6mm. These rumble devices produce audible and vibratory effects to alert drivers to take greater care and do not normally reduce traffic speeds in themselves. The typical design details of rumble strips proposed are transverse strips of open premix bituminous surfacing 500mm wide and overall thickness of 15mm laid across a carriageway up to the end of the paved shoulder. There will be 6 such transverse strips spaced at 1.0m c/c. Rumble strips are proposed in advance of:

- Sharp curves with a radius of less than 170m.
- Transition zones (speed limit zones).
- Village/urban approaches.

Proper signboards and marking are proposed to advise the drivers in advance of the situation.

#### 3.5.6 Improvement Proposal for Cross Drainage Structure

The improvement proposal for new bridges along the project road stretch are mentioned in **Table 9** **Error! Reference source not found..** The improvement proposal for new culverts along the project road stretch are mentioned in **Table 10**. The Improvement proposal for the existing bridge along the project road is mentioned in **Table 11**. The improvement proposal for existing culverts along the project road stretch are mentioned in **Table 12**.



**Table 9: Improvement Proposal for New Bridges**

Sr. No.	Design Chainage	Name of River / Bridge	Total Length of Bridge	Span Arrangements	Structure type	Bridge Type	Improvement Proposal
1	2+600	LOCAL NALLAH	Newly Proposed Minor Bridge of Span (1 x 30)				
2	5+858	CANAL	Newly Proposed Minor Bridge over Canal of Span (1 x 10)				
3	6+890	BURHI DEHING RIVER	Newly Proposed Major Bridge of Span (6 x 48)				
4	8+104	CANAL	Newly Proposed Minor Bridge over Canal of Span (1 x 10)				
5	14+168	TIPLING RIVER	45	1 X 45	TWIN CELL BOX GIRDER	Minor	Newly Proposed Minor Bridge of Span (1 x 48 )

Source: Structure Condition & Inventory Survey

**Table 10: Improvement Proposal for New Culverts**

Sr. No.	Location (km)	Type of Structures	Span Arrangement and Total Ventway (No. x Length)	Width of Culvert (m)	Improvement Proposal	
					Type	Size
<b>Pipe Culvert</b>						
1	18+526		Proposed New Culvert		Box Culvert	1 x 1.50 x 2
2	23+682		Proposed New Culvert		Box Culvert	1 x 1.50 x 1.75
<b>Slab Culvert</b>						
3	3+610		Proposed New Culvert		Box Culvert	1 x 2.50 x 2.75

Source: Structure Condition & Inventory Survey

**Table 11: Improvement Proposal for Existing Bridges**

Sr. No.	Design Chainage	Name of River / Bridge	Bridge No.	Total Length of Bridge	Span Arrangements	Structure type	Bridge Type	Improvement Proposal
1	0+718	DISHANG RIVER	61	37.2	1 X 37.2	STEEL TRUSS & SLAB	Minor	Retained with repairs
2	12+193	LOCAL NALLAH	78	31.4	1 X 31.4	GIRDER & SLAB	Minor	Out of Scope
3	13+201	LOCAL NALLAH	79	13	1 X 13	GIRDER & SLAB	Minor	Retained with repairs
4	14+168	TIPLING RIVER	80	45	1 X 45	TWIN CELL BOX GIRDER	Minor	Proposed Minor Bridge (Span - 1 x 48 )
5	15+746	LOCAL NALLAH	83	9.4	1 x 4.9 + 1 x 4.5	GIRDER & SLAB	Minor	Reconstruction- Minor Bridge (Span - 1 x 15 )
6	21+687	LOCAL NALLAH	124	14.8	4 x 3.3	BOX TYPE	Minor	Under Construction

Source: Structure Condition & Inventory Survey



Table 12: Improvement Proposal for Existing Culverts

Sr. No.	Location (km)	Type of Structures	Span Arrangement and Total Ventway (No. x Length)	Width of Culvert (m)	Improvement Proposal	
					Type	Size
<b>Pipe Culvert</b>						
1	12+000	Pipe Culvert	1 x 900mm	7.5	Out of Scope	
2	14+427	Pipe Culvert	1 x 900mm	7.5	Box Culvert	1 x 4.00 x 4.25
3	14+574	Pipe Culvert	1 x 900mm	7.5	Box Culvert	1 x 3.00 x 3.25
4	14+591	Pipe Culvert	1 x 1000mm	7.5	Box Culvert	1 x 2.50 x 2.75
5	14+616	Pipe Culvert	1 x 1000mm	7.5	Box Culvert	1 x 3.50 x 4
6	14+783	Pipe Culvert	1 x 1000mm	7.5	Box Culvert	1 x 1.50 x 1.25
7	14+858	Pipe Culvert	1 x 1000mm	7.5	Box Culvert	1 x 1.50 x 2
8	15+474	Pipe Culvert	1 x 1000mm	7.5	Box Culvert	1 x 3.00 x 3.5
9	15+586	Pipe Culvert	1 x 1000mm	7.5	Box Culvert	1 x 3.00 x 3.5
10	15+661	Pipe Culvert	1 x 1000mm	7.5	Box Culvert	1 x 4.00 x 4.25
11	15+908	Pipe Culvert	1 x 1000mm	7.5	Box Culvert	1 x 3.00 x 3.25
12	16+109	Pipe Culvert	4 x 1000mm	12.6	Box Culvert	1 x 4.00 x 2.25
13	16+647	Pipe Culvert	1 x 1000mm	12.5	Box Culvert	1 x 3.00 x 3.75
14	16+744	Pipe Culvert	1 x 1000mm	12.5	Box Culvert	1 x 4.00 x 4.5
15	16+775	Pipe Culvert	1 x 1000mm	12.5	Box Culvert	1 x 3.00 x 3.75
16	16+860	Pipe Culvert	NV	12.5	Box Culvert	1 x 4.00 x 5
17	17+010	Pipe Culvert	1 x 1000mm	12.5	Box Culvert	1 x 3.00 x 3.75
18	17+144	Pipe Culvert	1 x 1000mm	12.5	Box Culvert	1 x 2.50 x 3
19	17+269	Pipe Culvert	1 x 900mm	10.1	Box Culvert	1 x 3.00 x 3.25
20	17+360	Pipe Culvert	2 x 1400mm	12.5	Box Culvert	1 x 2.50 x 2.75
21	17+481	Pipe Culvert	1 x 1000mm	12.5	Box Culvert	1 x 2.00 x 2.25
22	17+618	Pipe Culvert	1 x 1000mm	12.5	Box Culvert	1 x 2.50 x 2.75
23	17+760	Pipe Culvert	2 x 1000mm	12.5	Box Culvert	1 x 3.50 x 4
24	17+846	Pipe Culvert	1 x 1000mm	12.5	Box Culvert	1 x 2.50 x 2.75
25	17+970	Pipe Culvert	1 x 900mm	12.5	Box Culvert	1 x 2.50 x 3
26	18+088	Pipe Culvert	1 x 900mm	12.5	Box Culvert	1 x 3.00 x 3.5
27	18+129	Pipe Culvert	1 x 600mm	10.6	Box Culvert	1 x 2.00 x 2.25
28	18+239	Pipe Culvert	1 x 900mm	11.7	Box Culvert	1 x 2.50 x 2.75
29	18+326	Pipe Culvert	1 x 900mm	10.4	Box Culvert	1 x 2.00 x 2.5
30	18+395	Pipe Culvert	1 x 1000mm	9.9	Box Culvert	1 x 2.00 x 2.5
31	18+423	Pipe Culvert	1 x 1000mm	10.1	Box Culvert	1 x 3.00 x 3.25
32	18+489	Pipe Culvert	2 x 1200mm	10.1	Box Culvert	1 x 2.00 x 2.5
33	18+602	Pipe Culvert	2 x 1200mm	8.5	Box Culvert	1 x 2.00 x 2.5
34	18+751	Pipe Culvert	2 x 1200mm	8.6	Box Culvert	1 x 2.00 x 1.75
35	18+845	Pipe Culvert	3 x 1000mm	10.2	Box Culvert	1 x 2.50 x 2.5
36	18+898	Pipe Culvert	2 x 1000mm	10.1	Box Culvert	1 x 2.50 x 2.75
37	18+959	Pipe Culvert	2 x 1000mm	9.9	Box Culvert	1 x 2.50 x 2.75
38	19+092	Pipe Culvert	1 x 600mm	12.5	Box Culvert	1 x 2.50 x 2.75



Sr. No.	Location (km)	Type of Structures	Span Arrangement and Total Ventway (No. x Length)	Width of Culvert (m)	Improvement Proposal	
					Type	Size
39	19+123	Pipe Culvert	1 x 1000mm	10.7	Box Culvert	1 x 2.50 x 2.75
40	19+208	Pipe Culvert	1 x 1000mm	10.1	Box Culvert	1 x 2.50 x 3
41	19+269	Pipe Culvert	1 x 600mm	10.7	Box Culvert	1 x 2.50 x 3
42	19+323	Pipe Culvert	1 x 600mm	11	Box Culvert	1 x 2.50 x 3
43	19+580	Pipe Culvert	1 x 600mm	11.7	Box Culvert	1 x 2.00 x 2.25
44	19+725	Pipe Culvert	1 x 600mm	11.7	Box Culvert	1 x 1.50 x 2
45	19+997	Pipe Culvert	1 x 600mm	10.5	Box Culvert	1 x 2.50 x 2.75
46	20+120	Pipe Culvert	1 x 900mm	10.1	Box Culvert	1 x 2.50 x 2.75
47	20+585	Pipe Culvert	1 x 1000mm	10.2	Box Culvert	1 x 3.00 x 3.75
48	20+816	Pipe Culvert	1 x 900mm	10.1	Box Culvert	1 x 4.00 x 4.5
49	21+097	Pipe Culvert	1 x 900mm	10.1	Box Culvert	1 x 3.00 x 3.75
50	21+129	Pipe Culvert	1 x 900mm	10.1	Box Culvert	1 x 3.00 x 3.75
51	21+195	Pipe Culvert	2 x 1000mm	10	Box Culvert	1 x 3.00 x 3.25
52	21+739	Pipe Culvert	1 x 1200mm	11.5	Box Culvert	1 x 1.50 x 2
53	22+780	Pipe Culvert	1 x 2000mm	10.5	Box Culvert	1 x 2.50 x 3
54	23+252	Pipe Culvert	1 x 900mm	10.1	Box Culvert	1 x 2.50 x 3
<b>Slab Culvert</b>						
54	1+000	Box Culvert	1 x 2	12.00	Box Culvert	1 x 2.00 x 2
55	16+190	Slab Drain	1 x 0.6	10.80	Box Culvert	1 x 1.50 x 2
56	16+370	Slab Drain	1 x 1.6	11.60	Box Culvert	1 x 2.00 x 2.25
57	16+428	Slab Drain	1 x 1.6	12.50	Box Culvert	1 x 2.50 x 2.75
58	16+523	Slab Drain	1 x 1.6	12.50	Box Culvert	1 x 2.00 x 2.5
59	23+933	Drain Crossing	NV	NV	Box Culvert	1 x 1.00 x 1

Source: Structure Condition & Inventory Survey

### 3.5.7 Wayside Amenities

Wayside Amenities like Bus Shelters, Bus Bays are provided as mentioned in **Table 13**, Solar Street Lights are proposed at Major & Minor Junctions. Overhead Gantry is proposed at start and end of the project road and Cantilever Gantry are proposed at all the Major Junctions.

**Table 13: Bus Shelter Details**

Sr. NO.	Location	Existing Chainage		Design Chainage	
		Left	Right	Left	Right
1	Duliajan	13+575	13+750	13+600	13+780
2	Rongagorah	19+750	19+775	19+800	19+850
3	Padumoni Gaon	21+350	21+375	21+400	21+400
4	Bhadoi Pachali	23+250	23+450	23+250	23+465

Source: Detailed Project Report



## 3.6 Analysis of Alternatives

### 3.6.1 With Project and Without Project Scenario

**With Project Scenario:** The “with project” scenario includes the widening of the existing road section to two-lane carriageways with paved and earthen shoulder configuration. The “with project” scenario has been assessed to be economically viable and will alleviate the existing conditions. To avoid the large-scale acquisition of land and properties, the project envisages the widening of the existing road alignment to minimize the loss of properties and livelihood of the PAPs. It would thereby, contribute to the development goals envisaged by the Government of India, and enhance the growth potential of the state as well as the project region.

**Without Project Scenario:** In the case of “without project” scenario, the existing road with single lane to intermediate carriageway width will be considered as it is. Considering the present traffic volume and potential for growth in the near future, the capacity of the present road is insufficient for handling expected traffic volume and calls in for immediate improvements.

The existing road section has poor riding conditions with poor drainage conditions and poor geometry. The poor road conditions, population growth, increase in traffic volumes and the economic development along the project corridor would continue to occur and will exacerbate the already critical situation. The existing unsafe conditions and the adverse environmental consequences, in terms of the environmental quality along the roads, would continue to worsen in the absence of the proposed improvements.

Therefore, the no-action alternative is neither a reasonable nor a prudent course of action for the proposed project, as it would amount to a failure to initiate any further improvements and impede economic development. Hence the “With” project scenario with minor reversible impacts is an acceptable option than the “Without” project scenario. The implementation of the project therefore will be advantageous to achieve the all-around development of the economy and progress of the State.

### 3.6.2 Bypass and Realignment Proposal

The road passes through semi built-up areas for most of its length and some agricultural areas are observed as well. The existing road section has poor riding conditions with poor drainage and poor geometry which are seriously impacting and deteriorating the road surface. The poor road conditions, population growth, increase in traffic volumes and the economic development along the project corridor would continue to occur and will exacerbate the already critical situation. The existing unsafe conditions and the adverse environmental consequences, in terms of the environmental quality along the roads, would continue to worsen in the absence of the proposed improvements.

Detailed analyses of the alternatives have been conducted taking into account both with and without project. The project road work involves improvement and up-gradation of the existing road. No alternate alignments were accessed for the Deesang Kinar Bangali to



Kathalguri road. 1 bypass and 4 realignment have been proposed in the entire project stretch. The realignments have been proposed to improve the geometric design of the road and to achieve the design speed. The project road will provide a better level of service in terms of improved riding quality and smooth traffic flow. It will facilitate access to different parts of the region and improve the economic status of the region. The improvement of the existing road section is considered to be the best possible alignment. The proposed strengthening of the road is likely to have a positive impact on the economic value of the region. However, there is a certain environmental and social issue, these need to be mitigated for sustainable development.

The details of the realignment proposals for the project road are presented in **Table 14**.



**Table 14: Details of Realignment**

Sr. No.	Start Point		End Point		Length of Realignment (m)	Justification for Realignment
	Place	Chainage	Place	Chainage		
<b>1. Realignment no. 1</b>						
<b>Existing Alignment</b>	Deesang Kinar Bangali	0+200	Deesang Kinar Bangali	0+650	450	i. Realignment undertaken for improvements in approaches of the existing bridge.
<b>New Alignment</b>	Deesang Kinar Bangali	0+150	Deesang Kinar Bangali	0+687	537	
<b>2. Realignment no. 2</b>						
<b>Existing Alignment</b>	No. 1 Ghuroniya	0+800	No. 1 Ghuroniya	1+325	525	i. Realignment undertaken for improvements in approaches of the existing bridge.
<b>New Alignment</b>	No. 1 Ghuroniya	0+762	No. 1 Ghuroniya	1+300	538	ii. Realignment undertaken for improvement in road geometry and removal of accidental spots formed due to presence of S-curves. iii. After Realignment, comparatively lesser number of trees will be cut. iv. Very few existing structures will be affected due to realignment
<b>3. Realignment no. 3</b>						
<b>Existing Alignment</b>	Duliajan	14+050	Duliajan	14+650	600	i. The existing bridge along the project road has a very sharp approach leading to the formation of accidental spot. Thus, the existing bridge is abandoned and a new bridge is proposed along the project road and the realignment is proposed to match the approaches of this newly proposed bridge.
<b>New Alignment</b>	Duliajan	13+990	Duliajan	14+420	430	
<b>4. Realignment no. 4</b>						
<b>Existing Alignment</b>	Rongagorah	20+225	Rongagorah	20+750	525	i. Realignment undertaken for improvement



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

Sr. No.	Start Point		End Point		Length of Realignment (m)	Justification for Realignment
	Place	Chainage	Place	Chainage		
<b>New Alignment</b>	Rongagorah	20+120	Rongagorah	20+953	833	ii. in road geometry and removal of accidental spots formed due to presence of S-curves. The realignment passes through Greenfield alignment leading to very few R&R issues.
<b>5. Bypass</b>						
<b>Existing Alignment</b>	No. 1 Ghuroniya	1+325	Pabhajan	10+225	8900	i. Realignment undertaken for improvement in road geometry
<b>New Alignment</b>	No. 1 Ghuroniya	1+350	Pabhajan	10+250	8900	

*Source: Detailed Project Report*



## **3.7 Construction Material and Source**

### **3.7.1 Sand**

The sand is found at Dihing River Sand which is at Chainage – 46+609 on the right-hand side with a Lead of 13.1 Km. The sand available at this quarry location is classified to be Zone-III can be used for any construction works.



Table 15: Details of Borrow Areas

Location and name of quarry if any (correlated with map)	Specimen No.	Location		Side	Natural Sand				
		km	Cut/Fill Existing Road		Sieve Size (mm)	Wt. of materials Retained (g)	Cum. Wt. Of materials Retained (g)	Cum. % materials of Retained	% Passing
Dihing River Village Naharkatia Bridge	1	0+000		RHS	10 mm	0.0	0.00	0.00	100.00
					4.75 mm	12.8	12.80	1.16	98.84
					2.36 mm	45.1	57.90	5.26	94.74
					1.18 mm	88.3	146.20	13.29	86.71
					600 microns	135.6	281.80	25.62	74.38
					300 microns	351.2	633.00	60.55	39.45
					150 microns	458.1	1091.10	96.19	3.81
					Pan	8.9	1100.00	100.00	0.00
					<b>Fineness Modulus</b>				

Merbil Majuli No.1  
 Assam  
 India  
 2020-02-14 (Fri) 11:20(AM)  
 21°C  
 70°F

Source: Material Report



### 3.7.2 Aggregate

Stone quarries have been primarily identified as stone aggregate source for construction of various components of road, namely, Bituminous Concrete (BC), Dense Bituminous Macadam (DBM), Wet Mix Macadam (WMM) as well as for the cement concrete works. Investigation for the stone quarries is done based on the existing licensed quarries authorized by government agency.

**Table 16: Details of Quarry Material Sources along the Project Corridor**

Sr. No.	Location	Ref. Chainage	Side of Road (LHS/RHS)	Distance from Existing Road (Km)	Type of Material Available
1	Bihubor	12+000	LHS	59+000	20mm, 10mm

Source: Material Report

### 3.7.3 Borrow Earth

The borrow earth selected for embankment construction comprises primarily classified as CS according to I.S. classification. The maximum dry unit (Heavy compaction) observed as 19.60 gm/cc satisfying the MoRTH requirements for embankment soil.



**Table 17: Details of Source and Quantity of Borrow Earth**

Sr. No.	Borrow area Number	Borrow area name village	Location	Lead	Area available for borrow material in sq.m	Suitability for embankment/ subgrade	Available quantity in Approx cum.	Required cum.
1	BA-1	NO.1 GHURANIA	27.256498N, 95.26455E	1.0 KM	48122	Suitable for subgrade and embankment	125256	3476585
2	BA-2	NEAR NAGAON DHADUMIA	27.272615N, 95.29678E	3.0 KM	32658	Suitable for subgrade and embankment	87950	
3	BA-3	NO.1 BORBAM	27.283703N, 95.24359E	3.0 KM	175000	Suitable for subgrade and embankment	510000	
4	BA-4	Lead - 100m CH 9+400	27.326835N, 95.28609E	100M	30500	Suitable for subgrade and embankment	90000	
5	BA-5	NEAR HATIGARH BLOCK	27.311709N, 95.31311E	3.0 KM	164500	Suitable for subgrade and embankment	421354	
6	BA-6	TIPLING	27.334888N, 95.32638E	200 MTR	157674	Suitable for subgrade and embankment	454326	
7	BA-7	NARR OUPHULIA ALIKINAR	27.330837N, 95.33607E	300 MTR	310480	Suitable for subgrade and embankment	606780	
8	BA-8	RONGAGORHI NO.1	27.324555N, 95.37694E	50 MTR	127600	Suitable for subgrade and embankment	326320	
9	BA-9	PADUMONI GAON	27.324938N, 95.40754E	1.0 KM	163400	Suitable for subgrade and embankment	386500	
10	BA-10	NEAR KATHALGURI NO. 2, Lead -	27.3303361N, 95.43903E	2.3KM	1064000	Suitable for subgrade and embankment	2035860	

Source: Material Report



### 3.7.4 Water Requirement

Location of water sources for the use in concrete works and for construction of road works have been identified in the vicinity of project road. Along the project road, streams / Nalas are in close proximity to some points of the alignment and cross the alignment at suitable intervals. However, to facilitate construction works it is always advisable to install deep tube wells at suitable places for obtaining water for construction purposes.

*Source: Material Report*

### 3.7.5 Materials Requirement

Total quantity of important materials required for the construction of the project is given in **Table 18**.

**Table 18: Estimated Quantities of Materials for Project**

Sr. No.	Material Type	Unit	Summary of Quantities
1	Embankment	Cum	3337879.86
2	Sub-grade	Cum	119502.39
3	Shoulder	Cum	19202.41
4	WMM	Cum	68533.29
5	Granular Sub-base	Cum	61632.23

*Source: Material Report*

### 3.8 Construction Camps

Construction camp will be set up by the contractor at a suitable location along the project corridor which will be in consultation with the Project Director and Pollution Control Board Assam. As the Contractor is required to source labour from the local communities along the subproject road, the size of the construction camps will be relatively small. It is the responsibility of the Contractors to maintain a hygienic camp with adequate water and electric supply; toilet facilities should be located away from the water bodies and wells; proper disposability of domestic refuse; temporary medical facilities; pest control; clean and adequate food; and social security.

### 3.9 Manpower Requirement

The proposed project will involve 200 un-skilled, 200 semi-skilled, 200 skilled and 200 highly skilled labours.

### 3.10 Land requirement

The total land to be acquired is 91.35 acre, out of which 30.02acre (32.86%) is government land, 54.25acre (59.38%) is private land, while ownership status of remaining 7.08 acre (7.75%) land is yet to be established, as the revenue records are not available for these stretches. No forest land is impacted in the proposed project stretch. **Table 19** shows the land to be acquired for the proposed project.



**Table 19: Proposed Land Acquisition**

Sr. No.	Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where owner-ship could not be ascertained (in acre)*	Government Land (in acre)	Total Land to be acquired (in acre)
1	Desang Kinar Bangali	Revenue Circle: Naharkhatiya; Dist. Dibrugarh	0.15	0.00	0.00	0.15
2	Asabam T.E		0.10	0.00	0.31	0.40
3	Grant No.334 NLR		1.91	0.00	0.00	1.91
4	1 No.Ghuronia		7.45	0.10	2.99	10.54
5	Desam T.E		0.82	0.00	0.07	0.89
6	Cheleng Gaon		1.31	0.17	1.12	2.59
7	Tairai Gaon		1.31	0.00	0.62	1.94
8	1 No.Habi Chengelijan		2.27	0.00	0.93	3.20
9	2 No.Borbam		3.56	0.00	0.26	3.82
10	Tarani Pathar		7.59	0.00	0.59	8.18
11	Sasoni Pathar		6.10	0.00	0.68	6.78
12	2 No. Mohamari	Revenue Circle: Tengakhat; Dist. Dibrugarh	4.95	0.61	0.10	5.66
13	1 No. Mohamari		4.62	4.18	0.96	9.77
14	Meribil Pabhajan		2.40	1.03	0.00	3.44
15	Pabhajan Gaon		0.88	0.32	0.75	1.96
16	1 No. Chalakataki		0.35	0.10	2.76	3.21
17	1 No Jagun Pathar Gaon		2.45	0.00	0.00	2.45
18	2 No Chala Kataki		0.21	0.00	0.00	0.21
19	Tipling Purana Ghat		0.18	0.00	1.46	1.64
20	Bara Gadhau & Naloni Pathar		1.04	0.00	0.61	1.65
21	15 No Jaloni Grant Gaon-1		0.18	0.00	4.76	4.94
22	15 No Jaloni Grant Gaon-2		1.15	0.00	8.25	9.40
23	Jagun Gaon		0.96	0.00	0.58	1.54
24	1 No Ronga Gora Gaon		0.13	0.00	0.22	0.35
25	Padumoni Gaon		1.98	0.54	0.83	3.35
26	2 No.Chopatali Gaon		0.21	0.03	0.19	0.43
27	2 No Chapatali-2		0.00	0.00	0.98	0.98
		<b>Total</b>	<b>54.25</b>	<b>7.08</b>	<b>30.02</b>	<b>91.35</b>

Source: SIA Report

### 3.11 Project Cost

The estimated total project cost is approximately **INR 3,679,591,070**. The per kilometre cost of the project road is **INR 153,585,068**.

Source: Cost Estimate

### 3.12 Implementation Schedule

The project construction period will be **30 months** for the project-road.



### 3.13 Sub-Project Benefits

The following are the expected benefits due to the improvement in the sub-project road:

- The project road would provide better access to urban areas and market places along project road such as Duliajan and Naharkatia.
- The project road will provide better access to tourist locations such as Dihing Patkai National Park (recently declared) which is in the vicinity of the project road.
- The project road will provide better connectivity to NH2, NH215, Nh315A, SH24, and SH27.
- Better level of service in terms of improved riding quality and smooth traffic flow.
- Faster transportation will ultimately lead to massive savings in the form of reduced wear and tear of vehicles, reduced vehicle operating costs (VOCs), and total reduction in transportation costs, etc.
- With the improvement of the road surface, the traffic congestion due to obstructed movement of vehicles will be minimized and thus wastage of fuel emissions from the vehicles will be reduced.
- Increased road landscaping and safety features.
- Enhanced connectivity between rural & urban populations which will benefit all sections of the society like the general population, small-medium-large scale industries, farmers, businessmen, etc.
- Improved access to higher education facilities & modern health facilities.
- Strengthening both rural & urban economies which in turn will improve the economic scenario of the state and country.
- Improved road connectivity helps in better implementation and management of government schemes.
- With the improvement in the economy, more generation of employment opportunities.
- Overall Environment and social improvement of the region.



## 4. Description of the Environment

### 4.1 Introduction.

To assess the impacts of the proposed improvement to the subproject road, field visits were undertaken to understand the environmental profile of the project influence area. This involved field inspections at all the sensitive locations, collection of secondary information for all the environmental components, and discussions with the officials and local populace. The profile presented below comprises of the following:

- Physical environmental components such as meteorology, geology, topography, soil characteristics, ambient air quality, noise levels, surface, and sub-surface water quality.
- Biological environmental components such as aquatic, biotic and marine flora, fauna and mammals, and
- The land environment in terms of land use, soil composition.
- Socio-economic environment in terms of demography, education, and health infrastructure.

#### 4.1.1 Data Collection Methodology

##### 4.1.1.1 Ambient Air Quality

Baseline data for the parameters - particulate matter size less than  $10\mu\text{m}$  or  $\text{PM}_{10}$   $\mu\text{g}/\text{m}^3$ , particulate matter size less than  $2.5\mu\text{m}$  or  $\text{PM}_{2.5}$   $\mu\text{g}/\text{m}^3$ , sulphur dioxide ( $\mu\text{g}/\text{m}^3$ ), nitrogen dioxide ( $\mu\text{g}/\text{m}^3$ ) and carbon monoxide ( $\mu\text{g}/\text{m}^3$ ) in the study has been generated for 24 hours for one season other than monsoon as per CPCB norms. While selecting the monitoring locations specific importance has to be given where ever sensitive environmental receptors and habitation exist.

##### 4.1.1.2 Noise Levels

While selecting the monitoring locations specific importance has given to sensitive environmental receptors like thickly populated areas, hospitals, schools, etc. Hourly monitoring of noise levels (Leq) has been recorded for 24 hours by using an integrated noise meter. The results obtained are compared with Noise standards designated for different types of land use, i.e. residential, commercial, industrial areas, and silence zones as per the Noise Pollution (Regulation and Control) Rules 2000.

##### 4.1.1.3 Water Quality

The monitoring of surface water and groundwater within the study area has been done. The sample collection, preservation, storage, transportation, and analysis were carried out as per the standard methods given in the manual of the American Public Health Association for the Examination of Water and Wastewater (APHA).

##### 4.1.1.4 Soil

The suggested parameters for soil analysis are pH, Electrical conductivity, sand (%), silt (%), clay (%), texture, moisture retention capacity (%), infiltration rate (mm/hour), bulk density



(gm/cc), porosity (%), organic matter (%), nitrogen (mg/1000g), potassium (mg/1000g), phosphorous (mg/1000g), sulphates and sodium sulphates.

#### 4.1.1.5 Flora & Fauna

The data for flora and fauna in the project region were collected by conducting site survey, field observations and secondary data from forest department and other relevant sources. Tree Inventory was conducted for identification of tree species within the proposed right of way. For identification of fauna in the study region, field observations were conducted and the Divisional Forest Office having jurisdiction of the project region were consulted.

## 4.2 Physical Environment

### 4.2.1 Physiography and Soil Type

Buridihing, a tributary of Brahmaputra divides the district from east-to-west. Buridihing flows through Naharkatia and Khowang, and at a later stage in its course, Buridihing acts as a divider between Dibrugarh and Sivasagar districts. The region is flat with a gradual slope from the East to the west. It is the gateway to the three tea-producing districts of Tinsukia, Dibrugarh, and Sivasagar. These three areas account for approximately 50% of India's Assam tea crop and this gives Dibrugarh its rightly earned sobriquet as the "Tea City of India". Oil and Timber are the other two big industries in and around Dibrugarh. It is a broad plain and rises to the foothills in the south. Apart from an outlying spur of the Naga Hills stretches from the Deesang river through the south of the Joypur and the Tipling ranges and a few isolated hills in the Buri Dihing mauzas, there is nothing to break the even level of the plain. The extensible plain of the district which is fairly high and fertile is covered with fields of waving paddy which changes from vivid green luster into a rich gold as the harvest time draws near or with stiff bushy tea bushes that spread over like a dark green carpet. Villages are encircled by groves of slender palms, broad-leaved plantains, feathery bamboos, and juicy fruit trees.

The soil of the district is fertile, acidic, and alluvial. Acidic phosphorous are good for tea cultivation. On the other hand, heavy clays with a high percentage of nitrogen in low lying areas of the district give a better yield of rice. Abundant rainfall and high humidity throughout the year favor the cultivation of tea and rice in the district.

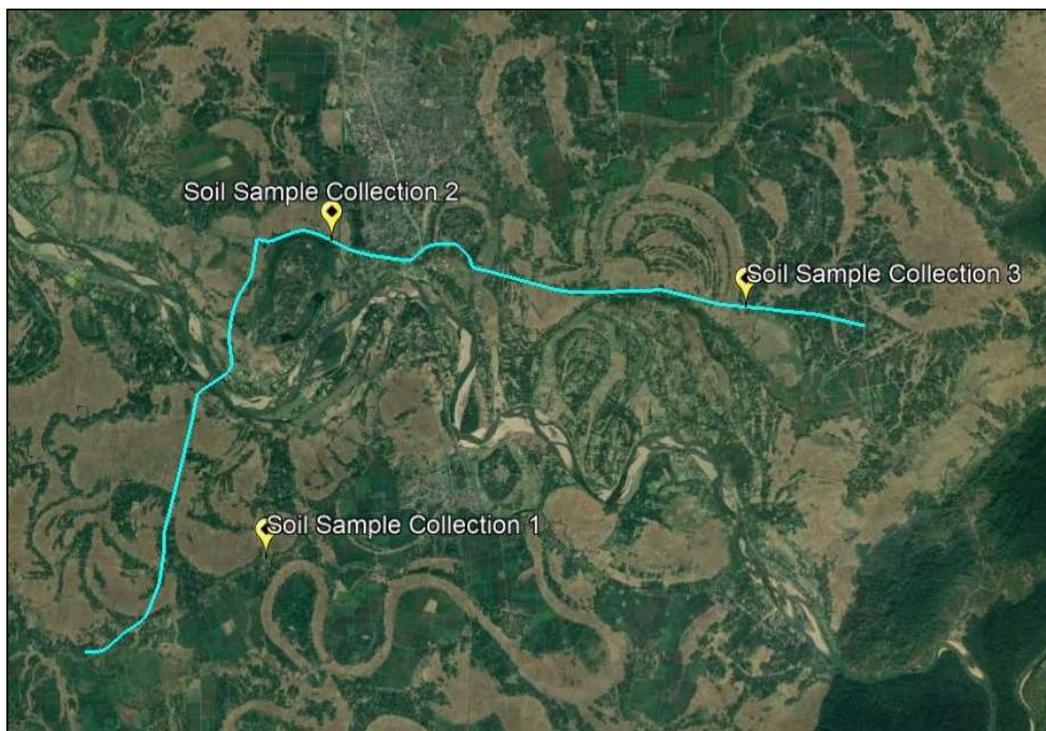
*Source: District Census Handbook, Dibrugarh District*

The details of soil sample collection are given in **Table 20** and **Figure 7**.

**Table 20: Soil sampling locations along the project road**

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Coordinates	
				Latitude	Longitude
1	18-Jan-2020	Nahorkatia	2190m/ East	27.27314	95.289675
2	18-Jan-2020	Duliajon No. 2	10m/North	27.334344	95.303877
3	18-Jan-2020	Padumoni Gaon	30m/ North	27.321492	95.3937488

*Source: Environmental Baseline Monitoring*



**Figure 7: Soil sampling locations along the project road**

The soil quality along the project road is given in the below **Table 21**. The soil map of India showing the project road is shown in **Figure 11**.



**Table 21: Soil Quality along the Project road**

Sr. No.	Parameters	Test Method	Unit	Nahorkatia	Duliajon No. 2	Padumoni Gaon	Standards/Permissible Limits (Handbook of Agriculture, ICAR, New Delhi)
1.	pH (1:5 suspension)	IS:2720 (Part-26)	-	6.85	6.69	6.56	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.00 Moderately acidic 6.01-6.50 Slightly acidic 6.51-7.30 Neutral 7.31-7.80 Slightly alkaline 7.81-8.50 Moderately alkaline 8.51-9.00 Strongly alkaline >9.00 Very strongly alkaline
2.	Electrical Conductivity at 250C (1:5 suspension.)	IS:2720 (Part-21)	µmhos/cm	62	51	54	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 Harmful to crops (sensitive to salts)
3.	Porosity	STP/SOIL	% by mass	26.3	25.89	24.25	-
4.	Texture	STP/SOIL	-	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	-
5.	Sand	STP/SOIL	% by mass	50.25	51.45	52.31	-
6.	Clay	STP/SOIL	% by mass	42.64	41.87	41.14	-
7.	Silt	STP/SOIL	% by mass	7.11	6.68	6.55	-
8.	Nitrogen	STP/SOIL	mg/1000g	1790	1840	1860	Upto 50 Very less 51-100 Less 101-150 Good 151-300 Better >300 Sufficient
9.	Potassium (as K)	STP/SOIL	mg/1000g	89.18	85.28	85.21	Upto 15 Very less 16-30 Less 31-50 Medium, 51-65 On an avg. sufficient 66-80 Sufficient >80 More than sufficient
10.	Phosphorus	STP/SOIL	mg/1000g	<5.0	<5.0	<5.0	0 -120 Very less 120-180 Less



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Sr. No.	Parameters	Test Method	Unit	Nahorkatia	Duliajon No. 2	Padumoni Gaon	Standards/Permissible Limits (Handbook of Agriculture, ICAR, New Delhi)
							181-240 Medium 241-300 Average 301-360 Better >360 More than sufficient
11.	Organic Matter	IS:2720 (Part-22)	% by mass	0.82	0.84	0.87	Upto 0.20: Very less 0.21-0.40: Less 0.41-0.50: Medium, 0.51-0.80: On an avg. sufficient 0.81-1.00: Sufficient >1.00: More than sufficient
12.	Moisture Retention capacity	STP/SOIL	% by mass	36.32	37.7	35.69	-
13.	Infiltration Rate	STP/SOIL	mm/hr	247	275	256	-
14.	Sulphates	STP/SOIL	mg/100gm	24.86	22.24	25.67	-
15.	Sodium Sulphates	STP/SOIL	mg/1000g	14.21	12.34	13.25	-
16.	Calcium Sulphates	STP/SOIL	mg/1000g	8.66	9.2	8.64	-
17.	Bulk Density	STP/SOIL	gm/cm <sup>3</sup>	1.23	1.24	1.24	-

Source: Environmental Baseline Monitoring



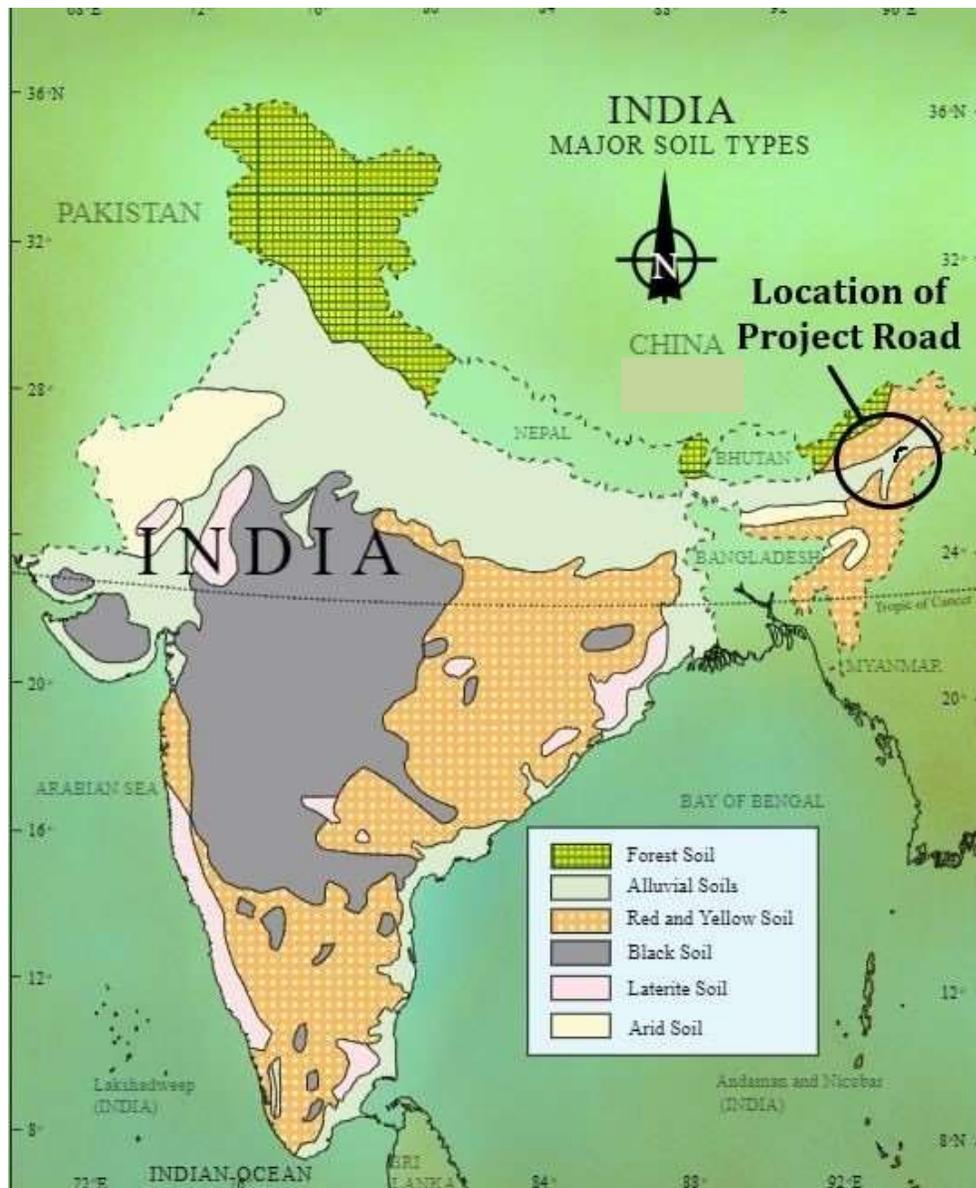
Figure 8: Soil Sample Collection at Nahorkatia



Figure 9: Soil Sample Collection at Duliajon No. 2



Figure 10: Soil Sample Collection at Padumoni Gaon



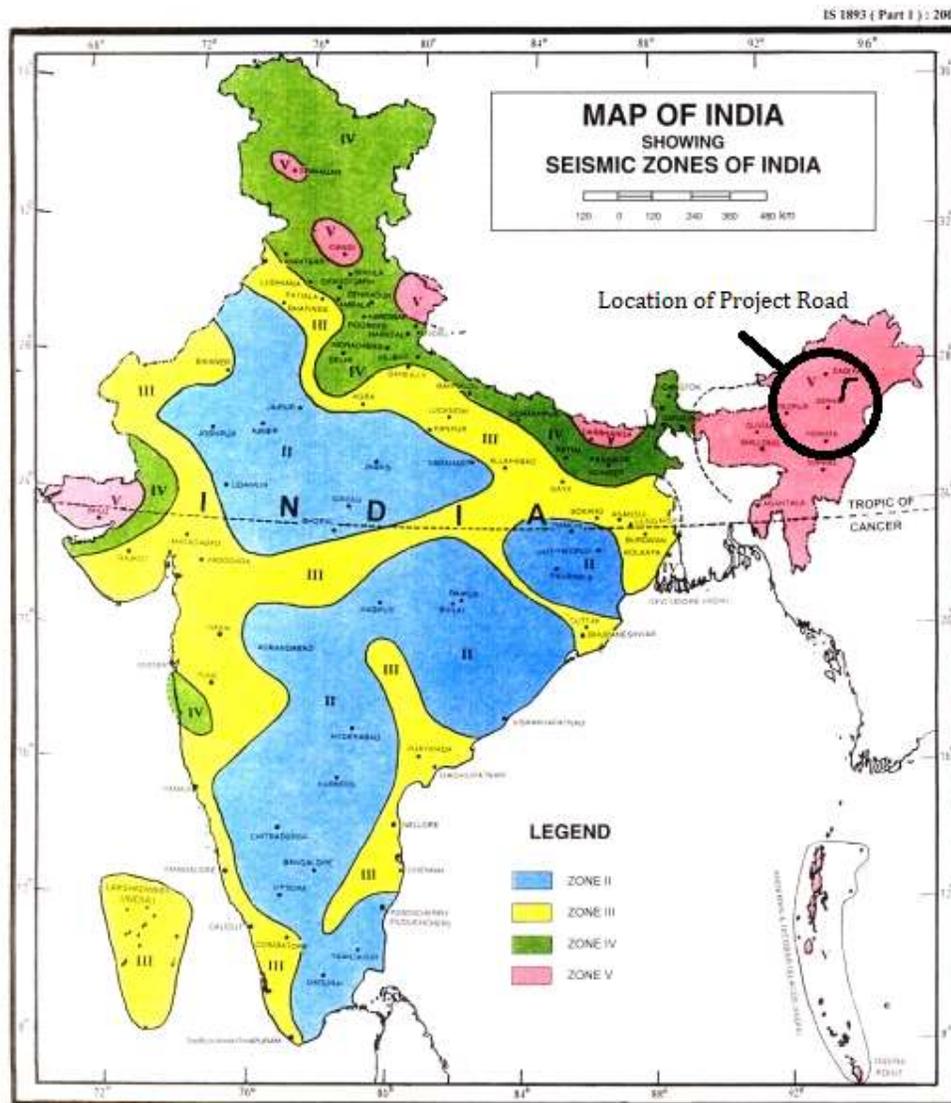
Source: Website of National Repository of Open Educational Resources

**Figure 11: Soil Map of India showing the project road**

As per the soil map of India, the soil found in the state of Assam is Alluvial soil. Soil is mostly found as sandy clay loam soil in the sampling locations and it is loaded with a sand percentage varying from 50.25% to 52.31% at Nahorkatia and Padumoni Gaon respectively. Nitrogen content varies from 1790 mg/1000g to 1860 mg/1000g at Nahorkatia and Padumoni Gaon respectively. The soil is poor in organic carbon content. Chemically soil along the project road has a neutral pH in the range of 6.56 to 6.89. The soil has less water holding capacity.

#### 4.2.2 Seismicity

Geomorphologically, NE India is located in an earthquake-prone zone (zone V) of the Indian subcontinent. In this region, an earthquake comes with land sliding flood and along with a series of smaller magnitude earthquakes. In the project district earthquakes of up to MM intensity IX can be expected. According to a hazard map by the Global Seismic Hazard Assessment Programme, the state can expect to have a peak gravitational acceleration (PGA) of 0.24g to 0.48g. The region where the highest PGA can be expected is along the state's border with Meghalaya, the site of the Great Indian earthquake of 1897. The seismic zone map of India showing the project road is shown in the below **Figure 12**.



Source: IS1893 (Part1) 2002

Figure 12: Seismic Zone Map of India showing the project road

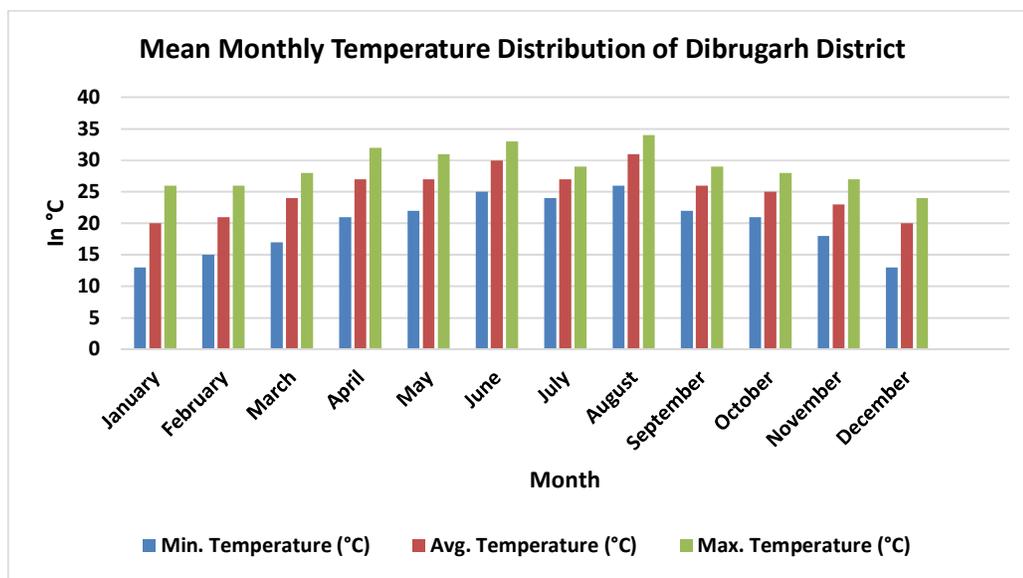


### 4.2.3 Climate

As the entire road stretch passes through Dibrugarh district, information related to climate is studied for Dibrugarh district.

#### 4.2.3.1 Annual Temperature

The coldest month is January, with an average high-temperature of 22.8°C (73°F) and an average low-temperature of 9.2°C (48.6°F). The warmest month in Dibrugarh is August, with an average high-temperature of 31.8°C (89.2°F) and an average low-temperature of 24.9°C (76.8°F). November is the month with the least rainfall. Rain falls for 1.8 days and accumulates 16.4mm (0.6") of precipitation. **Figure 13** represents the Mean monthly Temperature Distribution in the Dibrugarh district for 2019.

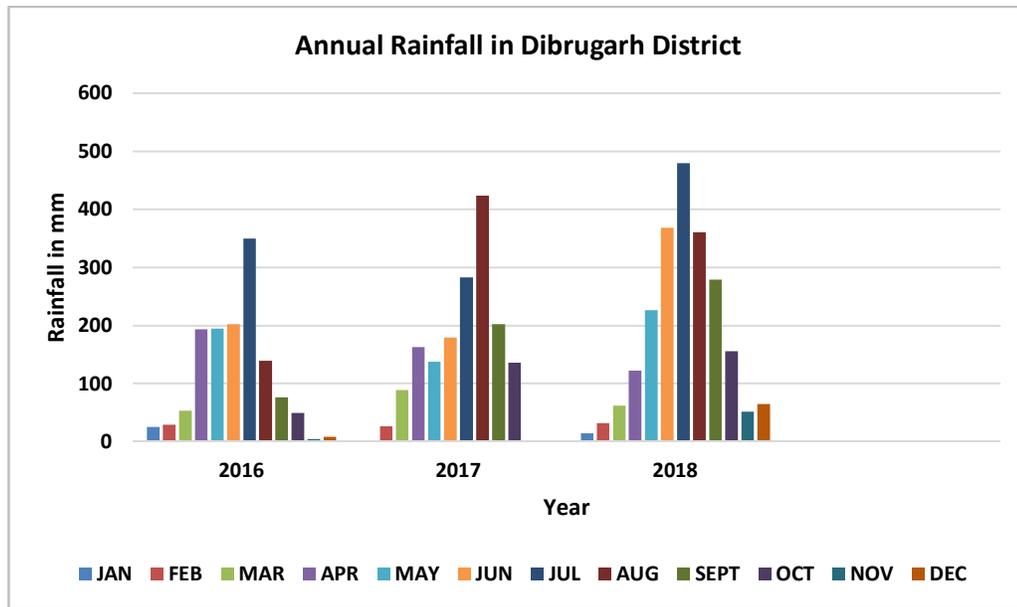


Source: [www.worldweatheronline.com](http://www.worldweatheronline.com)

**Figure 13: Mean Monthly Temperature Distribution details**

#### 4.2.3.2 Annual Rainfall

The rainfall is recorded as 3603.5 mm as against the state total rainfall of 2296.3 mm. The highest rainfall 463.4 mm is recorded in April and July 2011 in the district. The lowest rainfall of 20 is recorded in December. **Figure 14** depicts the details related to the Annual Mean Rainfall received by Dibrugarh district from 2016 to 2018.



Source: India Meteorological Department website ([www.imd.gov.in](http://www.imd.gov.in))

Figure 14: Annual Rainfall details

#### 4.2.4 Wind speed/Direction

Generally, light to moderate winds prevails throughout the year with speed ranging from 1 to 19 kmph. Winds were light and moderate particularly during the morning hours, while during the afternoon hours the winds were stronger. The wind rose diagram developed during January 2020 is shown in **Figure 15** which reveals that pre-dominant wind direction occurs mostly blowing from the North-East direction in Dibrugarh IMD station (Nearest IMD from the project road) and the average wind speed is 2.4 m/s. **Table 22** shows the Meteorological Data Parameters at Dibrugarh IMD station, Nearest IMD from the project road (during January 2020).

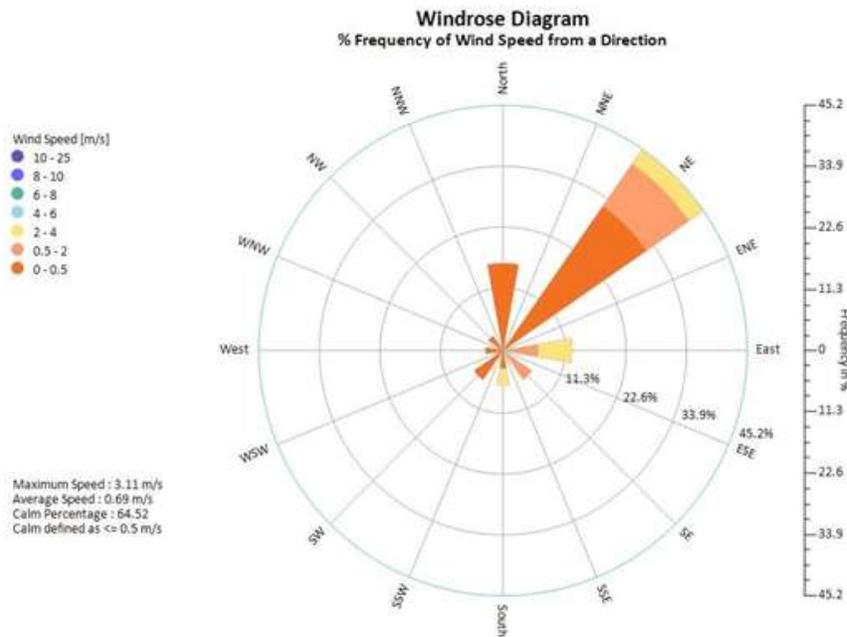


Figure 15: Wind rose diagram of Dibrugarh district (Nearest IMD station from the project road)

Table 22: Meteorological Data Parameters at Dibrugarh (Nearest IMD from the project road)

Month	Temperature, deg C			Humidity, %			Pressure, hPa			Wind Speed, km/Hr	Predominant Wind Direction	Rainfall mm
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Avg		
January	6.4	26.9	16.2	72	83	77.2	1002.3	1006.5	1004.2	2.4	NE	28.1

Source: www.imd.gov.in; Met Station: Dibrugarh

#### 4.2.5 Hydrogeology

Hydrogeologically the project state can be divided into three units namely consolidated formation, semi consolidated formation, and unconsolidated formation. More than 75% of the project state is underlain by unconsolidated formation comprising of clay, silt, sand, gravel, pebble, and boulders. The Bhabar belt is about 11 to 15 km wide; the tube wells yield 27 to 59 m<sup>3</sup>/hr in this zone. The Tarai zone follows immediately downslope of the Bhabar zone where the yield of the well's ranges between 80-240 m<sup>3</sup>/hr. The flood plains follow the Tarai in Brahmaputra valley where the shallow tube wells yield between 20-50 m<sup>3</sup>/hr and deep tube wells between 150-240 m<sup>3</sup>/hr. In the semi consolidated formations of the Cachar district, the yield of the tube well ranges between 50 to 100 m<sup>3</sup>/hr. The details of the hydrogeology have been presented in **Table 23** below.



**Table 23: Details of Hydrogeology in project state**

<b>Dynamic Ground Water Resources</b>	
Annual Replenishable Groundwater Resource	27.23 BCM
Net Annual Ground-Water Availability	24.89 BCM
Annual Ground Water Draft	5.44 BCM
Stage of Ground Water Development	22%
<b>Ground Water Development &amp; Management</b>	
Over Exploited	NIL
Critical	NIL
Semi-critical	NIL
Artificial Recharge to Ground Water (AR)	<ul style="list-style-type: none"> <li>Feasible AR structures</li> </ul> 250 Check Dams. 500 weirs, 1000 Gabion structures, 250 development of springs 600 RWH in Urban Areas
<b>Ground Water Quality Problems</b>	
<b>Contaminants</b>	<b>Districts affected (in part)</b>
Fluoride (>1.5 mg/l)	Goalpapa, Kamrup, Karbi Anglong, Nagaon
Iron (>1.0 mg/l)	Cachar, Darrang, Dhemaji, Dhubri, Goalpapa, Golaghat, Hailakandi, Jorhat, Kamrup, Karbi Anglong, Karunganj, Kokrajhar, Lakhimpur, Morigaon, Nagaon, Nalbari, Sibsagar, Sonitpur.
Arsenic (>0.05 mg/l)	Dhemaji

Source: <http://cqwb.gov.in>

#### 4.2.6 Water Quality

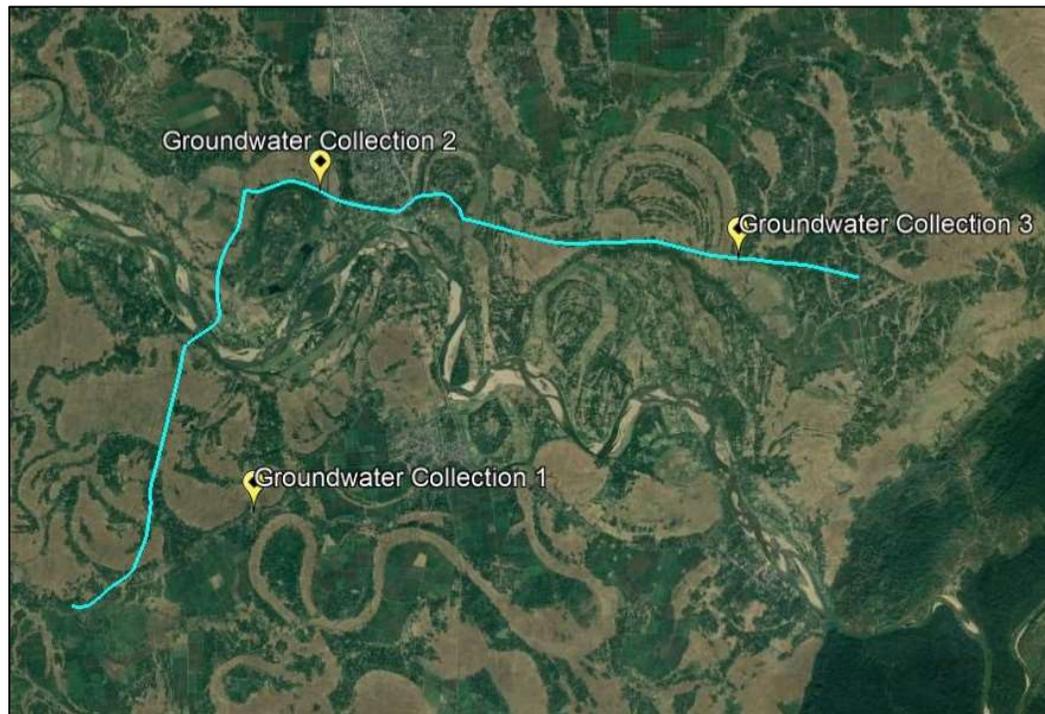
The objectives behind the monitoring are to develop an overall picture of the ground and surface water quality of the project district. The sampling of ground and surface water was carried out in January 2020 (winter period). The water samples after collection were immediately subjected to the analysis of various parameters in the NABL Accredited laboratory. The parameters analyzed, include pH, Electrical Conductivity (EC), Total Alkalinity (TA), Total Hardness (TH), Nitrate (NO<sub>3</sub>), and Fluoride (F). The sample collection, preservation, storage, transportation, and analysis were carried out as per the standard methods given in the manual of the American Public Health Association for the Examination of Water and Wastewater (APHA). The groundwater quality data thus generated was first checked for completeness and then the validation of data was carried out using standard checks.

In the study area, two surface and three ground water samples were collected for winter season (January 2020). These samples were taken as grab samples and were analyzed for various parameters to compare with the standards. The details of sample collection for Groundwater and Surface water are given in **Table 24** and **Table 25** respectively. The ground and surface water quality result of the project road is given in the following **Table 26** and **Table 27**.

**Table 24: Groundwater sampling locations along the project road**

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Source of Sample Collection	Coordinates	
					Latitude	Longitude
1	18-Jan-2020	Nahorkatia	2190m/ East	Hand pump	27.27314	95.289675
2	18-Jan-2020	Duliajon No. 2	10m/North	Hand pump	27.334344	95.303877
3	18-Jan-2020	Padumoni Gaon	30m/ North	Bore Well	27.321492	95.3937488

Source: Environmental Baseline Monitoring



**Figure 16: Groundwater sampling locations along the project road**

**Table 25: Surface water sampling locations along the project road**

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Source of Sample Collection	Coordinates	
					Latitude	Longitude
1	18-Jan-2020	Nagaon Dhadunia	2190m/ East	Pond	27.27314	95.289675
2	18-Jan-2020	Nahorkatia	1100m/ South	Deesang River	27.321845	95.308773
3	18-Jan-2020	Boragadhai	30m/ South	Tipling River	27.332846	95.325101

Source: Environmental Baseline Monitoring



Figure 17: Surface water sampling locations along the project road



**Table 26: Ground Water quality result of the project road**

Sr. No.	Parameters	Unit	Limit (as per IS:10500-2012)		WHO Drinking Water Standard (Fourth Edition 2011)	Result		
			Desirable Limit	Permissible Limit		Nahorkatia	Duliajon No. 2	Padumoni Gaon
1	pH	-	6.5-8.5	No Relaxation	8.2-8.8	6.3	7.5	6.6
2	Colour	Hazen	5	25	Not Exceeding 5 hazen Unit	<5.0	<5.0	<5.0
3	Odour	-	Agreeable	Agreeable	Unobjectionable	Agreeable	Agreeable	Agreeable
4	Turbidity	NTU	1	5	Not Exceeding 1.5 NTU	<1.0	<1.0	<1.0
5	Total Hardness (as CaCO <sub>3</sub> )	mg/l	200	600	-	78.24	103.12	83.07
6	Chloride (as Cl)	mg/l	250	1000	-	14.27	25.28	12.35
7	Fluoride (as F)	mg/l	1	1.5	1.5	0.19	0.27	0.16
8	Phenol Content	mg/l	<0.001	-	-	<0.001	<0.001	<0.001
9	Calcium (as CaCO <sub>3</sub> )	mg/l	75	200	-	21.29	32.72	22.24
10	Magnesium (as CaCO <sub>3</sub> )	mg/l	30	100	-	6.1	5.2	6.7
11	Sulphate (as SO <sub>4</sub> )	mg/l	200	400	-	22.47	25.3	24.28
12	Nitrate (as NO <sub>3</sub> )	mg/l	45	No Relaxation	50	0.22	0.15	0.29
13	Selenium (as Se)	mg/l	0.01	No Relaxation	0.04 (P)	<0.01	<0.01	<0.01
14	Alkalinity as (CaCO <sub>3</sub> )	mg/l	200	600	-	138.12	126	142.20
15	TDS	mg/l	500	2000	-	186.09	194.72	188.71
16	TSS	Mg/l	-	-	-	<1.0	<1.0	<1.0
17	Phosphates	mg/l	-	-	-	<0.05	<0.05	<0.05
18	Ammonia	mg/l	0.5	No Relaxation	-	<0.1	<0.1	<0.1
19	Electrical Conductivity	Micromhos/cm	-	-	-	286.30	299.57	290.32
20	Sodium (as Na)	mg/l	-	-	40	26.52	18.75	24.28
21	Potassium (as K)	mg/l	-	-	-	12.35	11.72	13.25
22	Iron (as Fe)	mg/l	0.3	No Relaxation	Not exceeding 0.1	0.04	0.07	0.05



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Sr. No.	Parameters	Unit	Limit (as per IS:10500-2012)		WHO Drinking Water Standard (Fourth Edition 2011)	Result		
			Desirable Limit	Permissible Limit		Nahorkatia	Duliajon No. 2	Padumoni Gaon
					mg/L			
23	TKN	mg/l	-	-		<0.1	<0.1	<0.1
24	Total Coliform	mg/l	Nil	Nil	Absent	Absent	Absent	Absent
25	Fecal Coliform	mg/l	Nil	Nil	Absent	Absent	Absent	Absent

*Source: Environmental Baseline Monitoring*



Figure 18: Groundwater Sample collection at Nahorkatia



Figure 19: Groundwater Sample collection at Duliajon No. 2



Figure 20: Groundwater Sample collection at Padumoni Gaon



The samples were collected from hand pumps and bore well. It can be seen from **Table 26** that; the pH of the drinking water varies from 6.3 to 7.5. Total hardness as  $\text{CaCO}_3$  varies from 78.24 mg/l to 103.12 mg/l. Other parameters analyzed like chloride, sulphate, fluorides are found well within standards. It can be seen from the results that the groundwater quality meets the standards of IS: 10500-2012 standards for drinking water and CPCB standards for groundwater at all sampling locations.



Table 27: Surface Water quality result of the project road

**Microbiological Requirement**

Sr. No.	Parameter	Test Method	Result			Standards/ Permissible Limits	CPCB Surface Water Standard	
			Nagaon Dhadunia	Nahorkatia	Boragadhai	WHO	Inland Surface water Tolerance Limits for Class -B	Inland Surface water Tolerance Limits for class -D
1	Total Faecal Coliform Bacteria (MPN/100ML)	IS-1622	469	487	474	Nil	Nil	Nil

**Organoleptic & Physical Parameters**

Sr. No.	Parameter	Test method	Unit	Result			Standards/Permissible Limits		
				Nagaon Dhadunia	Nahorkatia	Boragadhai	WHO	Inland Surface water Tolerance Limits for Class-B	Inland Surface water tolerance limits for class D
2	Colour	IS-3025 (P-04)	Hazen Unit	<5.0	<5.0	<5.0	-	-	-
3	Odour	IS-3025 (P-04)	-	Agreeable	Agreeable	Agreeable	-	-	-
4	Turbidity	IS-3025 (P-04)	NTU	2.5	2.4	2.6	-	-	-
5	pH value	IS-3025 (P-04)	-	7.12	7.19	7.10	6-9	6.5-8.5	6.5-8.5
6	Total Dissolved Solid (TDS)	IS-3025 (P-04)	mg/l	132.65	129.83	151.31	-	-	-
7	Electrical Conductivity	IS-3025 (P-04)	µs/cm	204.08	199.74	232.78	-	-	1000
8	Total Suspended Solid	IS-3025 (P-04)	mg/l	1.2	1.7	1.7	-	-	-
9	Total Dissolve Oxygen	IS-3025 (P-04)	mg/l	4.6	4.2	4.9	-	5	4
10	Biological Oxygen Demand	IS-3025 (P-04)	mg/l	3.5	3.7	3.6	30	3	-
11	Phosphate Content	IS-3025 (P-04)	mg/l	0.061	0.052	0.044	-	-	2

**Concerning Substances Undesirable in Excessive Amounts**



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Sr. No.	Parameter	Test method	Unit	Result		
				Nagaon Dhadunia	Nahorkatia	Boragadhai
12	Total Ammonia	IS: 3025 (P- 34)	mg/l	<0.1	<0.1	<0.1
13	TKN	IS: 3025 (P- 34)	mg/l	0.52	0.58	0.45
14	Boron (as B)	IS: 3025 (P- 57)	mg/l	BDL	BDL	BDL
15	Calcium (as Ca)	IS: 3025 (P- 40)	mg/l	16.25	14.28	14.26
16	Chloride (as Cl)	IS: 3025 (P- 32)	mg/l	25.35	20.14	24.14
17	Copper (as Cu)	IS: 3025 (P-42)	mg/l	<0.05	<0.05	<0.05
18	Fluoride (as F)	IS: 3025 (P-60)	mg/l	0.21	0.29	0.28
19	Phenol Content	IS: 3025 (P-43)	mg/l	<0.001	<0.001	<0.001
20	Iron (as Fe)	IS: 3025(P-53)	mg/l	0.027	0.028	0.024
21	Magnesium (as mg)	IS: 3025 (P-46)	mg/l	8.2	8.4	12.7
22	Nitrate (as NO <sub>3</sub> )	IS: 3025 (P- 34)	mg/l	5.4	5.6	4.34
23	Selenium (as Se)	IS: 3025 (P- 56)	mg/l	<0.01	<0.01	<0.01
24	Sulphate (as SO <sub>4</sub> )	IS: 3025 (P- 24)	mg/l	23.27	25.32	22.45
25	Alkalinity (as Ca CO <sub>3</sub> )	IS: 3025 (P- 23)	mg/l	62.24	62.35	91.25
26	Total hardness (as CaCO <sub>3</sub> )	IS: 3025 (P- 21)	mg/l	74.25	70.14	88.05
27	Zinc (as Zn)	IS: 3025 (P- 49)	mg/l	0.24	0.28	0.27
28	Sodium (as Na)	IS-3025(P-45)	mg/l	12.14	13.47	14.12
29	Potassium (as K)	IS-3025(P-45)	mg/l	4.27	5.21	4.47

Source: Environmental Baseline Monitoring



Figure 21: Surface Water Sample collection at Nagaon Dhadunia



Figure 22: Surface Water Sample collection at Nahorkatia



Figure 23: Surface Water Sample collection at Boragadhai

As seen from the results, the pH of the drinking water in the region is well within permissible limits (6.5-7.5). The total dissolved solids in the samples collected vary from 129.83 mg/l to 151.37 mg/l which is well within the permissible standards. Total hardness as  $\text{CaCO}_3$  in the



water sample varies from 70.14 mg/l to 88.05 mg/l which is within the standard limits. Other parameters analyzed like chloride, sulphate, fluorides are found well within standards. The surface water quality in the region is reported to be well within the permissible limits and also found by visual identifications. There are no reports of any water-borne disease in the region. People are using this water for various domestic purposes.

#### 4.2.7 Ambient Air Quality

The ambient air quality with respect to the study area forms the baseline information. The prime objective of the baseline air quality study was to assess the existing air quality of the area. This will also be useful for assessing the conformity to standards of the ambient air quality during the construction and operation phase.

This section describes the selection of sampling locations, methodology adopted for sampling, analytical techniques and frequency of sampling. The ambient air quality monitoring was conducted during winter season in the month of January 2020.

##### 4.2.7.1 Methodology Adopted for Air Quality Survey

###### Selection of Sampling Locations:

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality monitoring network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- Meteorological conditions on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Representatives of likely impact areas.

Ambient Air Quality Monitoring (AAQM) stations were set up at three locations with due consideration to the above-mentioned points.

##### 4.2.7.2 Frequency and Parameters for Sampling

Ambient air quality monitoring was carried out for 24hrs representing winter season. The baseline data of air environment was monitored for parameters mentioned below:

- Particulate Matter (PM<sub>2.5</sub>);
- Particulate Matter (PM<sub>10</sub>);
- Sulphur dioxide (SO<sub>2</sub>);
- Oxides of Nitrogen (NO<sub>x</sub>);
- Carbon Monoxide (CO)

The AAQ sampling is carried out as the present revised standards mentioned in the latest Gazette notification of the Central Pollution Control Board (CPCB) (November, 2009).

The baseline status of the ambient air quality has been checked through ambient air quality monitoring at selected points along the project road. The ambient air quality has been monitored at 3 locations as shown in **Table 29** and **Figure 24** along the project road for particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>); and carbon monoxides (CO) using standard analysis technique is shown in **Table 28**.



**Table 28: Techniques Used for Ambient Air Quality Monitoring**

Sr. No.	Parameter	Technique	Minimum Detectable Limit ( $\mu\text{g}/\text{m}^3$ )
1.	Particulate Matter ( $\text{PM}_{2.5}$ )	Gravimetric Method	120.0
2.	Particulate Matter ( $\text{PM}_{10}$ )	Gravimetric Method	100.0
3.	Sulphur dioxide	Modified West and Gaeke	5.0
4.	Nitrogen Oxide	Modified Jacob & Hochheiser	5.0
5.	Carbon Monoxide	Non-Dispersive Infrared Spectroscopy (NDIR)	1 (in $\text{mg}/\text{m}^3$ )



Table 29: Air Quality Monitoring locations along the project road

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Coordinates		Land use	Zones
				Latitude	Longitude		
1	18-Jan-2020	Nahorkatia	2190m/ East	27.27314	95.289675	Agricultural	Residential
2	18-Jan-2020	Chalakataki No.1	15m/ North	27.331584	95.311924	Semi built-up	Residential
3	18-Jan-2020	Padumoni Gaon	30m/ North	27.321492	95.3937488	Semi built-up	Residential

Source: Environmental Baseline Monitoring

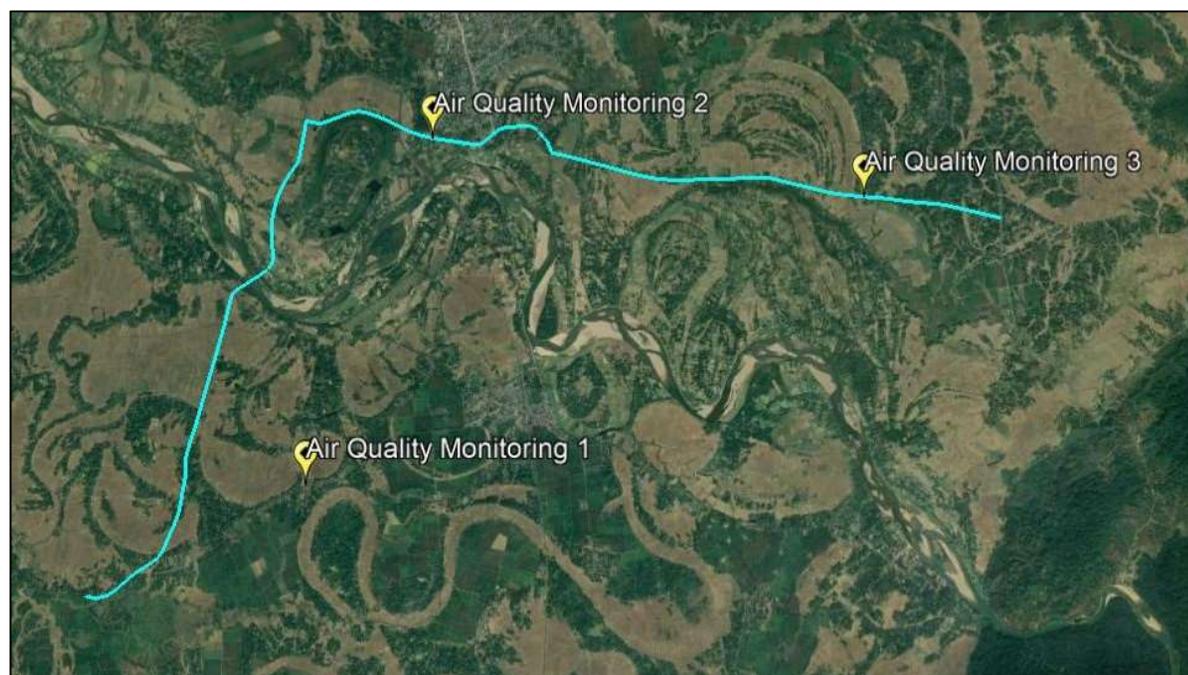


Figure 24: Air Quality Monitoring locations along the project road



Ambient air quality monitoring results for  $PM_{2.5}$ ,  $PM_{10}$ ,  $SO_2$ ,  $NO_x$ , and CO concentrations are given in **Table 30** and summarized below. The monitored values are compared with National Ambient Air Quality Standards prescribed by Central Pollution Control Board (CPCB) for residential, rural, and other areas and WHO Ambient Air Quality Guidelines (IFC EHS). The Ambient air quality levels meet the National air quality standards for the rural, residential area all along the project road.

- $PM_{2.5}$ : The mean  $PM_{2.5}$  concentration at ambient air quality monitoring locations varies from 17.5 to 18.2  $\mu\text{g}/\text{m}^3$ . The values are within the permissible limit at all the stations.
- $PM_{10}$ : The mean  $PM_{10}$  concentration at ambient air quality monitoring locations varies from 47.4 to 48.3  $\mu\text{g}/\text{m}^3$ . The values are within the permissible limit at all the stations.
- $SO_2$ : The mean concentrations of  $SO_2$  at all ambient air quality monitoring locations vary from 6.3 to 6.7  $\mu\text{g}/\text{m}^3$ . The values are within the permissible limit at all the stations.
- $NO_x$ : The mean concentrations of  $NO_x$  at all AAQM locations range from 12.2 to 12.6  $\mu\text{g}/\text{m}^3$ . The values are within the permissible limit at all the stations.
- CO: The mean concentrations of CO at all AAQM locations range from 0.430 to 0.460  $\text{mg}/\text{m}^3$ . The values are within the permissible limit at all the Stations.



**Table 30: Ambient Air Quality along the Project Road**

Sr. No.	Parameter	Method	Unit	National Ambient Air Quality Standard (CPCB) Permissible Limits	WHO Ambient Air Quality Guidelines	Results		
						Nahorkatia	Chalakataki No.1	Padumoni Gaon
1	Particulate Matter (PM <sub>10</sub> )	IS:5182 Part-XXIII	µg /m <sup>3</sup>	100	50	47.4	47.9	48.3
2	Particulate Matter (PM <sub>2.5</sub> )	CPCB Volume-Grav	µg /m <sup>3</sup>	60	25	17.5	18.1	18.2
3	Sulphur Dioxide	IS:5182 Part-II	µg /m <sup>3</sup>	80	20	6.3	6.7	6.4
4	Nitrogen Dioxide	IS:5182 Part-VI	µg /m <sup>3</sup>	80	200 – 1 Hourly	12.6	12.2	12.4
5	Carbon Monoxide	IS:5182 Part-X	mg/m <sup>3</sup>	4	-	0.430	0.460	0.430

*Source: Environmental Baseline Monitoring*



Figure 25: Air Quality Monitoring at Nahorkatia



Figure 26: Air Quality Monitoring at Chalakataki No.1



Figure 27: Air Quality Monitoring at Padumoni Gaon



#### 4.2.8 Noise Measurements

Noise in general is sound which is composed of many frequency components of various types of 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 complex sound made up of various frequencies at different loudness levels. The noise 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. The impact of noise sources on surrounding community depends on:

- Characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as one which is continuously varying in loudness;
- The time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because of sleep disturbance; and
- The location of the noise source, with respect to noise sensitive land-use, which determines the loudness and period of exposure.

The main objective of noise monitoring in the study area is to establish the baseline noise levels, and assess the impact of the total noise generated by the construction work and movement of vehicles during operations phase

##### Identification of Sampling Locations

A preliminary reconnaissance survey was done to identify the major noise generating sources in the area. The noise at different noise generating sources has been identified based on industrial, commercial, and residential activities, traffic, and noise at sensitive areas. Sound Pressure Level (SPL) measurements were undertaken at all locations, with an interval of about 5 seconds over 10 minutes per hour for 24 hr. The day noise level has been monitored from 7 AM to 10 PM and night levels from 10 P.M. to 7 AM at 3 locations. The Details of the monitoring locations are given in **Table 31** and **Figure 28**. Day and night-time Leq have been calculated from hourly Leq values and compared with the stipulated standards. **Table 32** gives the day and night-time Leq noise levels. Measured Leq noise levels are within the prescribed limits.



Table 31: Noise monitoring locations along the project road

Sampling Location	Date of Sampling	Name of place	Distance/ Direction	Coordinates		Land use	Zones
				Latitude	Longitude		
1	18-Jan-2020	Nahorkatia	2190m/ East	27.27314	95.289675	Agricultural	Residential
2	18-Jan-2020	Chalakataki No.1	15m/ North	27.331584	95.311924	Semi built-up	Residential
3	18-Jan-2020	Padumoni Gaon	30m/ North	27.321492	95.3937488	Semi built-up	Residential

Source: Environmental Baseline Monitoring

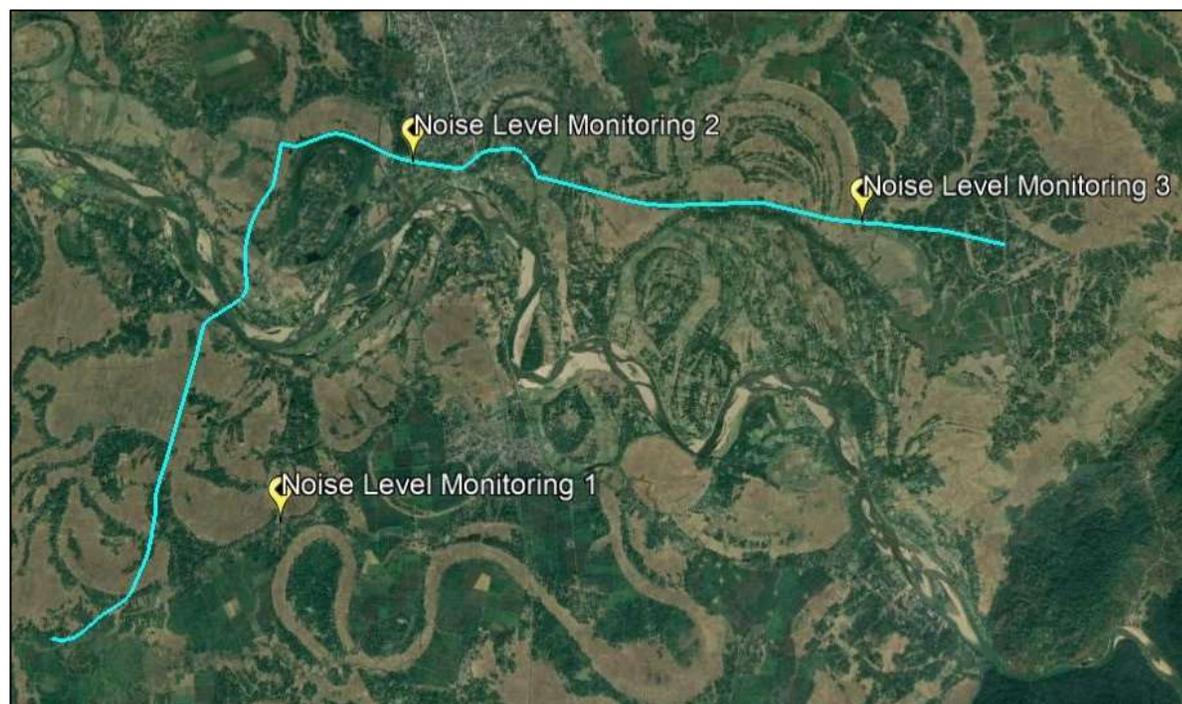


Figure 28: Noise monitoring locations along the project road



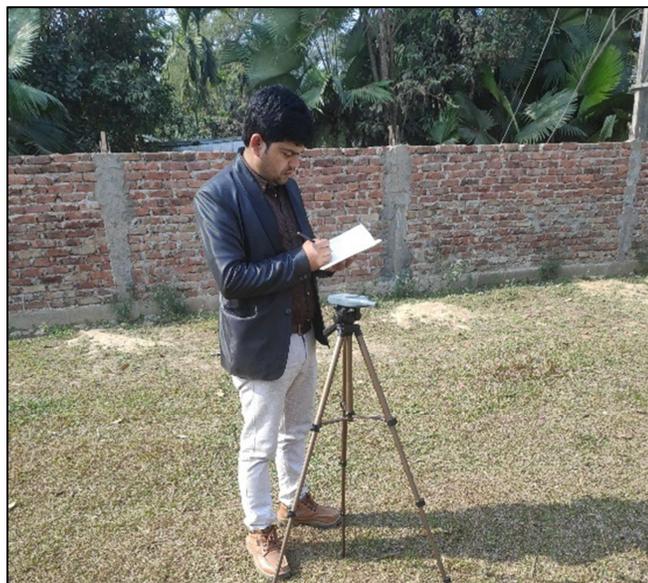
**Table 32: Day and Night Time Leq in the Project Area**

Sr. No.	Name of the Location	Units	Result		CPCB Ambient Air Quality Standards in respect of Noise (Residential Area)		Guidelines for Community Noise, World Health Organization (WHO) 1999		Approx. Distance from Road Edge (m)	Land Use
			Equivalent Noise Level (7 Am To 10 Pm)	Equivalent Noise Level (10 Pm To 7 Am)	Day	Night	Day	Night		
1	Nahorkatia	dB(A)	43.8	32.7	55	45	55	45	2180	Agricultural
2	Chalakataki No.1	dB(A)	45.3	32.4					15	Semi built-up
3	Padumoni Gaon	dB(A)	45.1	33.4					10	Semi built-up

*Source: Environmental Baseline Monitoring*



It can be seen from **Table 32** that at all the monitoring locations, the ambient noise levels are well within the permissible limits for residential areas prescribed by CPCB and also by World Bank EHS standards of 55 dB(A) and 45 dB(A) for day time and night time respectively. The maximum recorded day time noise level is 45.3 dB(A) and night time noise level is 33.4 dB(A) at Chalakataki No.1 and Padumoni Gaon respectively. Average day time noise level along the subproject roads varies from 43.8 dB(A) to 45.3 dB(A) whereas average night time noise levels vary from 32.4 dB(A) to 33.4 dB(A).



**Figure 29: Noise Level Monitoring at Nahorkatia**



**Figure 30: Noise Level Monitoring at Chalakataki No.1**



Figure 31: Noise Level Monitoring at Padumoni Gaon

#### 4.2.9 Land Use

The land-use pattern in the project section has major share of settlements which is semi built-up areas and agricultural area. The abutting land use patterns observed along the project road is as given in **Table 33**. The land use map of the project district is shown in **Figure 32** below.

Table 33: Land Use Pattern Abutting Project Road

Type of Land	Length (Km)	Percentage (%)
Agricultural	10.80	23.18%
Open Area	3.60	7.73%
Built Up	4.80	10.30%
Forest	-	-
Semi Built Up	27.41	58.80%
<b>Total</b>	<b>46.61</b>	<b>100</b>

Source: Road Inventory Survey

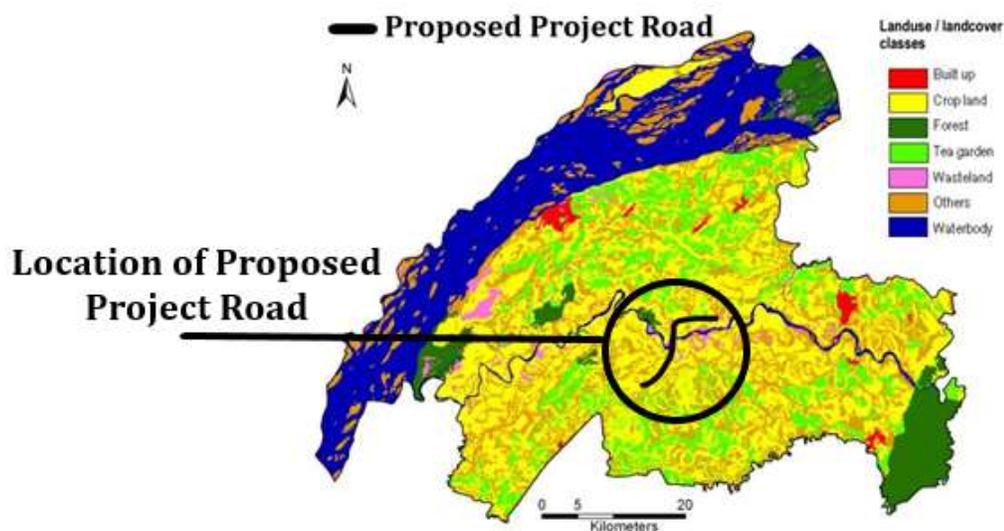


Figure 32: Land use map of the project district

## 4.3 Biological Environment

### 4.3.1 Forests

Forests of Assam have rich biodiversity of flora and fauna. It has a wide range of forests viz. Evergreen and Semi Evergreen forests, Mixed Deciduous forests, Sal Forests, Riverine forests, Moist Savannah, dry Savanna, and Dry Miscellaneous Type of forests. The state also has a humid weather which combined with the rich forest biodiversity gives the state several endemic species of flora and fauna. The state has many varieties of important commercial crops including rice, banana, citrus, ginger and tea. The state boasts of 3010 species of flowering plants including 347 medicinal plants, 102 endemic and restricted range plants, 182 species of orchids, 42 species of Bamboos and 14 species of cane. Different Forest types in the state can be classified as below:

- Tropical Wet Evergreen Forests
- Tropical Semi-Evergreen Forests
- Tropical Moist Deciduous Forests
- Sub-tropical Broadleaf Hill Forests
- Sub-tropical Pine Forests
- Littoral and Swamp Forests
- Grassland and Savannahs

A total of 26,832 sq km (37.21%) of the geographical area of the state is covered by forest. These forests have 193 species of mammals including 10 primates, 820 species and subspecies of birds, 185 species of fish, 405 species of butterflies, 115 species of reptiles, 46 species of amphibians and 39 species of snails. The state has 4% of its total green cover notified as Protected Area, comprising of 5 National Parks and 20 Wildlife Sanctuaries. The state also has 2 UNESCO World Heritage sites and 2 Biosphere reserves, 4 Tiger Reserves and 5 Elephant Reserves.





Based on the Primary survey and discussion with the DFO while doing tree inventory for tree felling permission, it was noted that no forest land notified under the Indian Forest Act – 1927 are reported within the proposed ROW.

### 4.3.2 Important Flora of the State

The state is rich with several important flora species. Different types of species are prevalent in different type of forest in the state. Each of these forest types, regions for the same and the prevalent flora species in each are given below.

The state is rich with several important flora species. Different types of species are prevalent in different type of forest in the state. Each of these forest types, regions for the same and the prevalent flora species in each are given below.

#### Evergreen Forests:

Evergreen Forests are mainly found in Lakhimpur, Dhemaji, Dibrugarh, Sivasagar, Tinsukia, Cachar extending upto Panchnadi in north bank and Golaghat district. Present species in these forests includes the following.

**Table 34: Present Species in Evergreen forests of Assam**

Sr. No.	Dominant Families
1	Dilleniaceae
2	Anonaceae
3	Clusiaceae
4	Magnoliaceae
5	Fabaceae
6	Myrtaceae
7	Styraceae
8	Ebenaceae
9	Myristicaceae
10	Lauraceae
11	Euphorbiaceae
12	Fagaceae
13	Myrtaceae
14	Styraceae
15	Ebenaceae
16	Myristicaceae
17	Lauraceae
18	Euphorbiaceae
19	Fagaceae
20	Arecaceae
21	Poaceae
22	Dipterocarpaceae

#### Deciduous Forests:

Deciduous Forests lie mainly in Dhubri, Kokrajhar, Goalpara, Bongaigaon, Chirang, Baksa, Nalbari and Udalguri regions in the state. Various species under this includes the following.



**Table 35: Present Species in Deciduous forests of Assam**

Sr. No.	Dominant Families
1	Lagerstroemia parviflora
2	Kydia calycina
3	Schima Wallichii
4	Careya arborea
5	Gmelina arborea
6	Cassia fistula
7	Albizia lucida
8	A. Odoratissima
9	Millusa velutina
10	Stereospermum chelonoides

**Swamp Forests**

These forests are usually found in low lying areas, abandoned river channels etc. Dominant species in these includes:

**Table 36: Present Species in Swamp forests of Assam**

Sr. No.	Dominant Families
1	Crataeva lophosperma
2	Eugenia species
3	Duabanga grandiflora
4	Terminalia myriocarpa
5	Lagerstroemia flos-regina
6	Trewia nudiflora
7	Ficus pyriformes
8	Hygrophiza aristate
9	Vossia procera
10	Panicum proliferum
11	Phragmites communis
12	P.karka
13	Arundo donax
14	Nymphaeaceae
15	Lamnaceae
16	Alismaceae
17	Naiadaceae
18	Eriocaulaceae
19	Cyperaceae

**Grass lands:**

Grasslands in the state is found in the riparian belt and in low rainfall areas. Some of the species in these grasslands are as follows:

**Table 37: Present Species in Grasslands of Assam**

Sr. No.	Dominant Families
1	Saccharum
2	Anthistena
3	Erianthus
4	Arundo



Sr. No.	Dominant Families
5	Phragmities
6	Imperata arundinaceae
7	Aptuda varia
8	Andropogon jwarancusa
9	Nardus contortus
10	Setaria glauca

Some of the species of plants of medicinal importance to the state are as follows:

**Table 38: Plants of medicinal importance to the state**

Sr. No.	Scientific Name	Common Name	Uses
1	Flacoutia jangomas	Paniol	The fruits from the plant are used as a medicine to treat jaundice. Leaves and Roots are taken for schistosomiasis, malaria and diarrhoea. Roots of the plant are believed to treat pneumonia, intestinal worms and act as pain reliever.
2	Baccaurea ramiflora	Leteku	The bark, roots and wood from this plant are harvested for medicinal use and is used to treat skin diseases.
3	Garcinia lanceifolia	Rupahi thekera	The fruits from this plant are used for preparation of soft drinks and used as a medicine for diarrhoea.
4	Myrica esculenta	Nagatenga	The fruits have antioxidant, antiviral and antidiarrhoeal properties.
5	Garcinia pedunculata	Bor thekera	This dried fruit is used to treat dysentery. The bark of this fruit is used to dye clothes.
6	Carissa carandas	Karza tenga	The fruit is antiscorbutic and is used for anaemia. It is also an ingredient in jelly, jam syrup and chutney.
7	Ajuga integrifolia	Nilakantha	This plant is aromatic, astringent and tonic. It is useful in treatment of agues. Roots are helpful in treatment of diarrhoea and dysentery. The leaves are used in the treatment of fever substituting quinine.
8	Andrographis paniculata	Sirata/Kalmegh	The plant extract has antityphoid and antifungal properties. It is also reported to be helpful as antihepatotoxic, antibiotic, antimalarial, antihepatic, antithrombogenic, anti-inflammatory, anti-snake venom and antipyretic.
9	Bacopa monnieri	Brahmi	It is used in Ayurvedic treatment for epilepsy and asthma. It is also used for ulcers, tumors, enlarged spleen, indigestion etc.
10	Centella asiatica	Manimuni	This has antibacterial, antiviral, anti-inflammatory, antiulcerogenic, anxiolytic, nervine and vulnerary properties and acts as cerebral tonic.
11	Cheilocostus speciosus	Jomlakhuti	This plant has uses in Ayurveda to treat fever, rash, asthma, bronchitis and intestinal worms.
12	Catharanthus roseus	Nayantara	This species is cultivated for herbal medicine and is prevalent in Ayurveda as a cure against several diseases like diabetes, malaria and Hodgkin's lymphoma.
13	Amaranthus spinosus	Khutura xak	This is used in treatment of diarrhoea, excessive menstruation and snake bites.



### 4.3.3 Flora and Fauna of Dibrugarh District

Dibrugarh has a rich flora and fauna in the surrounding wildlife sanctuaries and rainforest. In 1999 Dibrugarh district became home to Dibru-Saikhowa National Park, which has an area of 340 km<sup>2</sup> (131.3 sq km.) The Dibru Saikhowa National Park is the fourth National Park of Assam that lies partly in Dibrugarh district and partly in Tinsukia district. The national park is about 13 kms from Tinsukia Town, which is 483 kms from Guwahati. This national park covers an area of about 340 square kms. Of the seven parts of the park one part is wet land and the rest is mainly grassland and dense forest. The main attractions of this park are its semi-wild horse and White winged Wood Duck. Besides this, other animals like Leopard, Clouded Leopard, elephant, Sambar, Slow Loris, Indian wild water Buffalo, Capped Langur, Gangetic River Dolphin, Indian Wild Dog can be seen in this park. Various reptiles are found in the district including King- Cobra and Python. More than 250 varieties of local and migratory birds are also found in this park. The best season to visit this park is from November to March. The main marketable species are Outenga, Hillikha, Morhal, Jululi etc. The open area of the forest is covered with grasses, weeds, sorat, digholoti, etc. And low-lying areas are full of patidoi, reeds, nal, cane etc.

### 4.3.4 Wild Life and Protected Areas

The protected area network of Assam includes 5 National Parks and 18 wildlife sanctuaries covering an area of 0.40 million ha constituting 4.98% of the geographical area. The state has three Tiger Reserves, namely Kaziranga, Manas, and Nameri. Kaziranga National Park and Manas National Park are on the list of World Heritage sites. The List of National Park and Wildlife declared protected the Wildlife (Protection), Act -1972 located in the State of Assam and Project district is discussed in **Table 39**.

**Table 39: List of National Park & Wildlife Sanctuary in the State of Assam**

Sr. No.	Name	Location	Area (km <sup>2</sup> )	Year
<b>List of National Park in Assam</b>				
1	Kaziranga National Park	Golaghat, Nagaon district and Karbi Anglong	858.98	1905
2	Manas National Park	Kokrajhar, Chirang, Baksa, Bajali, Udalguri, and Darrang	950	1985
3	Nameri National Park	Sonitpur	200	1978
4	Dibru-Saikhowa National Park	Dibrugarh and Tinsukia district	340	1978
5	Orang National Park	Darrang, Udalguri and Sonitpur district	78.81	1999
6	Dihing Patkai National park (recently declared)	Dibrugarh and Tinsukia	111.19	2020
<b>Wildlife Sanctuary in Assam</b>				
1	Hoollongapar Gibbon Sanctuary	Jorhat	20.98	
2	Garampani Wildlife Sanctuary	Karbi Anglong	6.05	



Sr. No.	Name	Location	Area (km <sup>2</sup> )	Year
3	Bura Chapori Wildlife Sanctuary	Sonitpur	44.06	
4	Bornadi Wildlife Sanctuary	Darrang	26.22	1980
5	Sonai Rupai Wildlife Sanctuary	Sonitpur	220	
6	Pobitora Wildlife Sanctuary	Marigaon	38.8	1987
7	Panidihing Bird Sanctuary	Sibsagar	33.99	
8	Bherjan-Borajan-Padumoni Wildlife Sanctuary	Tinsukia	7.22	
9	Nambor Wildlife Sanctuary	Karbi Anglong	37	
10	East Karbi-Anglong Wildlife Sanctuary	Karbi Anglong	222.81	
11	Laokhowa Wildlife Sanctuary	Nagaon	70.13	
12	Chakrashila Wildlife Sanctuary	Dhubri and Kokrajhar	45.57	
13	Marat Longri Wildlife Sanctuary	Karbi Anglong	451	
14	Nambor-Doigrung Wildlife Sanctuary	Golaghat	97.15	
15	Borail Wildlife Sanctuary	Cachar and Dima Hasao	326.25	
16	Amsang Wildlife Sanctuary	Guwahati	78.64	
17	Dipor Bil Wildlife Sanctuary [4]	Kamrup	4.14	

As per the approved Protected Areas & Reserve Forests map received from the PCCF office, Guwahati vide Letter No. FG 69/REWP/GIS/PART-1/7032 (**Annexure 21**) during the initial survey, the project road does not pass through any protected area such as Wildlife Sanctuary, National park, or bio-reserve. The nearest protected area from the project road is the Dihing Patkai National Park (recently declared) which is at a distance of 3.6 km (approx.) from the project road.

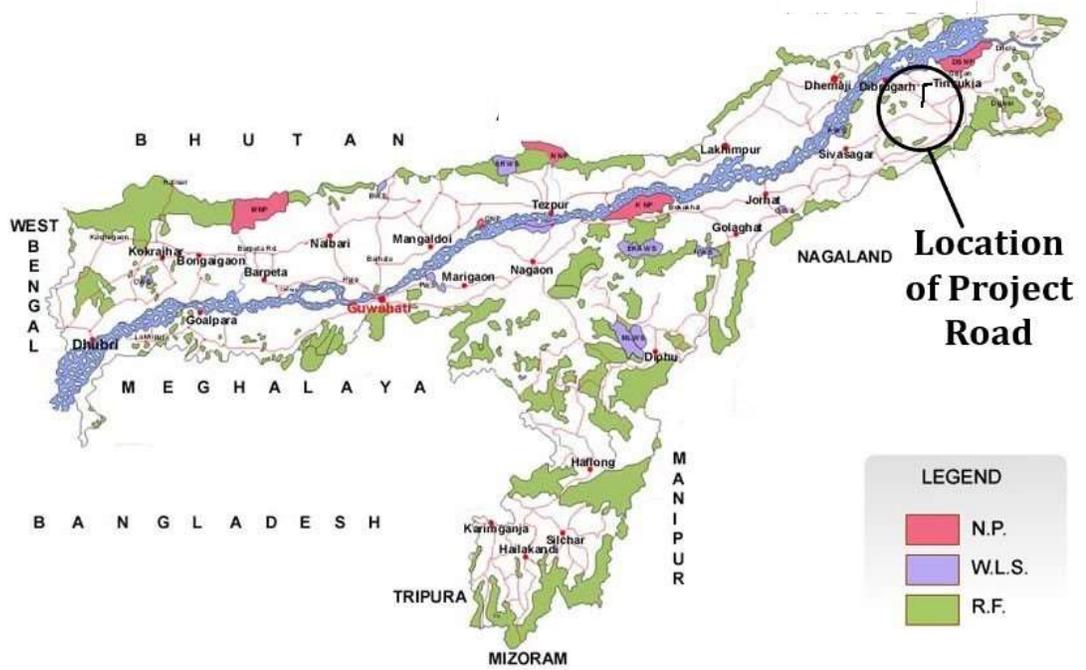


Figure 34: Protected Areas in Assam



Figure 35: Approximate distance of nearest protected area from project road

#### 4.3.5 Biodiversity in Dibrugarh District

Dibrugarh is situated in the eastern part of Assam. The district is surrounded by Dhemaji district in the north, part of Sivasagar, Tinsukia district in the east and Sivsagar district and a



part of Jorhat district in the west. The biodiversity hotspots located in Dibrugarh district are as follow:

#### **Dibru-Saikhowa National Park**

Dibru-Saikhowa is a National Park as well as a Biosphere Reserve situated in the south bank of the river Brahmaputra in the extreme east of Assam state in India. Dibru-Saikhowa, with an area of 340 sq km, situated in the flood plain of Brahmaputra is a safe haven for many extremely rare and endangered species of Wildlife.

The forest type of Dibru-Saikhowa comprises of semi-evergreen forests, deciduous forests, littoral and swamp forests and patches of wet evergreen forests. Famed for Feral horses, a total 36 species of mammals and above 400 species of birds have so far been recorded from the Dibru-Saikhowa National Park.

6 species of mammals have so far been recorded – Tiger, Elephant, Leopard, Jungle Cat, Bears, Small Indian Civet, Squirrels, Gangetic Dolphin, Slow Loris, Assamese Macaque, Rhesus Macaque, Capped Langur, Hoolock Gibbon, Wild Pigs, Sambar, Barking Deer, Water Buffalo, Feral Horses etc.

It is an identified Important Bird Area (IBA) having more than 382 species of Birds, some of which are Greater Adjutant Stork, Lesser Adjutant Stork, and Greater Crested Grebe. Large Cormorant, Open bill Stork, Black necked Stork, Large Whistling Teal. Grey leg Goose, Grey-headed Fishing Eagle, Griffon Vulture, Osprey, Crested Serpent Eagle, Spot Billed Pelican, White Winged Wood Duck, Baer's Pochard, Greater Spotted Eagle, Pale Capped Pigeon, Great Pied Hornbill, Marsh Babbler, Jerdon's Babbler, Black Breasted Parrot bill, etc. The Park is renowned for natural regeneration of Salix trees.

#### **Dihing Patkai National Park**

Dihing Patkai National Park (recently declared) is located in the Dibrugarh and Tinsukia Districts of Assam and covers an area of 111.19 km<sup>2</sup> (42.93 sq mi) rainforest. It is part of the Assam valley tropical wet evergreen forest and consists of three parts: Jeypore, Upper Dihing River and Dirok rainforest. It was declared a sanctuary on 13 June 2004. This sanctuary is also a part of the Dihing-Patkai Elephant Reserve. The rainforest stretches for more than 575 km<sup>2</sup> (222 sq mi) in the districts of Dibrugarh, Tinsukia and Sivasagar. A part of the forest was declared as a wildlife sanctuary by the Government of Assam, while another part falls under the Dibru-Deomali Elephant Reserve. The Dihing Patkai forms the largest stretch of tropical lowland rainforests in India. The forest is often referred to as "The Amazon of the east" owing to its large area and thick forests.

Being a completely virgin rainforest, this sanctuary is very rich in biodiversity. It is an ideal habitat for non-human primates. Till date, 47 mammal species, 47 reptile species and 30 butterfly species have been recorded. The most common mammal species of this sanctuary are hoolock gibbon, slow loris, pig-tailed macaque, stump-tailed macaque, capped langur, Asian elephant, Bengal tiger, Indian leopard, gaur, Chinese pangolin, Himalayan black bear, Himalayan squirrel, leopard cat, clouded leopard, porcupine, crab-eating mongoose, sambar, sun bear, binturong, barking deer, golden cat and marbled cat.



Dihing Patkai rainforest harbors about 293 bird species, belonging to 174 genera and 51 families. The majority is resident (63.7%), some are winter visitors (23.1%), and very few are summer visitors (2.5%). About 10.7% are altitudinal migrants, coming mainly from the higher reaches of the western, central and eastern Himalayas. The avifauna includes slender-billed vulture, white-winged duck, greater adjutant, lesser adjutant greater spotted eagle, beautiful nuthatch, marsh babbler, tawny-breasted wren-babbler, yellow-vented warbler, broad-billed warbler, white-naped yuhina, white-cheeked partridge, great hornbill, brown hornbill, Oriental darter and painted stork, osprey, kalij pheasant, grey peacock pheasant, besra, black baza and hill myna.

#### 4.3.6 Biodiversity of the Project Area

The project road from Deesang Kinar Bangali to Kathalguri traverses through settlements of Deesang Kinar Bangali, Mohamari gaon no.1, Duliajan, Da-Hukuta, Joloni, Padumoni gaon and ends at Bhadoi Panchali in Kathalguri. The roads coming from nearby villages of Thengal, Tiloi Nagar, Sukani, Barbam, Kadamoni, and many others meet the route. There are no major rivers along the project road. The project road crossed the Dickson River at Ch. 6+800 and tipling river at Ch. 14+200. There are a few small fish ponds along the project road. The Fish species found are Rahu, Bahu, Mirika, Pithila, Kurhi, Bhangon, Barali, Kaoi, Magur, Singee, Pabha, Eleng, etc. There is no forest area along the project road. The project road does not pass through any protected areas in the state. The Dihing Patkai National Park (recently declared) is at a distance of approx. 3.6 km from the project road. There are no animals observed in the vicinity of the project road except for domestic animals. The project road does not lie in near vicinity of any of the IBAs.

#### 4.3.7 Trees

During primary survey of the proposed road, tree species were reported beyond the earthen shoulder of the existing road. The species of trees reported during primary survey and based on the tree inventory done during tree numeration. The details of tree inventory are attached as **Annexure – 11**. The main tree species observed in Dibrugarh district are Outenga (*Dillenia Indica*), Hillikha (*Terminalia chebula*), Morhal (*Vatica lancafolia*), Jululi, weeds, sorat (*Laportea crenulate*), digholoti (*Litsea salicifolia*), patidoi (*Schumannianthus dichotomus*), reeds (*Phragmites australis*), nal, cane (*Arundinaria*) etc.

*Source: District Census Handbook, Dibrugarh District*

Based on the Joint inception, tree numeration done with ranger and forest officers of Dibrugarh forest division about **1515** nos. of trees are felling will be involved in widening and realignment work. Based on the tree felling permission and in discussion with the DFO during site visit no Tree species identified along the PROW are Critical/endangered/protected species list as per IUCN Red list.

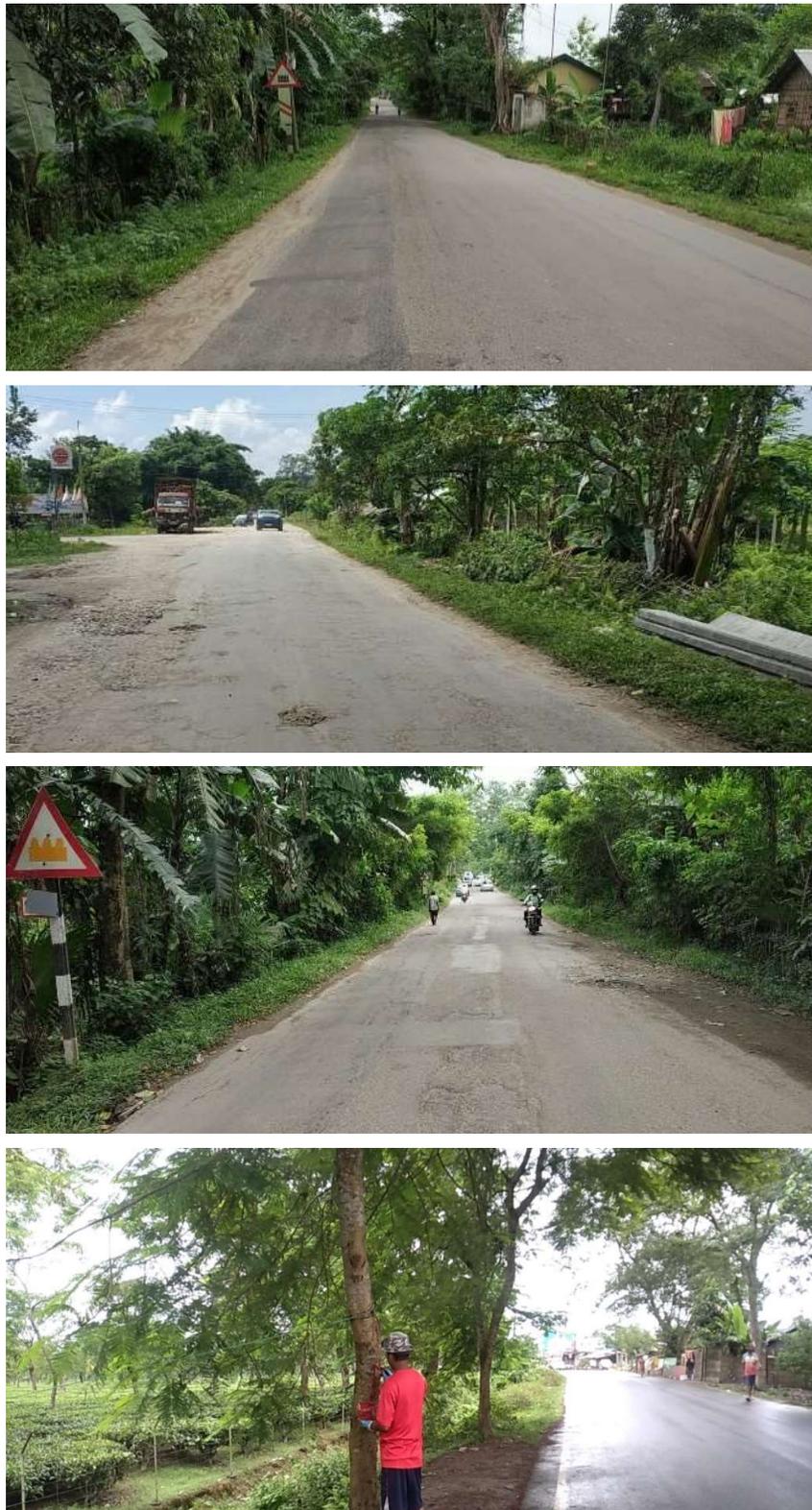


Figure 36: Trees along the project road

### 4.3.8 Heritage Trees

There are a range of criteria that designate a tree as a heritage tree. These attributes—both material and non-material—makes the tree stand out. The material attributes could be age or size of the tree. It could also be the result of the form or shape of the tree. Further, it could be that the tree is a rare species or a tree at risk of being lost. The non-material criteria relate to cultural and aesthetic aspects. It could be that the tree has a historical or cultural association either with a person, an event or a place. It could also be a tree associated with myth or folklore.

In order to identify Heritage trees in the study area a detailed field study was conducted. As per the study conducted 4 trees of cultural significance have been identified along the road. The locations of such identified heritage trees are given in **Table 40**.

**Table 40: Location of Heritage Trees along the Project Road**

Sr. No.	Chainage	Location	Side of the Road
1	13+500	Tipling Purana ghat	Right
2	15+300	Tipling Na gaon	Right
3	21+400	Podumoni gaon	Left
4	22+850	Podumoni gaon	Right



**Figure 37: Heritage Tree at Ch. 22+850**

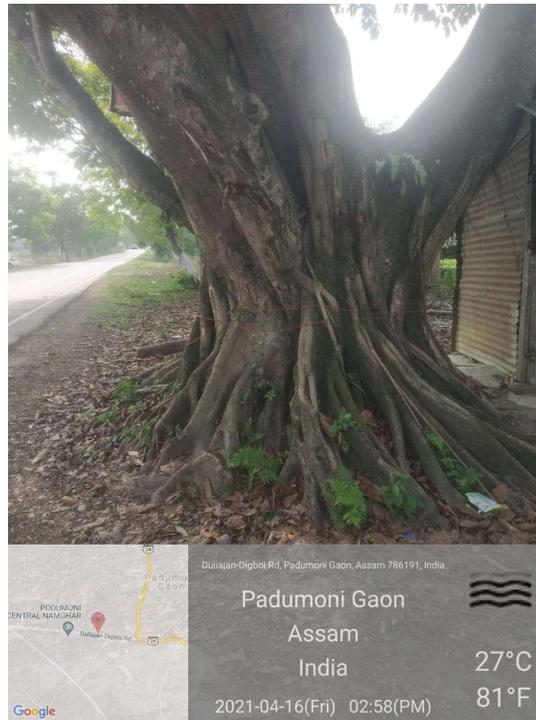


Figure 38: Heritage Tree at Ch. 21+400

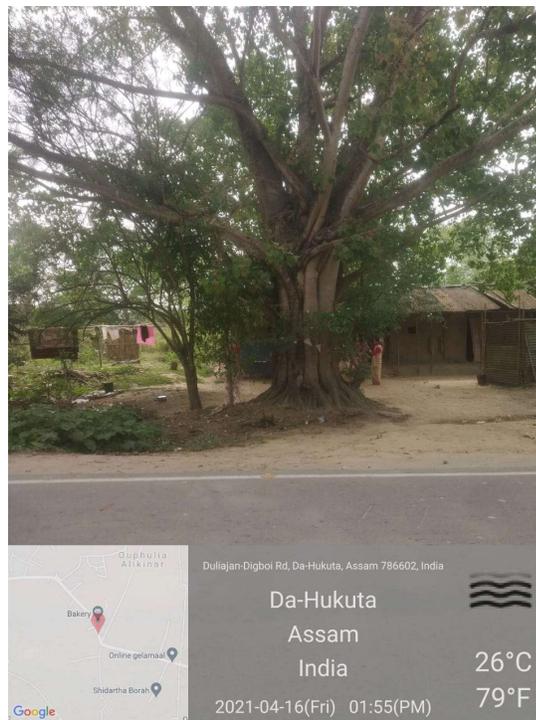


Figure 39: Heritage Tree at Ch. 15+300

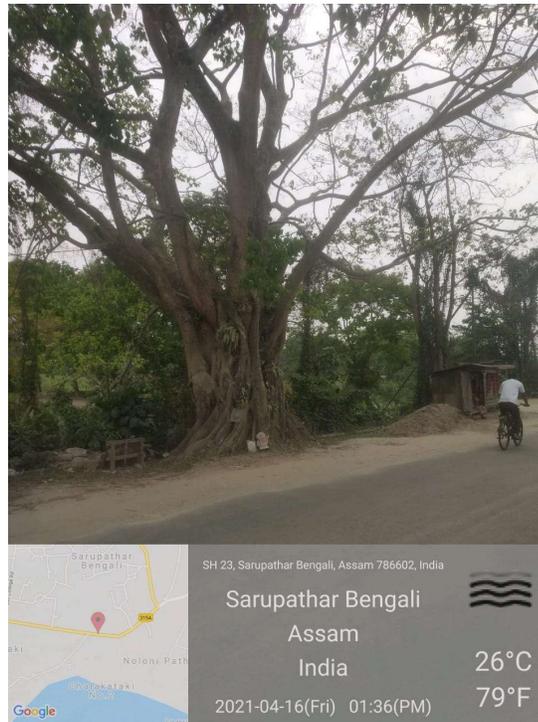


Figure 40: Heritage Tree at Ch. 13+500

#### 4.3.9 Nesting trees

As per the detailed site study conducted and tree inventory conducted with the forest department officials, no nesting trees have been found within the proposed RoW of the project.

#### 4.3.10 Sericulture

Sericulture is the major agro-based industry generating large number of employments in the rural areas of Assam with minimum investment cost. It plays a very vital role in the socio-economic development of the weaker section of the rural population especially during their off-agricultural season. Muga silk (*Antheraea assamensis*) and Eri Silk worm rearing (*Samia cynthia ricini*) and production of silk yarn and fabric is wide spread amongst the people of Assam. The larvae of these silk worms feed on som leaves (*Machilus gamblei*) and sualu (*Litsea monopetala*) leaves. The silk produced from these silk worms are natural golden colored and glossy in texture. Muga and Pat silk are famous from these silk worms. Since, cultivation of these silk worms is important to the economy of the locals. Som and suala trees are necessary for this region.

A detailed study was conducted to identify Sericulture activities in the project region. No locations were identified where sericulture is been carried out.

#### 4.3.11 Rice Cultivation

Assam has always been a rice growing state. Some of the special classes of rice in the state include joha or aromatic rice, bora or waxy rice and chokuwa or soft rice. Many of the rice in

the state can also be divided into Autumn Rice, Winter Rice, Summer Rice and Jhum cultivation. Black rice has been a latest addition to the rice cultivation in the state. Black rice is a common name for a range of rice belonging to *Oryza Sattiva L.* species. These varieties grow well in tropical zones like Japan, Korea, Myanmar, China and North-east India. These black rice variety are beneficial not only for the health consideration but also due to the fact that these varieties are more resilient to the effect of climate change. These varieties can grow well even at a higher temperature and flood conditions.

A detailed study was conducted to identify black rice cultivation in the project region, no such location has been identified along the project road.

#### **4.3.12 Tea Estates**

Tea Plantations are an important constituent of biodiversity of Assam and play a major role in conservation of biodiversity of the region. Several tea germplasms (a total of 1074) have been identified in the state of Assam. Some of the species identified are *C. kissi*, *C. caduca*, *C. drupifera* etc. Since cultivation of tea depends closely on the water availability, water quality, humidity, pests and several other biological factors. It is important to conserve the biodiversity of the region to maintain the micro-climate around the tea estates. Also, several wild varieties of tea are also found naturally in the forest of the state. Such wild varieties of plant need to be conserved to ensure that the genetic diversity of the tea plants is not lost. Since, tea plantation is highly critical to changes in temperature, pests and other factors, gene pool conservation is important to ensure further development and continued productivity of the tea estates in the state. Hence, the developmental activities in this region should not affect the tea plants growing in wild or in the abandoned tea estates.

A detailed study was conducted to identify tea estates along the project road. 2 tea estates are located along the project road.

**Table 41: Tea Estates along the Project Road**

<b>Sr. No.</b>	<b>Chainage</b>	<b>Location</b>	<b>Side of the Road</b>
1	0+000	Achabam T.E.	Right
2	3+300	Tea Estate at Habi Cheleng gaon	Both



**Figure 41: Achabam T.E.**



**Figure 42: Tea Estate at Habi Cheleng gaon**

#### 4.3.13 Aquatic Ecology and Fisheries

The project road crosses the Deesang river at Ch. 0+718, Buri Dehing river at Ch. 6+890, Tipling river at Ch. 14+168, and some nallahs are also observed crossing the alignment.

In the Dibrugarh district, fishes of various kinds are found in the beels and rivers. The most popular among the large varieties of fishes are Rahu, Bahu, Mirika, Pithila, Kurhi, Bhangon, Barali etc. The smaller variety of fishes Kaoi, Magur, Singee, Pabha, Eleng, Bariala are common.

*Source: District Census Handbook, Dibrugarh district*



**Figure 43: Deesang River**



**Figure 44: Buri Dehing River**



Figure 45: Tipling River

#### 4.3.14 Rare or Endangered Species

The local forest department was consulted to know the presence of any endangered and protected species of flora within the formation width. It is confirmed by the forest department officials that there are no endangered species that are likely to be affected by the current project.

Joint inspection is being carried out with field officials from the local forest department to prepare the detailed inventory and marking of the trees to be cut. During the joint inspection, if any endangered and or protected species of flora are found within the formation width of the subproject road, necessary mitigation measures will be adapted to protect such species. Also based on the joint inspection, a suitable compensatory afforestation plan will be prepared to mitigate the loss of vegetative cover due to the subproject activities (refer Annexure 23 - Biodiversity Assessment Report).

#### 4.3.15 Fauna and Wildlife

Based on the primary survey within the Corridor of impact (COI) and secondary information obtained for buffer zone by public interaction, forest working plan, interaction with DFO during site inspection, etc., it can be concluded that no wildlife habitat for mammals are reported within the COI. Domestic animals mainly cow (*Bos taurus*), goat (*Capra aegagrus hircus*), pig (*Sus*), dogs (*Canis lupus familiaris*) and buffalos (*Bubalus bubalis*) were observed in study area. (refer Annexure 23 - Biodiversity Assessment Report).

### 4.4 Socio-economic Environment

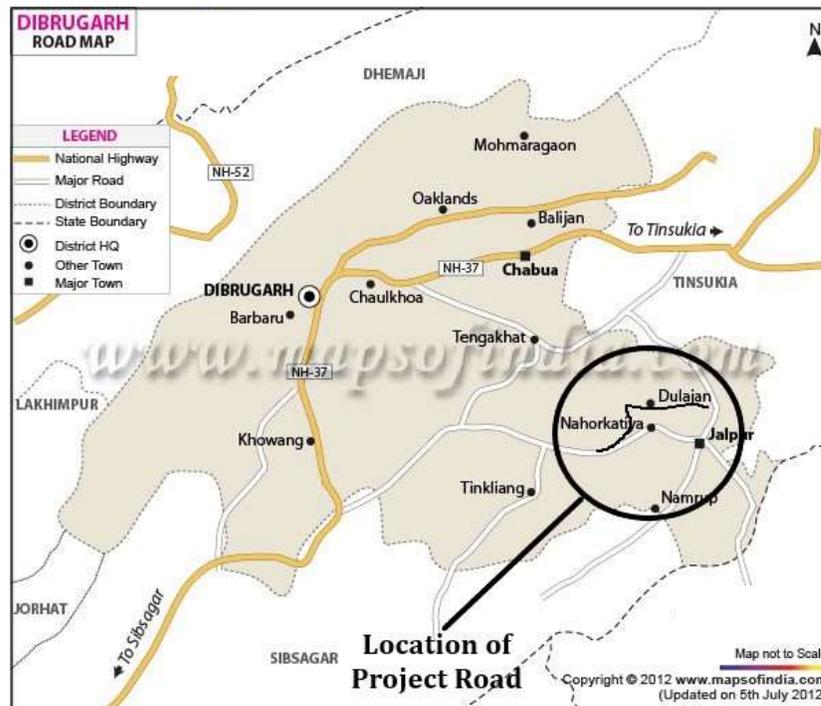
The primary purpose of the socio-economic analysis is to provide an overview of the State's socioeconomic status and the relative status of the Project Influence Area (PIA) within the State. The proposed project passes through one district of Assam i.e. Dibrugarh. The demographic profile and socioeconomic status of the people in the project affected district and state as per census 2011 are as follows. The demographic details of the project area are listed in **Table 42**.

**Table 42: Demographic details of Dibrugarh district**

Particulars	Assam	Dibrugarh
Total Population	31,205,576	1,326,335
Rural Population	26,807,034	1,082,605
Urban Population	4,398,542	243,730
Male	15,939,443	676,434
Female	15,266,133	649,901
Gender Ratio	958	961
SC Population	2,231,321	58,876
% SC	7.15	4.44
ST Population	3,884,371	102,871
% ST	12.45	7.76
Density of Population (per sq. km.)	398	392

#### 4.4.1 Road Network

Roads are considered the most important component of infrastructure, to which national economy either directly or indirectly connected. Constructing high-quality roads of international standards has come to reality in the soil of Assam because of the potential will of the Government of Assam. The state is connected to other neighboring states like Nagaland, Meghalaya, Mizoram, and Tripura through all-weather high standard roads. The approaching roads to the main roads have qualitatively improved. In recent years the internal roads connecting villages, hamlets have become R.C.C roads. The roads connecting to Gram Panchayats Road and Taluka (Block) Road have also been constructed through R.C.C. In recent days attempts have been made for constructing roads through Public-Private Partnership (PPP). The road map of the Dibrugarh district has been shown in the following Figure 46.



**Figure 46: Road Map of Dibrugarh district**



#### 4.4.2 Settlements along the Sub-project

The list of villages and towns on the sides of the project highway, identified during the Reconnaissance Survey and Road Inventory of project road is presented in **Table 43**.

**Table 43: Important Settlements Abutting Project Highway**

Sr. No.	Existing Chainage (Km)		Length (m)	Name of Settlement
	From	To		
1	1+200	1+500	300	Deesang kinar bangali
2	13+700	14+150	450	Duliajan
3	23 +550	23+958	408	Kathalguri

Source: Road Inventory

#### 4.4.3 Existing Economy & Employment Base

Agriculture and Tea farming is the mainstay of the people of the region. It plays a significant role with respect to both generations of employment and share in the GDP. Agriculture is closely followed by livestock rearing. Many families in the project region mainly depend on Agriculture, Allied Agriculture & commercial works. There are some small-scale industry units where people are employed to work as laborers.

#### 4.4.4 Cultural/Religious resources

The language spoken by the majority of the people is Assamese and Bengali. English is widely used for official purpose and Assamese and Bengali is used as a regional language. The state has a very opulent cultural heritage, one of the richest in India. The capital city of Assam is Dispur. No protected or unprotected ASI monument exists along the project road. As per the field survey, the following **Table 44** is the religious structures observed along the project road.

**Table 44: List of religious structures along the project road**

Sr. No.	Receptor	Side	Chainage (Km)	Distance from Road Edge (m)
1	Religious place	Right	4+050	15
2	Religious place	Right	12+550	15
3	Temple	Right	13+100	20
4	Religious place	Left	13+900	10
5	Temple	Right	16+300	15
6	Religious place	Left	18+610	20
7	Religious place	Right	19+240	35
8	Religious place	Right	20+760	10
9	Religious place	Left	22+650	10
10	Religious place	Right	23+400	20
11	Temple	Left	23+800	50

Source: Environmental Baseline Survey



#### 4.4.5 Archaeological and Historical Monuments

No archaeological sites or historical monuments are located along the project road section.

#### 4.4.6 Sensitive Receptors

During the environmental and social screening survey, several sensitive receptors such as religious places, schools, colleges, hospitals, etc. are located within the existing RoW. However, no structure is going to be affected by the proposed road improvement works. The list of these structures is presented in **Table 45** below.

**Table 45: Sensitive receptors along the project road**

Sr. No.	Receptor	Side	Chainage (Km)	Distance from Road Edge (m)
1	School	Right	11+600	15
2	School	Right	12+000	25
3	School	Left	14+550	70
4	School	Right	15+000	40
5	School	Right	15+950	15
6	School	Right	18+200	50
7	School	Left	19+900	20
8	School	Left	20+850	20
9	School	Right	22+400	20

Source: Environmental Baseline Survey

#### 4.4.7 Demography of Displaced families

The total number of Displaced Persons is 1860 with 51.23% (953) males and 48.76% (907) females. The age-wise distribution of Displaced Persons is presented in **Table 46**. Almost 52.63% of the Displaced Persons are in the age group of 21 to 50 years.

**Table 46: Age wise Distribution of Total Displaced Persons**

Age Category	Total Males	Total Females	Total Persons	Percentage
0 to 6 Years	75	72	147	7.90%
7 to 14 Years	117	96	213	11.45%
15 to 20 Years	89	79	168	9.03%
21 to 30 Years	178	178	356	19.14%
31 to 40 Years	185	177	362	19.46%
41 to 50 Years	130	131	261	14.03%
51 to 60 Years	106	98	204	10.97%
Above 60 Years	73	76	149	8.01%
<b>Total</b>	<b>953</b>	<b>907</b>	<b>1860</b>	<b>100%</b>

Source: SIA Report

#### 4.4.8 Social Stratification

The social fabric of the project area predominantly comprises of four social groups, a) Scheduled Tribes (ST) b) Scheduled Castes (SC) comprising, the Other Backward Class (OBC)



and d) General Castes. The main indigenous Assamese communities inhabiting the district include Ahoms, Chutia, Sonowal Kacharis, Muttock, Moran people, Tea Tribes etc. There are also some indigenous Assamese Tai Buddhist communities like Tai Phake, Khamti and Khamyang. The Scheduled Tribes population in the project affected villages is only 5.50% (22) of the total population in these villages. Of the total 400 families displaced by the project, 241 i.e., 60.25% are OBC's, followed by the General Category at 30.75% i.e. 123 and lastly Scheduled Caste at 3.50% (14) (refer **Table 47**).

**Table 47: Social Category of the Displaced Families**

Social Category	Total No. of Families	Percentage
Schedule Tribe	22	5.50%
Schedule Caste	14	3.50%
Other Backward Class	241	60.25%
General	123	30.75%
<b>Total</b>	<b>400</b>	<b>100%</b>

Source: SIA Report

#### 4.4.9 Educational Profile

The educational status of the Displaced Persons is presented in **Table 48**. The total number of Displaced Persons, of more than school going age of 6 years, is 1713. Out of which 1.05% reported to be illiterate, 0.82% reported that they are only literate as they can both read and write in the local language but never had any formal schooling, 13.66% of the Displaced Persons have education up to primary level, 73.15% up to secondary/higher secondary, 10.92% up to graduation & higher, only 0.35% (6 persons) have technical and 0.06% (1 persons) have vocational qualifications.

**Table 48: Educational Status**

Educational Status	Male	Female	No. of Displaced Persons	Percentage
Illiterate	8	10	18	1.05%
Literate (can only sign)	4	10	14	0.82%
Primary	98	136	234	13.66%
Secondary & Higher Secondary	678	575	1253	73.15%
Graduate & Higher	84	103	187	10.92%
Technical	6	0	6	0.35%
Vocational	0	1	1	0.06%
<b>Total</b>	<b>878</b>	<b>835</b>	<b>1713</b>	<b>100.00%</b>

Source: SIA Report

#### 4.4.10 Occupational Profile

The social impact of the project may be also assessed in terms of viewing the occupation pattern in the project area. The occupational status of the Displaced Persons is presented in **Table 49**. It is reported that out of the total displaced population of 1860 children below 14 years (360 in number) have not been included in the analysis of occupation. Out of the total



remaining 1500 Displaced Persons, 883 reported to be unemployed (including housewives and persons above the age of 60 years). The total working population is 617 taking the workforce participation rate to 41.33%. Overall, the contribution of females in the workforce is 16.73% and that of males is 83.46%. Analysis of work force data also points to the fact that the primary sector occupation is dominated by business/trade 56.07, followed by the secondary and tertiary sectors i.e., Private Services (15.55%) and Govt. Services (10.21%). Of the total workforce of 617 only 74 are engaged in agriculture and as agricultural laborer making overall dependency on agriculture at 11.99.

**Table 49: Occupation Pattern**

Employment Status	Male	Female	Total	Percentage
Agriculture	53	5	58	3.87%
Agriculture Labourer	12	4	16	1.07%
Non-Agriculture Labourer	11	2	13	0.87%
Business/ Trade	297	49	346	23.07%
Govt. Service	43	20	63	4.20%
Private Services	79	17	96	6.40%
Maid Servant	2	0	2	0.13%
Others	18	5	23	1.53%
Unemployed	246	637	883	58.87%
<b>Total</b>	<b>761</b>	<b>739</b>	<b>1500</b>	<b>100%</b>

Source: SIA Report



## 5. Anticipated Environmental and Social Impacts and Mitigation Measures

### 5.1 Introduction

This chapter presents key environmental issues associated with various aspects of the proposed subproject. The environmental impacts caused due to the development of the subproject road sections can be categorized as primary (direct) and secondary (indirect) impacts. Primary impacts are those which are induced directly by the subproject whereas the secondary impacts are those which are indirectly induced and typically include the associated investment and changing patterns of social and economic activities due to the proposed action. Interaction of the subproject activities with environmental attributes is presented as Activity- Impact matrix in **Table 50**.

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

During the operation stage, road-side economic activities supporting transport like Petrol pumps, automotive repair shops, lodging, and restaurants will increase due to the increased number of vehicles. An increase in agro-industrial activities is also expected to take advantage of improved access to urban centers where there are higher demands and better prices for agricultural products. The project will accelerate the industrial activities and induced development significantly. One important project-specific benefit is the avoidance of flooding or waterlogging by increasing the waterway of bridges and the provision of side drains. 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, educational and other infrastructural facilities (iv) improved quality of life of rural tribal population (v) reduced accident events and (vi) better investment climate for industries creating more employment opportunities to local people.

The identification of potential effect requires identifying the components of the physical, biological, and human environments that are at risk of being impacted in the upgrading of state roads in Assam. It involved an integration grid between the valued environmental components and project activities. The valued environmental components for this project were drawn from the environmental baseline and are as follow:

- Physical environment – air quality and greenhouse gas emissions, land and soil, surface water quality and quantity, and groundwater quality and quantity,
- Biological environment – terrestrial vegetation
- Human environment – private land and buildings, public infrastructures, sound
- Environment, aesthetic and visual, and community and occupational health and safety.



The assessment of potential environmental impacts requires the definition of the effects associated with the MDR upgrading in terms of intensity, duration, and scope as follow:

- Nature of the effect: The nature of the effect refers to the kind of effect on the environment. Two levels have been defined:
  - Positive: The work would have a good impact on the environment or stakeholders.
  - Negative: The work will have a bad impact on the environment or stakeholder.
- Duration of the effect: Duration means the time dimension of the effect. The term short term and long term are used to describe the period:
  - Short-term: the effect disappears promptly once the source is eliminated;
  - Long Term: the effect is felt for a while even after the source is eliminated;
- Scope of the effect: The scope describes the spatial dimension of the effect caused by an action in the environment. It refers to the distance or area covered by the disruption. The terms regional, local, and limited are used to describe the scope:
  - Limited: the scope is limited when the action affects only one environmental element located near the project;
  - Local: the scope is local when the action affects the study area;
  - Regional: the scope is regional when the action affects areas beyond the study area

Assessment of the potential effect: The potential effect considering the above parameters come into one of three categories:

- Major (MAJ): signifies an effect that is permanent and that affects the integrity, diversity, and sustainability of the element. Such an effect substantially or irretrievably alters the quality of the environment.
- Medium (MED): signifies a perceptible, temporary, and/or low- return effect that has little impact on the environmental component and is not irreversible. Such an effect is short-lived and/or limited in scope.
- Minor (MIN): signifies that the effect is non-existent or virtually non-existent, that it does not affect the environmental component in any observable or quantifiable way and that it is related to a randomly occurring natural effect.



**Table 50: Activity Impact Identification Matrix**

Activity	Severity of Impact	Degree of impacts		Duration of Impact		Scope of Impact		
		Positive	Negative	Short term	Long Term	Local	Regional	Limited
<b>PRE-CONSTRUCTION PHASE</b>								
Road alignment and design considerations	MED	x			x	x		
Utility shifting: removal and transfer of electrical and other utilities, tree cutting	MED		x	x			x	
<b>CONSTRUCTION PHASE</b>								
Site Clearance	MIN		x	x			x	
Generation of Debris	MIN		x	x		x		
Non-bituminous waste	MIN		x	x		x		
Bituminous waste	MIN		x	x		x		
Traffic diversion	MED		x	x			x	
Borrow areas	MIN		x	x			x	
Quarries	MIN		x	x			x	
Water extraction	MED		x	x		x		
Haul vehicles	MED		x	x		x		
Material storage	MED		x	x		x		
Excavation	MED		x	x		x		
Natural drainage	MIN		x	x		x		
<b>ENVIRONMENTAL AND SOCIAL ATTRIBUTES</b>								
Air	MED		x	x		x		
Water	MIN		x	x		x		
Noise	MED		x	x		x		
Soil	MIN		x	x		x		
Flora	MED		x		x	x		
Social Environment	MAJ	x			x		x	



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

Activity	Severity of Impact	Degree of impacts		Duration of Impact		Scope of Impact		
		Positive	Negative	Short term	Long Term	Local	Regional	Limited
<b>OPERATION PHASE</b>								
<b>Environmental Attribute</b>								
Air	MIN		×		×	×		
Water	MIN	-	-	-	-	×		
Noise	MIN		×		×	×		
Soil	MIN	-		-		×		
<b>Social Environment</b>								
Increase in property value	MED	×			×		×	
Transportation Development	MAJ	×			×		×	
<b>Road User</b>								
Safety and Better Connectivity	MAJ	×			×		×	
Road Users Safety	MAJ	×			×	×		



Identification and assessment of the potential environmental impacts are based on secondary information supplemented by field visits. Impacts on various environmental components have been assessed at four different stages, namely:

- The project location;
- Design and pre-construction;
- Construction; and
- Operation stages.

A few permanent as well as short-term and long-term adverse effects, mainly at the construction and operation stages, are, nonetheless, anticipated. Temporary short-term impacts can be kept in check through proper planning and adopting environment-friendly road construction methods and the appropriate regulatory measures

## 5.2 Positive Environmental impacts due to the improvement of sub-project road

The positive impacts expected from the improvement of the project road section includes:

- The consequences of soil erosions are far wider than the 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 the embankment and sub-grade resulting in softening of the subgrade. This may also increase siltation in water bodies. The project design includes provisions of retaining walls for protection. Regular checks will be made to check its effectiveness.
- Improvements to the road drainage will result in improved stormwater flows and reduce the tendency of blockages to occur in roadside drains. Risks to the public health caused by such stagnant water bodies by acting as disease vector breeding places will be reduced. By designing the drains to withstand appropriate storm events and regular maintenance will further reduce the chances of drainage system failure. Accidental oil spillage, washing of vehicles, used engine oils, paints used in maintenance can contaminate the water bodies. Proper handling of such chemicals under strict supervision will help to minimize the water pollution during the maintenance period. Rejuvenation of the drainage system by removing encroachments/ congestions will be regularly conducted.
- Improved quality of life for the rural population in the projects influence area, this as a result of better access to markets, health, education, and other facilities; and the derived stimulus for local economic activity;
- A more efficient and safe road transport system: through reduced travel times, reduced road accidents, reduced vehicle operating and maintenance costs, and reduced transportation costs for goods;
- Interstate connectivity to neighboring districts; and
- Better connectivity to the State Highway and National Highway network.



### 5.3 Adverse Environmental impacts due to the improvement of sub-project road

The adverse environmental impacts anticipated from the improvement of the project road section are:

- Cutting of roadside trees that fall within formation width may reduce the ecological balance of the area and also increase soil erosion problems.
- Noise, air and water pollution and disposal of construction waste, during construction, will adversely impact the residents. These latter effects should, however, only be temporary/reversible.
- Several quarries and other sources will be established which will change the landscape. However, the operation of quarries is an independent and already regulated activity.
- Improvement on the existing road although limited, may increase soil erosion, landslips and reduce the micro-level ecological balance of the area. Construction may also disturb the habitation of fauna living in this area. These should, however, be only temporary/reversible effects.
- Minor impacts of noise and air quality for those now living and workings close to the project road will deteriorate during the construction period and afterward during operation.

### 5.4 Impacts Related to Sub- Project Location, Preliminary Planning and Design

#### 5.4.1 Natural Hazard

The entire Assam falls under zone V (very high-risk zone) as per the seismic map of India and therefore the risk of damage to the subproject road due to an earthquake is critical. Relevant IS codes shall be adopted in the design of civil structures.

#### 5.4.2 Road Widening, Utilities shifting, and Safety Planning

The entire road section has enough available ROW to accommodate the proposed road improvement works and will be undertaken along the existing alignment with minimal land acquisition required at some locations. Road widening will result in the shifting of utilities and encroaching structures. Poor coordination with local authorities and communities will increase the risk of accidental damage to drainage channels and temporary disruption of water and electricity supplies along active construction fronts. The further contraction of the useable carriageway during construction will exacerbate traffic and will hinder direct access across the road by residents along the road. Temporary detention of drain water on depressed areas during the reconstruction of drainage canals may occur.

Road formation widening will be made based on minimizing tree cutting, utility shifting, and damage to community properties. Road design has incorporated the drainage system to avoid the accumulation of drainage water and surface run-off. Temporary pits will be



constructed at side-and cross drains to collect drainage water from demolished or damage drainage channels which will be hauled for off-site treatment.

Adequate safety provisions like crash barriers on accident-prone areas rumble strips in community areas to regulate speed, retro-reflective warning signboards near school, hospital, and religious places are incorporated in the design. All utilities requiring shifting shall be largely made before the start of construction. Before shifting, the Contractor will coordinate with the concerned agencies regarding the time and extent of shifting, and the community affected will be informed of a potential service disruption at least 1 week earlier.

### 5.4.3 Impact on Land

The total land to be acquired is 91.35 acre, out of which 30.02acre (32.86%) is government land, 54.25acre (59.38%) is private land, while ownership status of remaining 7.08 acre (7.75%) land is yet to be established, as the revenue records are not available for these stretches. No forest land is impacted in the proposed project stretch. **Table 51** shows the land to be acquired for the proposed project.

**Table 51: Proposed Land Acquisition**

Sr. No.	Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where owner-ship could not be ascertained (in acre)*	Government Land (in acre)	Total Land to be acquired (in acre)
1	Desang Kinar Bangali	Revenue Circle: Naharkhatiya; Dist. Dibrugarh	0.15	0.00	0.00	0.15
2	Asabam T.E		0.10	0.00	0.31	0.40
3	Grant No.334 NLR		1.91	0.00	0.00	1.91
4	1 No.Ghuronia		7.45	0.10	2.99	10.54
5	Desam T.E		0.82	0.00	0.07	0.89
6	Cheleng Gaon		1.31	0.17	1.12	2.59
7	Tairai Gaon		1.31	0.00	0.62	1.94
8	1 No.Habi Chengelijan		2.27	0.00	0.93	3.20
9	2 No.Borbam		3.56	0.00	0.26	3.82
10	Tarani Pathar		7.59	0.00	0.59	8.18
11	Sasoni Pathar		6.10	0.00	0.68	6.78
12	2 No. Mohamari	Revenue Circle: Tengakhat; Dist. Dibrugarh	4.95	0.61	0.10	5.66
13	1 No. Mohamari		4.62	4.18	0.96	9.77
14	Meribil Pabhajan		2.40	1.03	0.00	3.44
15	Pabhajan Gaon		0.88	0.32	0.75	1.96
16	1 No. Chalakataki		0.35	0.10	2.76	3.21
17	1 No Jagun Pathar Gaon		2.45	0.00	0.00	2.45
18	2 No Chala Kataki		0.21	0.00	0.00	0.21
19	Tipling Purana Ghat		0.18	0.00	1.46	1.64
20	Bara Gadhou & Naloni Pathar		1.04	0.00	0.61	1.65
21	15 No Jaloni Grant Gaon-1		0.18	0.00	4.76	4.94
22	15 No Jaloni Grant Gaon-2		1.15	0.00	8.25	9.40



Sr. No.	Village Name	Revenue Circle & District	Total Impacted Pvt Land (in acre)	Land Parcels where owner-ship could not be ascertained (in acre)*	Government Land (in acre)	Total Land to be acquired (in acre)
23	Jagun Gaon		0.96	0.00	0.58	1.54
24	1 No Ronga Gora Gaon		0.13	0.00	0.22	0.35
25	Padumoni Gaon		1.98	0.54	0.83	3.35
26	2 No.Chopatali Gaon		0.21	0.03	0.19	0.43
27	2 No Chapatali-2		0.00	0.00	0.98	0.98
		<b>Total</b>	<b>54.25</b>	<b>7.08</b>	<b>30.02</b>	<b>91.35</b>

Source: SIA Report

#### 5.4.4 Impact on Structure

The break-up of the identified impacted structures (451 numbers) is presented in given in Table 52.

Table 52: Impact on Structures

Impact	Residential	Commercial	Resi. & Com	Others	Total	% of Total
Less than 10%	2	7	1	0	10	2.22%
10-20%	1	22	0	3	26	5.76%
20-30%	0	17	0	0	17	3.77%
30-40%	4	27	0	2	33	7.32%
40% & above	24	178	11	152	365	80.93%
<b>Total</b>	<b>31</b>	<b>251</b>	<b>12</b>	<b>157</b>	<b>451</b>	<b>100%</b>

Source: SIA Report

#### Mitigation Measures

The Resettlement plan will be prepared on the mitigation measures of finding of SIA and in guidance of re-settlements framework. The RP will be implemented through PR implementing agency onset of civil work.

#### 5.4.5 Terrestrial Ecology

The project road does not pass through any protected area in the state. The nearest protected area from the project road is the Dihing Patkai National Park (recently declared) which is at a distance of 3.6 km (approx.) from the project road. 1515 no. trees are likely to be affected. The impact and mitigation due to tree cutting have been discussed in the following paragraphs. The road has a direct bearing on tree resources. Road widening option is made in such a way as to minimize the cutting of trees. However, efforts have been made in the design to reduce the tree cutting to only eight meters from the central line of the existing road. Compensatory plantation in a 1:10 ratio with preference to fast-growing local species has been proposed under the project to address this impact.



## 5.5 Environmental Impacts - Construction Stage

### 5.5.1 Air Quality

The potential sources of air emission during the construction phase of the project are (i) dust re-suspension from earthworks including materials loading and unloading; (ii) quarrying and rock crushing; (iii) operation of construction equipment's and machines; (iv) fugitive emissions from unpaved travel on road; and (v) combustion of fuels in equipment, machinery, and vehicles. Particulate matter, comprising the majority from road construction, Particle size distribution from road construction is dominantly large, with 85.5% > 10 $\mu$ m and 55% > 20  $\mu$ m which can settle within proximity of the source. Hot mix plant will generate carbon monoxide (CO), un-burnt hydrocarbon, sulphur dioxide, particulate matters, and nitrogen oxides (NO<sub>x</sub>). These may affect the air quality of nearby areas especially due to emission from low height stack. The deterioration of the air quality within the immediate vicinity of the road construction activities will be significant but temporary.

**Mitigation Measures:** Following measures are proposed to minimize the dust and emission generation:

- Vehicles delivering loose and fine materials like sand and aggregates shall be covered.
- Loading and unloading of construction materials in the project area or provisions of water logging around these locations.
- Storage areas should be located downwind of the habitation area.
- Water shall be sprayed on earthworks and unpaved haulage roads regularly.
- Regular maintenance of machinery and equipment. Vehicular pollution check shall be made mandatory.
- Explore the potential for using readymade asphalt and crushed rocks to avoid or minimize the use of hot mix and rock crushing plants.
- Mixing plants and asphalt (hot mix) plants shall be located at least 1 km downwind of the human settlements. The asphalt plants, crushers, and the batching plants shall be sited at least 500m in the downwind direction from the nearest settlement and after securing a No-Objection Certificate (NOC) from the SPCB. Hot mix plants shall be fitted with a stack of adequate height as may be prescribed by SPCB to ensure enough dispersion of exit gases.
- Only crushers licensed by PCB shall be used.
- LPG should be used as a fuel source in construction camps instead of wood. Tree cutting shall be restricted.
- Mask and other PPE shall be provided to the construction workers.
- Diesel Generating (DG) sets shall be fitted with adequate height as per regulations
- Low sulphur diesel shall be used in DG sets as well as machinery.
- Air quality monitoring should be carried out during the construction phase. If monitored parameters are above the prescribed limit, suitable control measures must be taken.
- Dust Control Measures – Contractor shall sprinkle water to suppress dust along the entire project length using three water tankers. However, settlement areas, schools,



markets shall be given preference. Contractor shall cover material by tarpaulin during transportation.

- Contractor shall install wet scrubber or any other suitable pollution control mechanism for Hot Mix Plant and ensure that flue gas passes through the wet scrubber before releasing into ambient air. Contractor shall also ensure that wet scrubber or other filter is always in operational stage when HMP is in operation.
- Contractor shall install water sprinkler at different point of crusher operation such before feeding into hopper, transportation at conveyor belt and before screening so that emission of dust is minimized.
- Debris Handling – contractor shall sprinkle water before handling debris to minimize generation of dust as per requirement of the site.
- Maintenance of the existing road and haul road – Contractor shall maintain existing road and haul road so that vehicle can pass easily and ensure that generation of dust is minimized.
- Storage sites of top soils shall be covered with grass and separated with bund. Water should be sprinkled to facilitate growing of grass.
- Storage area should be located downwind of the habitation area.
- Hot mix plant should be located at least 1.5 km from the nearest habitation, school, hospital, river, streams, lakes, 500m from ponds, and national highways, 250m from state highways. Hot mix plant shall be fitted with stack of adequate height as may be prescribed by SPCB to ensure dispersion of exit gases.
- LPG should be used as fuel source in construction camps instead for woods.
- Vehicles and machinery shall be maintained regularly and PUC certificate shall be obtained by the Contractor regularly
- Ambient air quality shall be monitored by Contractor as per Environmental Monitoring Plan to ensure that air quality parameter is within permissible limit.

### 5.5.2 Noise

The scale of the construction necessary to upgrade the road and the corresponding slight increase in traffic is not expected to generate adverse impacts. Ambient noise level may increase temporarily in the close vicinity of various construction activities, maintenance workshops, and vehicles and earthmoving equipment. These construction activities are expected to generate 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 than the permissible limit for ambient noise level for residential/commercial levels but will occur only intermittently and temporarily. This noise level will attenuate with an increase in distance from the noise source, decreasing by 10dB at a distance of about 55m and 20 dB at 180 meters. Impact due to noise during construction activities will be minimal near communities as construction camps are located at least 50 meters away from community areas.

Along the project road, noise-sensitive places have been located which includes schools and hospitals. Noise impacts during project construction will be significant on these but



temporary. The details of the Sensitive location along the project road are mentioned in **Table 53**.

**Table 53: Sensitive Structures along the project road**

Sr. No.	Receptor	Side	Chainage (Km)	Distance from Road Edge (m)
1	School	Right	11+600	15
2	School	Right	12+000	25
3	School	Left	14+550	70
4	School	Right	15+000	40
5	School	Right	15+950	15
6	School	Right	18+200	50
7	School	Left	19+900	20
8	School	Left	20+850	20
9	School	Right	22+400	20

The major source of noise and vibration pollution are use of vehicle for material transport, equipment used for cutting, leveling, dumping, pressing, concrete mixing, welding etc. These vehicles/equipment's when operated by the operator generate noise level which is discussed in This will also have impact on the sensitive receptors if located nearby, resulting in hearing loss, loss in sleep, and other health related problems to the local nearby.



**Table 54: Typical noise levels of principal construction equipment (Noise Level in dB (A) at 50 Feet)**

Activities/ Operation of Equipment	Noise Level dB(A)	Activities/ Operation of Equipment	Noise Level dB(A)
<b>CLEARING AND GRUBBING</b>		<b>STRUCTURE CONSTRUCTION</b>	
Bulldozer	80	Welding generator	71-82
Front end loader	72-84	Concrete mixer	74-88
Jack hammer	81-98	Concrete pump	81-84
		Concrete vibrator	76
<b>EXCAVATION &amp; EARTH MOVING</b>		Air compressor	74-87
Bulldozer	80		
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
<b>GRADING AND COMPACTING</b>		<b>LANDSCAPING AND CLEAN-UP</b>	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
<b>PAVING</b>		Front end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94
<b>Source:</b>			
<ul style="list-style-type: none"> <li>• <i>U.S. Environmental Protection Agency. Noise from Construction Equipment and Operations. Building Equipment and Home Appliances. NJID. 300.1. December 31. 1971,</i></li> </ul>			

Based on the standards prescribed by Occupational Safety and Health Administration (OSHA-USA) which in-turn are being enforced by Government of India through Model rules framed under the Factories Act. The acceptable limits for each shift being of 8-hour duration, the equivalent noise level exposure during the shift is 90 dB(A).

Hence noise generated due to various activities in the construction camps may affect workers, if equivalent 8-hour exposure is more than the safety limit. ACGIH (American Conference of Government Industrial Hygienists) proposed an 8-hour Leq limit of 85 dB(A). Exposure to impulses or impact noise should not exceed 140 dB(A). The workers in general are likely to be exposed to an equivalent noise level of 80-90 dB(A) in an 8-hour shift for which all statutory precautions as per laws should be taken into consideration. Noise limits for different working environment are provided in **Table 55**.



**Table 55: Noise Limits for different working Environment**

Location/ Activity	Equivalent Level LAeq,8h	Maximum LA max, fast.
Heavy Industry (no demand for oral communication)	85dB (A)	110dB (A)
Light industry (decreasing demand for oral communication)	50-65dB(A)	110 dB(A)
Open offices, control rooms, service contours of similar	45-50 dB(A)	
Individual offices (no disturbing noise)	40-45dB(A)	
Classrooms lecture halls	35-40 dB(A)	
Hospital	30-35 dB(A)	40 B (A)

*General EHS Guidelines: Occupation Health and Safety; IFC World Bank group.*

**Identification of Pollution Sources**

Noise sources identified are:

- Construction activities such as demolition of structures, clearing and grubbing, excavation & earth moving, grading and compacting, structure construction crushing
- Transportation of construction material/debris/spoil through heavy vehicles
- Operation of hydraulic rigs for piles

The construction activities will generate temporary noise impacts in the immediate vicinity of the construction site. These noises generated by construction activities is a temporary phenomenon and is limited to construction phase only. Based on the noise level the OSHA Daily Permissible Occupational Noise Level Exposure time prescribe the exposure time for resident, local and people engaged in construction of road is discussed in **Table 56**.

**Table 56: OSHA Daily Permissible Occupational Noise Level Exposure<sup>2</sup>**

Sr. No.	Duration per day, hours	Sound level dB(A)
1.	8	90
2.	6	92
3.	4	95
4.	3	97
5.	2	100
6.	1 and ½ or 1.5	102
7.	1	105
8.	½	110
9.	14 or less	115

<sup>2</sup> Occupational Safety and Health Administration (OSHA).



### Mitigation Measures for Construction Phase

The high noise levels may cause discomfort to local residents and workers. Following mitigation measures shall be adopted to keep the noise and vibration levels under control.

- The plants and equipment used for construction will strictly conform to Central Pollution Control Board (CPCB) noise standards. Vehicles, equipment and construction machinery shall be monitored regularly with particular attention to silencers and mufflers to maintain noise levels to minimum;
- Workers in the vicinity of high noise levels must wear ear plugs, helmets and should be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A); the exposure time for the workers should be as per the reference in **Table 56**.
- In construction sites within 150 m of human settlements, noisy construction will be stopped between 10 PM and 6 AM except in case of laying of cement concrete pavement for which lower working temperature is a requirement;
- Hot mix plant, batching or aggregate plants shall not be located within 500 m of sensitive land use as schools and hospitals;
- Noise barriers such as brick wall or concrete panel shall be used near to the sensitive receptors given in **Table 53** such as hospitals and schools;
- Phase demolition, earthmoving and ground-impacting operations so as not to occur in the same time period. Unlike noise, the total vibration level produced could be significantly less when each vibration source operates separately
- Construction machinery will be located away from the settlements;
- Careful planning of machinery operation and scheduling of operations can reduce the noise levels. Use of equipment, emitting noise not greater than 90 dB(A) for the eight-hour operations shift and locating of construction yards at a distance of at least 500 m from any residential areas can be adhered to;
- Use of noise shields to construction machinery and provision of earplugs to the heavy machine operators are some of the mitigation measures, which should be followed by the contractors during the civil works;
- The noise control measures include limitations on allowable grades. Open-graded asphalt and avoidance of surface dressings to reduce tire noise in sensitive areas. Maintenance of proper road surface repairs also helps in reducing noise levels;
- Use of air horns should be minimized during night time. During daytime use of horns should be restricted at few sensitive locations. This can be achieved through the use of sign boards along the roadside;
- The worker should have job rotation and especially for those workers, exposed to higher noise level.
- During the operational stage, the movement of traffic will be the prime source of the noise. Traffic congestion and pedestrian interferences increase the use of horns. This may result in increased noise levels at nearby schools and religious places.



### 5.5.3 Impact on Land and Soil

Borrow areas may lose their productivity if the topsoil is not preserved. Similarly, land area used for locating construction camp may lose its productivity, if it is not restored to its original stage after disbanding the construction camp.

**Mitigation Measures:** The topsoil from the productive land shall be preserved and reused for plantation purposes. It shall also be used as a top cover of the embankment slope for growing crops and vegetation to protect soil erosion. It shall be ensured that the land taken on lease for access to the road and construction camp is restored to its original land use before handing over back to be the owner.

### 5.5.4 Soil Erosion

Soil erosion may take place at locations of the sharp bend near bridge construction locations, along steep and incompact embankment slope, and wherever vegetation is cleared. Soil erosion may have cumulative effect viz. siltation, embankment damage, and drainage problem. Loss of soil due to runoff from earth stock-piles may also lead to the siltation of nearby water bodies. The intensity of soil erosion at different locations will be influenced by the lithology, topography, soil type, and climatic condition (mainly rainfall) and drainage pattern.

**Mitigation measures:** Following mitigation measures are proposed for the prevention of soil erosion:

- Bank protection measures shall be taken at erosion-prone areas. The protection measures may include the use of stone pitching for embankment height more than 3m.
- 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.
- Shrubs shall be planted in loose soil areas.
- In rural stretches, longitudinal side drains shall be intercepted by drains serving as outlet channels to reduce the erosion.
- IRC: 56 -2011 recommended practice for the treatment of embankment slopes for erosion control shall be taken into consideration.
- Soil erosion shall be visually checked on slopes and high embankment areas. In case soil erosion is found, suitable measures shall be taken to control the soil erosion further including bio-turfing.
- During excavations, the Contractor will take all adequate precautions against soil erosion as per MoRTH Specification for Road and Bridge works (5<sup>th</sup> Revision) Clause no. 306.
- The earth stockpiles to be located shall be provided with gentle slopes to prevent soil erosion and flow with water.



### 5.5.5 Borrow Areas and Quarries

The project area is flat terrain. Farmers are willing to provide earth from their field up to a certain depth on adequate compensation; it is recommended that borrowing from agricultural land shall be minimized to the extent possible.

Borrow areas if left un-rehabilitated may pose risk to people, particularly children and animals of accidentally falling into the pit as well as become potential breeding ground for mosquitoes of vector born disease.

Illegal quarrying may lead to unstable soil conditions; destroy the landscape of the terrain, air, and noise pollution. The opening of new quarries is not envisaged due to the proposed project. Quarry material will be sourced from existing nearby quarries.

**Mitigation measures:** 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 landowners desire to level the land. The topsoil 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 the selection of borrow pits and the amount of material that can be borrowed.

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 inhabited areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. In addition, it shall be converted into fishpond in consultation with the fishery department and if desired by the landowner/community. The borrow area shall be rehabilitated according to the broad guidelines.

Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval/ rehabilitation plan for a new quarry or use of existing sources will be submitted to EO, PIU. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state, and submit a copy of it for the approval to EA if new quarries are opened. The guidelines for borrow area management are given in **Annexure 6**.

### 5.5.6 Compaction and Contamination of Soil

The soil in the adjoining productive lands beyond the ROW, haulage roads, and construction camp area may be compacted due to the movement of construction vehicles, machinery and equipment, and due to the sitting of construction camps and workshops. Approach road either paved or unpaved is available for most of the bridge approaches. However, for some bridges approach road has to be constructed.

Soil may be 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 be contaminated due to the inappropriate disposal of domestic solid waste and sewage from construction camps.



**Mitigation Measures:** Fuel and lubricants shall be stored at the predefined storage location and away from drainage channels. The storage area shall be paved with a gentle slope to a corner and connected with a chamber to collect any spills of the oils. Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil.

All efforts shall be made to minimize waste generation. Unavoidable waste shall be stored at the designated place before disposal. To avoid soil contamination at the wash-down and refueling areas, oil interceptors shall be provided. Oil and grease spill and oil-soaked materials are to be collected and stored in labeled containers (Labeled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/MoEF&CC authorized Waste Oil Recycler.

To prevent soil compaction in the adjoining productive lands beyond the ROW, the 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 the construction camp.
- Domestic solid waste at construction camp shall be segregated into biodegradable and non-biodegradable waste. The non-biodegradable and recyclable waste shall be sold off.
- Efforts shall be made that biodegradable waste shall be composted in the mechanized and movable composter by the contractor. Non bio-degradable and non-saleable waste shall be disposed of at authorized landfill site. Non-bituminous wastes to be dumped in borrow pits with the concurrence of the landowner and covered with a layer of topsoil conserved from opening the pit.
- Bituminous wastes will be disposed of in an identified dumping site approved by the State Pollution Control Board.

Construction waste constitutes debris, which is generated due to dismantling of pavement (though involved only for few kilometers in DBH Road), quarry dust, and unused iron bars or damaged support structures. Uncontrolled disposal of these wastes may affect soil and even receiving water bodies may cause contamination of soil, and landscape of the area.

**Mitigation Measures:** Construction waste shall be disposed of in an environmentally acceptable manner. Some of the measures are as follows:

- The existing bitumen surface can be utilized for paving of crossroads, access roads, and paving works in construction sites and camps, temporary traffic diversions, and haulage routes. All excavated materials from roadway, shoulders, drains, cross drainage should be used for backfilling embankments, filling pits, and landscaping. Unusable debris material should be suitably disposed of at pre-designated disposal locations, with approval of the concerned authority.



- The bituminous wastes shall be disposed of in secure landfill sites only in an environmentally accepted manner. For removal of debris, wastes and its disposal MoRTH guidelines should be followed.
- The locations of dumping sites should be selected away from residential areas and located at least 1000 m downwind side of these locations with the following consideration.
- Dumping sites do not contaminate any water sources
- Dumping sites have adequate capacity for accommodation debris generated.
- Public perception and consent from the village Panchayats about the location of debris disposal site shall be obtained before finalizing the location.
- Unproductive/wastelands shall be selected for dumping sites.

### 5.5.7 Groundwater

Contamination of groundwater is not envisaged since construction camps will have toilets commode to septic tanks or mobile toilets depending on the number of workers in each camp.

**Mitigation Measures:** Requisite permission as applicable shall be obtained for the abstraction of groundwater. The contractor shall plan for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. Water intensive activities shall not be undertaken during the summer season.

### 5.5.8 Surface Water Bodies

Temporary pollution of water bodies may occur due to spillage of chemicals and oil at construction sites. Installation of a haul road or temporary access across the river/nala maybe required while construction work is ongoing in the existing minor bridges and culverts. This may cause sedimentation and other disturbances to the water body.

**Mitigation Measures:** To prevent the siltation of roadside ponds, the provision of retaining wall is made along the road for the ponds located next to the road. To enhance the ponds along the road 5m width turfing and surface drains will be provided at ponds located at Ch. 10+450 (R), 14+100 (R), 16+325 (R), 18+700 (L), 21+125 (R). As control measures, efforts shall be made to increase the water-holding capacity of the ponds (other than those affected) in the region by using the bed material as borrow earth. Following measures shall be followed additionally:

- Bridge construction activity including piling is recommended during non-monsoon seasons (October to End of May) period.
- Check dams must be created during construction to catch the silt or debris generated from construction activities across the water channels
- All chemicals and oil shall be stored away from water and concrete platforms with catch pit for spills collection.
- All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up.



- Readily available, easy to understand, and preferably written in the local language emergency response procedure, including a reporting system will be provided by the contractors.
- Silt fencing and/or brush barrier shall be installed along drainage path, erosion-prone areas for collecting sediments before letting them into the water body. Silt/sediment should be collected and stockpiled for possible reuse as the surfacing of slopes where they have to be re-vegetated.
- All wastes arising from the construction should be disposed of in an environmentally accepted manner so as not to block the flow of water in the channels. The wastes should be collected, stored, and transported to the approved disposal sites.
- No vehicles or equipment should be parked or refueled near water bodies, to avoid contamination from leakage of fuel and lubricants.
- Substructure construction should be limited to the dry season.
- Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Sewage from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies because these are used for bathing and washing purpose.
- The borrow areas may also be converted into ponds with the concurrence of the landowners. Fisheries activity can be encouraged in such ponds through institutional support from the concerned department
- Vehicle shall be washed at designated location and washed-out water shall be collected at oil interceptors for removal of grease and oil before disposal.

#### 5.5.9 Hydrology and Drainage

Construction material and waste may contaminate or clog the small drains if stored or disposed of close to the water body.

**Mitigation Measures:** Adequate cross drainage structures shall be provided. Additional balancing culverts shall be provided in flood-prone areas. The embankment height shall be designed consistent with the existing topography of the region and shall be higher than the HFL. The elaborate drainage system shall be provided to drain the stormwater from the roadway and embankment and to ensure minimum disturbance to natural drainage of surface and subsurface water of the area.

The design of the drainage system such as surface and sub-surface drainage shall be carried out as per IRC: SP: 42 and IRC: SP: 50. Surface runoff from the main highway, embankment slopes, and the service roads shall be discharged through longitudinal drains, designed for adequate cross-section, bed slopes, invert levels, and the outfalls. If necessary, the walls of the drains shall be designed to retain the adjoining earth.

IRC: 34-2011: Recommendations for road construction in the waterlogged area and IRC: 75 and MORT&H guidelines for the Design of High Embankments shall be referred.

No construction material will be stored or disposed near any water body except for reusing it for enhancement measures such as embankment raising.



## 5.5.10 Impact on Biological Environment

### 5.5.10.1 Terrestrial Ecology

As per the approved Protected Areas & Reserve Forests map received from the PCCF office, Guwahati vide Letter No. FG 69/REWP/GIS/PART-1/7032 (**Annexure 21**) during the initial survey, the project road does not pass through any notified protected area in the state. The nearest protected area from the project road is the Dihing Patkai National Park (recently declared) which is at a distance of 3.6 km (approx.) from the project road. However, some trees are likely to be affected. The impact and mitigation due to tree cutting have been discussed in the following paragraphs.

One month before the construction starts, clearing and grubbing will be performed by the contractor. A total of 1515 trees are likely to be affected due to the proposed project. The cutting of trees will have a minor to negligible impact on the local environment.

**Mitigation Measures:** Requisite permission from the Forest Department shall be obtained for cutting of roadside trees located in forest land. In the State of Assam, as per the Assam (Control of Felling and Removal of trees from Non-forest lands) Rules, 2002, the felling of trees from the Non-forest area will require prior approval of the Forest Department.

The project envisages plantation of 15150 trees along both sides of the road as per IRC SP: 21 specifications. This will include the compensatory plantation in the 1:10 ratio as per the NGT order. The saplings shall be planted before cutting the existing trees. Besides, additional plantation shall be done on banks of water bodies near bridge sites to enhance the aesthetics and check soil erosion. All tree plantations will be carried out through the forest department, local community, or the civil works contractor. Tree species selected for plantation must be suitable for local climatic conditions and be equal to or better in sequestering carbon than the trees removed/be good for sequestering carbon (only for roads where there is no tree cutting). Necessary advice may be sought from the local Forestry office in the selection of tree species.

### 5.5.10.2 Aquatic Ecology

Temporary sedimentation and water quality deterioration are expected from the project during the construction stage. An accidental spill of materials, chemicals, and fuels may also deteriorate receiving water quality and hence the aquatic ecology.

**Mitigation measures:** It is proposed to undertake construction activities near water bodies during the summer season when most of the water bodies are practically dry. Best construction practices shall be adopted to prevent an increase in siltation level of the water. All precautionary efforts shall be made as given under the surface water section to prevent accidental damage of water quality.

### 5.5.11 Socio-Economic Impact

Economic activities supporting transport like fuel stations, automotive repair shops, lodging, and restaurants are expected to increase with the increase of traffic and induced development of the area. The improved road will provide better connectivity which will result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to



quality health care facilities, access to educational and other infrastructure al facilities (iv) enhanced tourism activities in the area and state which in many times will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people.

### **Pandemic Effect of COVID -19 on Health & Safety Issues**

During public consultation, care has to take that the State of Assam COVID-19 Guidelines are well practices.

During public consultation with the local people the following guideline need to be followed:

- Social Distancing measures need to be followed as per the guidelines of Assam Government circular.
- No more than 4 people should be Assemble during consultation and that to minimum distance of 6 feet need to be complied.
- During consultation if somebody is seen having cold, cough or unhealthy appearance like from the face reading it appears that he/she is sick, that person should be avoided.
- Do exchange any documents, pens, attendance sheet for signing during consultant. The consultant should enter all the consultation findings and attendance sheet on his/ her own behalf.
- Any document submitted during consultation should be left in one box with all the entries made by the document holder and signed by his/her own pens.
- The social consultant should carry face mask, hand sanitizer, hand gloves, face shield, body cover, etc.
- There should be no exchange or free distribution of face mask during consultation.
- Avoid those people who are not adopting social distancing measures or are not wearing face mask and are not adopting precautionary measures.
- Take photographs of consultation adopting social distancing measures and regular use of hand sanitizer after each consultation.
- Avoid those area, where number of COVID-19 patients are reported in large number by the state authority. The consultation can be repeated after situation improves.

### **Health and Safety Guideline for Workers under COVID -19 Pandemic situation.**

- The labour will have to have COVID -19 induction when he join the work site.
- The EHS officer during the tool box talk should educate the labors about the COVID -19 pandemic, usage of Mask is mandatory, frequent hand washing and provision of hand sanitizer at all the project site
- The labors coming from home time should be kept under quarantine as per the State quarantine regulations.
- At each project site there should have register maintained for recording of labors temperature at entry gate. At the active construction site all the workers should wear mask. The contractor should provide mask free of cost to all the labors.
- At the labors camps poster in local language should be paster at notice board.



- The social distance measures i.e number of labors in each room, kitchen strength, bathroom facilities and water point should be multiples.
- Each labors camp should have isolation room available to quarantine the labors in case COVID -19 is reported.
- There should be COVID-19 antigen test conducted for each labors travelling from outstations.
- There should be noticed board having number of Police Station, COVID treatment center, Hospitals, doctor on panel with the contractor in case of COVID-19 inspection.

The EHS office at project site should keep the track records of workers health, traveling scheduled and health complaint or complaint received from other workers on colleague's health.

### 5.5.12 Labour and Construction Camp

Construction workers expected to be about 250 per day per package are likely to be employed during construction. Most of the workers will be employed locally. However, some may be from nearby areas. This will cause an additional burden on local resources. However, this impact will be temporary and will not have the potential for changes in the demographic scenarios of the area. The outside workers will be housed at the construction camp, which is expected to one per package. Poor sitting and improper management of construction camps 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 the transmission of communicable diseases among the workers and the host communities. This includes the possible spread of sexually transmitted diseases, diseases from improper handling and supply of foodstuffs, poor water supply, and insect-borne diseases.

**Mitigation Measures:** Construction camp shall be sited at such locations to utilize the existing infrastructure. No productive land should be utilized for a construction camp. All sites must be graded, ditched, and rendered free from depressions to avoid water stagnation. Accommodation and ancillary facilities including a recreational facility for workers shall be erected and maintained to standards and scales approved by the resident engineer. All camps should maintain a minimum distance of 1000 m from habitation and water bodies.

All construction camps shall be provided sanitary latrines and urinals with the provision of septic tanks attached with soak pits or mobile toilets fitted with the anaerobic digestion system. Stormwater drains shall be provided for the flow of used water outside the camp. Drains and ditches shall be treated with bleaching powder regularly. Garbage bins must be provided in the camp and regularly emptied and disposed of hygienically. LPG cylinders shall be provided as a fuel source for cooking to avoid any tree cutting.

The Contractor will ensure the following:



- 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 between and among the workers and community, promote early diagnosis, and assist affected individuals.
- Activities under the program include monthly information, education, and consultation communication campaigns to workers, drivers, delivery crew, and communities on the risk, dangers, and impacts of STD and HIV/AIDS.
- The contractor will also provide first aid facilities at the camp and organize regular health check-up camps as well.
- The availability of safe drinking water and sufficient supply of suitable and hygienically prepared food at a reasonable price is available to the workers.
- Adoption of all precautions to protect the workers from insects and pests to reduce the risk to health. This includes the use of insecticides, which should comply with local regulations.
- Prohibition on supply or availability of alcoholic liquor or prohibited drugs at the camp.
- Regular health check-ups and immunization camps shall also be organized for the workers and nearby populations.
- Construction Workers shall be encouraged to clean/sanitize their hands frequently. Necessary arrangements for it like hand basins shall be made. They shall be encouraged to maintain social distancing at work sites and camp.
- Concrete flooring with slope drains and oil interceptors should be proposed for hot mix plant area and workshop, vehicle washing and fuel handling area as per ESMP, so that oil and lubricants that may spill on the floor does not contaminate any soil or water body. In case of any oil spills, it should be cleaned properly. There shall also be provisions for storage of used oil until it is disposed as per comprehensive waste management plan prepared by Contractor and approved by CSE.
- The temperature of the workers should be checked every morning using an Infrared Thermometer before the start of construction activities.
- Workers showing symptoms of Covid-19 shall be provided with appropriate medical assistance.
- Workers joining the construction site/labour camp after traveling from outstation shall be tested for Covid-19 before allowing them at site/labour camp.
- Workers should be encouraged to use hand gloves and face masks.
- Labour camps and construction sites shall be sanitized at regular intervals.

### 5.5.13 Safety

The road construction activities may create various unsafe situations. This will require attention to the following safety aspects viz.

- Safety of construction workers,
- Safety of road users including pedestrians and cyclists
- Safety to cattle;
- Safety of the local community



- Unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during the design and construction stage and
- Conduct safety audits.

**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 machinery, (iii) handling of chemicals and hazardous materials, and inflammable substances (iv) welding and (v) electrical works. The contractor shall also arrange required PPEs for workers, first aid, and firefighting equipment at construction sites. The contractor will also prepare an emergency preparedness plan, which shall be duly approved by EA to respond to any emergency and unsafe conditions. To avoid disruption of the existing traffic due to construction activities, a comprehensive traffic management plan shall be drawn up by the contractor.

Retro-Reflector zed traffic caution signs shall be used during construction. Regular safety audit or periodic reviews shall be made to assess the effectiveness of safety measures adopted during construction.

Adequate caution signage near the school, sensitive locations, speed control, caution notes shall be fixed at appropriate locations. These shall be preferable with Retro-reflective paints. Steel base signage shall be avoided to prevent theft of the same. Crash barriers shall also be installed at appropriate locations particularly near the school to provide safety to school children. The provision of speed breakers or rumble strips shall be made near schools, health centers etc.

#### 5.5.14 Community Health and Safety

Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures. Poor safety signage and lack of barriers at work site and trenches will create hazard to pedestrians and children.

**Mitigation measures:**

- Provide safety barriers near any trenches, and cover trenches with planks during non-work hours.
- Contractor's activities and movement of staff will be restricted to designated construction areas.
- Consult with local PWRD authority on the designated areas for stockpiling of soils, gravel, and other construction materials.
- If the contractor chooses to locate the work camp/ storage area on private land, he must get prior permissions.
- Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.
- A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii)



construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do.

- Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environmental and social specialist attention immediately; and (iv) taking remedial action as per environmental and social specialist instruction.
- The contractor shall immediately take the necessary remedial action on any complaint/ grievance received by him and forward the details of the grievance along with the action taken to the environmental specialist within 48 hours of receipt of such complaint/ grievance.

#### 5.5.15 Chance Find Procedures

There is risk that any work involving ground disturbance can uncover and damage archaeological and historical remains. Although no such sites have been identified. For this project, excavation will occur in and around the existing RoW and specified government land so no risk is foreseen to these structures. Nevertheless, the PMU and PMC will:

- Consult Archaeological Survey of India and/or State Department of Archaeology to obtain an expert assessment of the archaeological potential of the site.
- Consider alternatives if the site is found to be of medium or high risk.
- Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available.
- Develop a protocol for use by the Contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.
- If fossils, coins, articles of value or antiquity, structures, and their remains of geologic or archaeological interest are found, local government shall be immediately informed of such discovery and excavation shall be stopped until identification of cultural relics by the authorized institution and clearance is given for proceeding with work. All the above discovered on site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation.
- The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing.
- He shall, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, waiting which all work shall be stopped.



- The Engineer shall seek direction from the Archaeological Society of India (ASI) before instructing the Contractor to recommence work on the site.

## 5.6 Environmental Impacts – Operation Phase

The subproject road passes through open agricultural land in most of the sections, which will provide adequate dispersion of gaseous emission from vehicles. Further, the proposed plantation will ameliorate/enhance the microclimate. No adverse climatic changes/impacts are anticipated during the operation stage other than GHG (CO<sub>2</sub>) emission due to increased traffic, which would be largely offset with better fuel efficiency and reduced vehicle idling due to improved road conditions.

### 5.6.1 Air Quality

The impacts in the operation stage for air would be less severe as compared to that in construction phase. After completion of road improvement works, smoothed new pavement and widened roads reduce fugitive dust emissions. This reduced vehicular emission is due to uniform speed and less frequent acceleration and deceleration of vehicles. With reduction in the levels of CO<sub>2</sub>, NO<sub>x</sub>, CO and HC emissions from the operating vehicles, there will be extensive saving on fuel consumption. Air pollution can be an important concern due to increase in number of vehicles on the improved roads and poor maintenance of vehicles. To assess the likely concentrations at the critical location along the project road corridors, the prediction of the pollutant concentrations has been carried out for project using CALINE-4, a dispersion model based on Gaussian Equation. The current and projected traffic volume of A30\_2 Deesang Kinar Bangali to Kathalguri road has been used for the prediction. CALINE-4 is a dispersion model developed by the California Department of Transportation for the prediction of concentrations of critical atmospheric pollutants (CO, NO<sub>x</sub> and PM<sub>2.5</sub>) along the highways. This model employs a mixing zone concept to characterize pollutant dispersion over the highway and can be used to predict the pollutant concentrations for receptors up to 500 m of the corridor. The model uses the baseline data on existing concentration of pollutants and estimates the incremental emissions due to the project.

#### Input Parameters:

- **Traffic Data:** The fleet wise traffic volumes for the present study has been taken from the detailed project report of the project. The annual average daily traffic (AADT) data is available for the proposed road through traffic survey. CALINE 4 model needs hour average traffic volume. The total traffic hour volume is further categorized into two-wheeler, four-wheeler, light commercial vehicles (LCV), bus, high commercial vehicles (HCVs) based on traffic survey at existing road.

**Table 57: Predicted Traffic Volume Per Hour**

Year	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck	PCU
2020	115	1	69	3	2	4	274
2025	154	1	93	4	3	7	366



Year	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck	PCU
2030	205	1	124	6	4	9	490
2035	275	2	166	8	5	11	656
2040	368	2	223	10	7	14	878

- **Meteorological data:** The study was conducted to predict pollutant concentration for worst-case meteorological conditions. The meteorological parameters such as wind speed, wind direction, wind direction standard deviation, temperature, mixing height and stability condition are used in model.

**Table 58: Meteorological Data for CALINE 4**

Sr. No.	Baseline Condition Input Data	Values
1	Altitude above Sea Level	128.7m
2	Wind speed	2.22 m/s
3	Wind direction	North-East
4	Ambient Temperature	25°C

- **Road Geometry:** In the CALINE-4 model the entire length of the selected road section is divided into various road links. The division of sections into links has been done in such a way, so that the link can be fairly considered straight stretch of road having homogenous geometry with uniform road width, height and alignment. The coordinates of end points of links specify the location of the links in the model. The maximum number of links in each road section can be 20. The mixing zone width calculated for selected highway corridor is  $7m + 3m + 3m = 13m$  as per guideline provided in CALINE4 model.
- **Emission Factors:** Emission factor is one of the important input parameters in CALINE-4 model. In the present study, the emission factors specified by the Automotive Research Association of India (ARAI) have been used for calculation of weighted emission factors. These emission factors have been expressed in terms of type of vehicles and type of fuel used (for petrol and diesel driven passenger cars). Since, there is only one input requirement for total no. of vehicles in the CALINE 4 model, whereas there are different categories of vehicles (viz. two wheelers, cars, bus and trucks) with different year of manufacture and fuel used, it is essential that a single value representing the equivalent or weighted emission factors for all the vehicles is input into the model. The emission factor used to estimate WEF are given below. The traffic data are not available for fuel types, therefore average emission factor is used in this study.

**Table 59: Emission factors for different types of Vehicle (ARAI, 2007)**

Pollutants	Unit	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck
CO	g/km	1.036	1.25	1.281	1.56	8.03	6
NOx	g/km	0.312	0.219	0.04	0.288	0.548	1.24
PM2.5	g/km	0.021	0.01	0.031	0.061	0.133	0.133

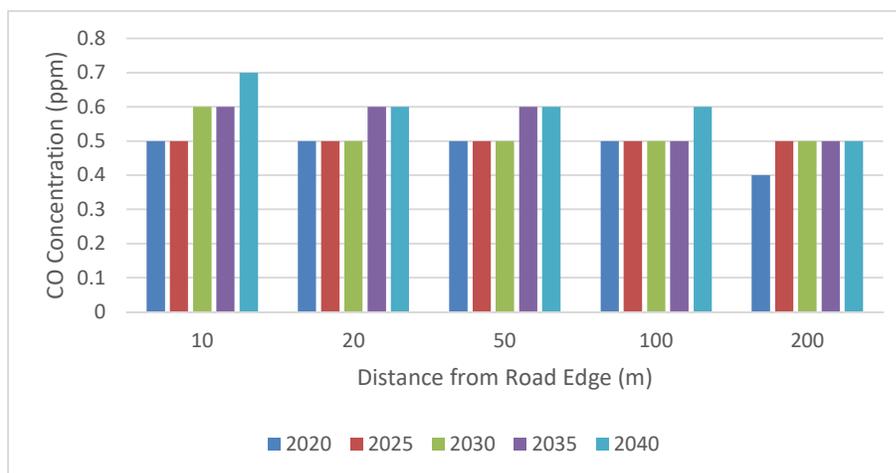


These projected vehicles would generate various air pollutants among which CO, NO<sub>2</sub> and Particulate matter (PM<sub>2.5</sub>) would be modelled to predict their quantities for the year 2020, 2025, 2030, 2035 and 2040. PM<sub>10</sub> and SO<sub>2</sub> concentration need not be modeled as sulfur content in the fuel used in vehicles is quite less to cause a significant SO<sub>2</sub> emission. SO<sub>2</sub> emission factor for vehicles is not included in the report on “Emission Factor Development for Indian Vehicles” by The Automotive Research Association of India (ARAI). Similarly, Particulate Matter in the emission factor considers only PM<sub>2.5</sub> as a coarse fraction PM<sub>2.5</sub> to PM<sub>10</sub> is negligible in vehicle exhaust.

The predicted results of CALINE4 has been tabulated below. Considering the predicted future traffic according to the normal growth rate for the years 2020, 2025, 2030, 2035, and 2040, CO, NO<sub>2</sub>, and PM<sub>2.5</sub> levels are predicted. These levels were within the limiting standards as specified in National Ambient Air Quality Standards.

**Table 60: Predicted Concentrations of CO in the study location (ppm)**

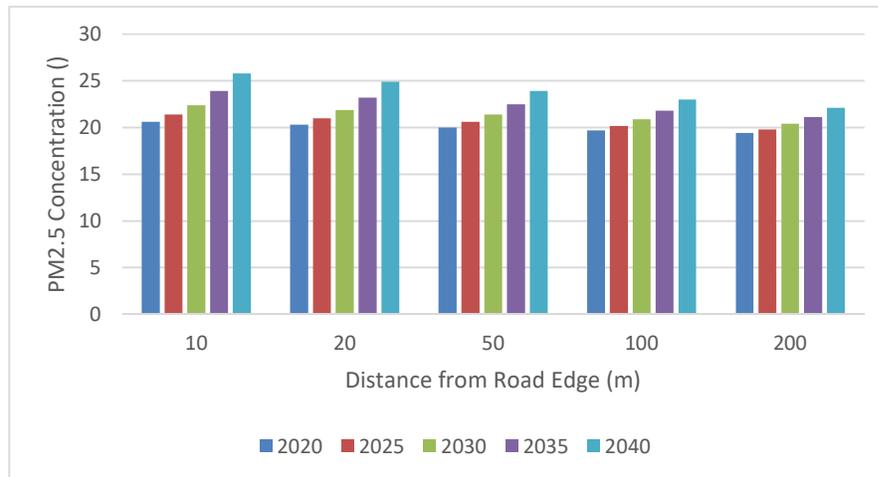
Year	Distance from Road Edge (m)				
	10	20	50	100	200
2020	0.5	0.5	0.5	0.5	0.4
2025	0.5	0.5	0.5	0.5	0.5
2030	0.6	0.5	0.5	0.5	0.5
2035	0.6	0.6	0.6	0.5	0.5
2040	0.7	0.6	0.6	0.6	0.5



**Figure 47: Graph representing Predicted Concentrations of CO in the study location (ppm)**

**Table 61: Predicted Concentrations of PM<sub>2.5</sub> in the study location (µg/m<sup>3</sup>)**

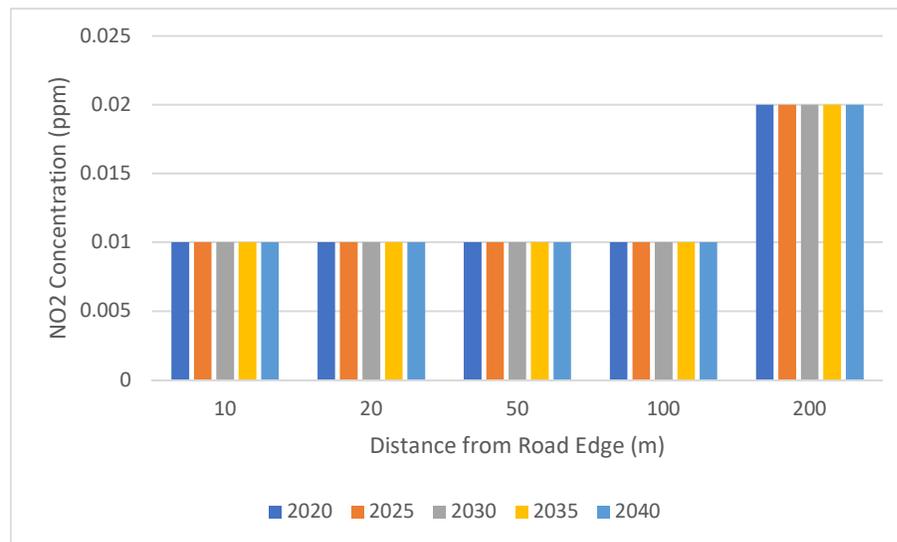
Year	Distance from Road Edge (m)				
	10	20	50	100	200
2020	20.6	20.3	20	19.7	19.4
2025	21.4	21	20.6	20.2	19.8
2030	22.4	21.9	21.4	20.9	20.4
2035	23.9	23.2	22.5	21.8	21.1
2040	25.8	24.9	23.9	23	22.1



**Figure 48: Graph representing Predicted Concentrations of PM<sub>2.5</sub> in the study location (µg/m<sup>3</sup>)**

**Table 62: Predicted Concentrations of NO<sub>2</sub> in the study location (ppm)**

Year	Distance from Road Edge (m)				
	10	20	50	100	200
<b>2020</b>	0.01	0.01	0.01	0.01	0.02
<b>2025</b>	0.01	0.01	0.01	0.01	0.02
<b>2030</b>	0.01	0.01	0.01	0.01	0.02
<b>2035</b>	0.01	0.01	0.01	0.01	0.02
<b>2040</b>	0.01	0.01	0.01	0.01	0.02



**Figure 49: Graph representing Concentrations of NO<sub>2</sub> in the study location (ppm)**

**Mitigation measures:**

During the operation stage, vehicular emissions of pollutants (PM<sub>10</sub>, PM<sub>2.5</sub>, CO, SO<sub>2</sub>, NO<sub>x</sub>) shall be monitored at approved locations against National Standards. Regular monitoring is done to ensure that the air quality along the project area is within permissible limits.



Avenue and median plantation along the roadsides and medians should be done to control dust and fugitive emissions from reaching receptors. Compensatory plantation could be taken up in the available space within ROW in consultation with the local forest department. Tree plantation for attenuating pollution levels shall include pollution tolerant species with thick foliage.

### 5.6.2 Noise

During operation noise generating sources will be traffic noise and road-side commercial activities at some places. Noise generated due to traffic on this road will have impact on the nearby villages. Cumulative noise levels of these traffic sources were computed using Federal Highway Administration (FHWA's) Traffic Noise Model (TNM). TNM computes incremental highway traffic noise at nearby receivers. As sources of noise, it includes noise emission levels for the following vehicle types:

- Automobiles: all vehicles with two axles and four tyres primarily designed to carry nine or fewer people (passenger camp, vans) or cargo (vans, light trucks), generally with gross vehicle weight less than 4500 kg.
- Medium trucks: all cargo vehicles with two axles and six tires – generally with gross vehicle weight between 4500 kg and 12000 kg.
- Heavy trucks: All cargo vehicles with three or more axles, generally with gross vehicle weight more than 12000 kg.
- Buses: all vehicles designed to carry more than nine passengers
- Motorcycles: all vehicles with two or three tires and an open-air driver/passenger compartment.

The procedure for prediction of noise levels involved the following steps:

- Identification of various receivers,
- Determination of land uses and activities which may be affected by the noise generated
- Assemble input parameters
- Application of the model

#### Input Parameters

Traffic volume for the projected period is obtained from the traffic projections. The total number of vehicles passing per hour by type- light, medium and heavy along with their average speed is used for predictions. The average speeds for vehicles in our project road around build-up area are considered as 30 kmph for this model.

#### Average Noise Level

All vehicles produce some noise, which is taken as the base and the cumulative noise at the receiver distance due to the whole traffic is estimated. The average noise levels vary depending on the type of vehicle. In order to assess the impact of noise due to the change in traffic density and speed, a small road section of each project road has been selected to develop noise projections for future years 2020, 2025, 2030, 2035, and 2040. In order to assess the impact of traffic on sensitive receptors along the road, receptor locations were



set at 50 m, 100 m, 200 m, 300 m, 400 m, 500 m, 600 m, 700 m and 800 m from the center line of the road.

The outputs of the assessment are presented in table below. The **Table 63** shows the noise levels that will be generated by traffic at the respective distance from the centerline of the road. The predicted noise levels are those predicted around built-up area considering vehicle speed as 30 kmph. The permissible noise levels in residential area according to Ambient Noise Standards are 55 dB in daytime and 45 dB at nighttime. It can be seen that even without mitigation measures, noise levels in built up area are within the permissible levels except, 50m and 100m from road during night time. The sensitive receptors located within 50m and 100m distance of the road are not operational at night time, hence increased noise will not cause any adverse impact.

**Table 63: Anticipated Noise Levels due to projected traffic**

Sr. No.	Distance from Centerline (m)	2020		2025		2030		2035		2040	
		Day time	Night time								
1	50	46.6	47.5	47.6	49.2	49.5	50.4	50.6	51.5	51.7	52.7
2	100	41.6	42.6	42.5	44.4	44.5	45.6	45.6	46.7	46.7	47.8
3	200	36.8	37.9	37.7	39.7	39.8	40.9	40.9	42	42	43.1
4	300	34.2	35.2	35.2	36.9	37.1	38.1	38.2	39.2	39.4	40.4
5	400	32.5	33.4	33.4	35.1	35.4	36.4	36.5	37.4	37.6	38.6
6	500	31.3	32.1	32.2	33.9	34.1	35.1	35.3	36.2	36.4	37.4
7	600	30.3	31.2	31.3	32.9	33.2	34.1	34.3	35.2	35.4	36.4
8	700	29.6	30.4	30.5	32.2	32.4	33.4	33.5	34.5	34.7	35.6
9	800	28.8	29.7	29.8	31.5	31.7	32.7	32.8	33.8	34	34.9

It is evident from the above table that minor increase in noise levels are anticipated due to increase in traffic intensity over the years. However, with mitigation measures like limiting the speed of vehicles around built up area, the noise levels will be maintained below the permissible limits. Most of the road alignment passes through agricultural fields and small proportion is passing through residential areas. The number of sensitive receptors within 50m and 100m distance of the road is very few. Hence, overall noise impacts on sensitive receptors will be insignificant.

**Mitigation Measures**

One or more rows of avenue vegetation are planted along the road to reduce the noise due to moving vehicles. Traffic management like speed restrictions and prohibition of horns shall be implemented near sensitive receptors. Regular monitoring programs should be undertaken to check any increase in noise levels due to traffic congestion.

**5.6.3 Land and Soil**

Better access can lead to the conversion of agriculture land for residential and commercial purposes close to roads and especially in a rural and urban area.



**Mitigation Measures:** The EA may explore the feasibility of restricting about 30 m area either side of the road as no development zone on the line restriction is imposed for National Highways Authority of India.

#### 5.6.4 Soil Erosion

No impact on soil is anticipated during the operation phase of the project except bridge approaches where unexpected rainfall may erode the embankment formation and deterioration of borrow areas if not rehabilitated properly.

**Mitigation measures:** Embankment stabilization shall be checked periodically during the operation stage and suitable stabilization measures shall be taken wherever any erosion is identified. Borrow areas will also be rehabilitated following the guidelines given in Annexure 6.

#### 5.6.5 Ground Water

No impact is anticipated on groundwater due to the project during the operation phase of the project hence, no specific mitigation measure is proposed.

#### 5.6.6 Surface Water Bodies

No major or long-term impact is anticipated during the operation phase on the surface water bodies due to the project implementation activities. Oil contaminated runoff from the road during monsoon will have minimal impacts considering their low concentration.

#### 5.6.7 Hydrology and Drainage

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.

#### 5.6.8 Impact on Biological Environment

##### Terrestrial ecology

Positive impacts on terrestrial ecology are expected during the project operation stage due to the increase in vegetation and landscaping along the road. The project will coordinate with the local communities to maintain and enhance the trees planted along the state road. "No adverse impact is anticipated during operation stage except accidental damages or absence of proper tree management.

**Mitigation Measures:** Arrangement shall be made to ensure the survivability of the tree plantation. The tree survivability audit shall also be conducted at least once in a year to assess the effectiveness of the program.

##### Aquatic Ecology

No impact is envisaged during the operation phase of the project and hence no mitigation proposed. However, periodic surveillance shall be conducted to check erosion and siltation in major water bodies.



### 5.6.9 Community Health and Safety

During the operation phase, the increase in the number of motorized road users traveling at higher speeds also increases the chances of injuries and fatalities from road crashes.

**Mitigation Measures:** Adequate caution signage near the school, sensitive locations, speed control, caution notes shall be fixed at appropriate locations. These shall be preferable of PCC with Retro-reflective paints. Steel base signage shall be avoided to prevent theft of the same. Crash barriers shall also be installed at appropriate locations particularly near the school to provide safety to school children. The provision of speed breakers shall be made near schools and religious places.

## 5.7 Cumulative and Induced Environmental Impacts

Cumulative impact is described as: “The combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/ or beneficial impacts that cannot be expected in the case of a stand-alone project.

The cumulative impact is sum of the impact expected by the project discussed in this EIA report and other project which is planned or under implementation in the study area. The cumulative impact is sum off all the environmental components i.e. for e.g. total number of tree felling involve in all projects, land acquisition, total forest area effect etc. need to be addresses. The cumulative impact expected by all the project area is highlighted in **Table 64**.

**Table 64: Cumulative Impact Expected Due to Project Development**

Sr. No.	Features Affected	Name of Project	Cumulative Impact
1	No of tree Felling Involve	A30_1 (Moran to Deesang Kinar Bangali)	2553
2	Government Land Affected	A30_1 (Moran to Deesang Kinar Bangali)	100.22 acres
3	Forest Land Affected	A30_1 (Moran to Deesang Kinar Bangali)	No forest land will be affected due to the proposed project development
4	Increase in emission rate	A30_1 (Moran to Deesang Kinar Bangali)	The CO <sub>2</sub> emission rate will increase by 35,114.06 tons/year
5	Influx of labor	A30_1 (Moran to Deesang Kinar Bangali)	800 labors
6	Structure Affected	A30_1 (Moran to Deesang Kinar Bangali)	1880
7	Incremental load due to NO <sub>2</sub> , SO <sub>2</sub> , PM 2.5 and CO	A30_1 (Moran to Deesang Kinar Bangali)	The widened road, particularly in the present more congested urban sections together with the improved road surface, will reduce congestion. This will have the impact of encouraging a more regular and uniform speed. With the same traffic flows at this increased speed, emission levels and noise levels will be reduced. However, the projected increase in traffic flows may have the impact of increasing the overall vehicle



Sr. No.	Features Affected	Name of Project	Cumulative Impact
			emissions and noise levels.
8	Land Acquisition	A30_1 (Moran to Deesang Kinar Bangali)	176.71 acres
9	Forest Area Affected	A30_1 (Moran to Deesang Kinar Bangali)	No forest area will be affected due to the proposed project development

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. Further the increased industrial activities will significantly reduce migration. 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.

In terms of environment precaution issues the improved road surface is expected to result in less dust and noise due to traffic plying on the damaged roads. However, the increased traffic due to the improved road will generate more air pollution due to vehicle exhaust and noise. The smoother road conditions will also result in increase of traffic speeds, hence creating more risks for accidents amongst traffic users as well as the local communities in the subproject area of Dibrugarh district.

For addressing the impacts of air pollution and noise, regular maintenance of the road surface, maintenance and monitoring of newly planted trees and installation of noise barriers where necessary have been included in the ESMP for implementation during operation stage. For addressing safety related impacts, regular maintenance of the road furniture includes safety related furniture, enforcing rules against encroachment of structures and sensitive structures inside the ROW and implementation of the emergency management system has been included in the ESMP for implementation during operation stage.

## 5.8 Potential Environmental Enhancement/ Protection Measures

### 5.8.1 Traffic Management Plan

A traffic management plan is site-specific and needs to cover the design, implementation, maintenance, and assure temporary traffic management measures while the work or activity is being carried out along the road corridor. It explains how road users - including cyclists and pedestrians - will be directed around a worksite, or other temporary road disruption, to minimize inconvenience while providing safe conditions for both the road user and those carrying out the activity.

Any traffic management plan must contain the specifics of the work being done, such as the specific location, date/times of works, who is doing the work, the work methodology, temporary speed limit information (as needed), contact details, as well as a traffic

management diagram, and it must comply with the Code of Practice for Temporary Traffic Management.

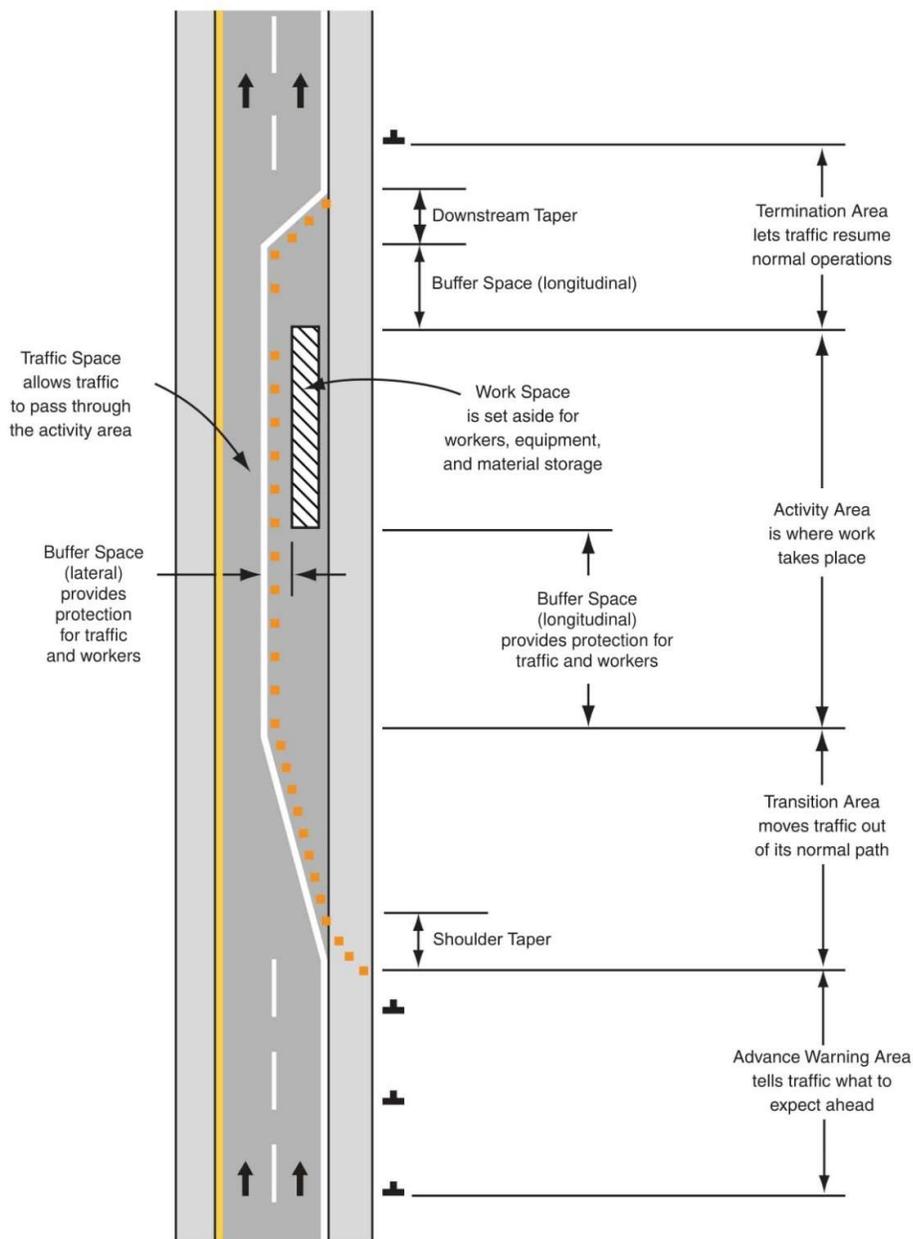
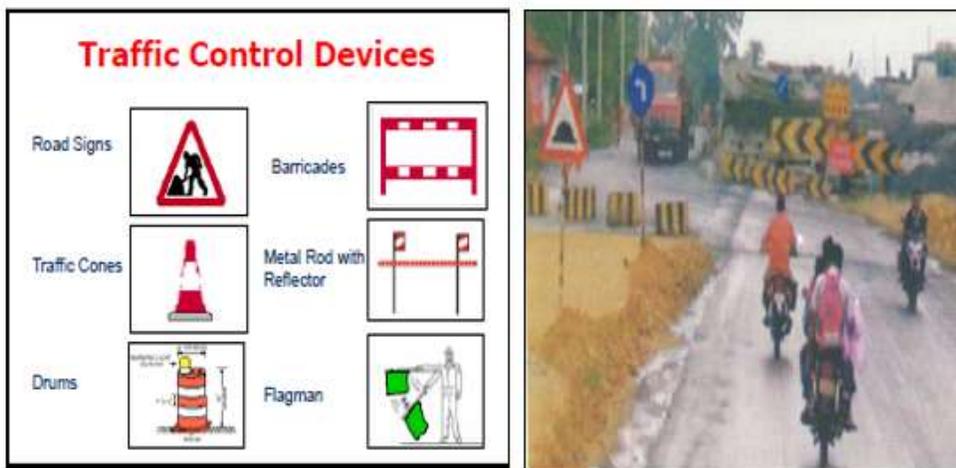


Figure 50: Traffic Management Diagram

### 5.8.2 Road Safety Plans – (During Construction)

A work zone is an area of a highway where road user operating conditions are changed because of construction and maintenance activities. The construction and maintenance activities would involve movement of workers and construction equipment requiring dedicated space for performing the activities and moving materials for the activities. The

presence of regular traffic and works traffic makes the work zone a potential zone of conflict resulting in disruption to normal traffic and hazards. A work zone is typically distinguished by the presence of signs, channelizing devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or high-intensity rotating flashing or oscillating or strobe lights installed on roadside or a vehicle-mounted sign posted to indicate the work zone, and continues to delineate the channelized vehicle paths till up to the end road work sign.



**Figure 51: Traffic Control Devices at traffic diversion locations.**

### **5.8.3 Road Safety Plans – (Post Construction)**

At this stage the observations are given for the checking of Whatever the provision and improvement recommended during Road safety Audit at various stages i.e. Existing audit stage, Preliminary design stage and Detailed design stage and execution of same during construction stage. On the basis of this observations the appropriate recommendations are provided as final improvement proposal at post construction/ pre-opening stage.

### **5.8.4 Health and Safety Plan for COVID19 Pandemic**

#### **5.8.4.1 Introduction**

- This document is intended to supplement formal Health & Safety policies, procedures and plans that the contractor has in place for its employees and staff working on Asom Mala project. Hence, this document is not intended to replace any formalized procedures currently in place for the Contractor. Where this guideline does not meet or exceed the standards put forth by the Contractor, the Contractor shall abide by the most stringent procedure available.
- This approved project-specific Health and Safety Plan (H&SP) shall be modified to require that the COVID-19 Officer<sup>2</sup> (supervised by the contractor’s environmental and health and safety officer) at the Contractor’s worksite (appointed by Contractor and agreed by PIU) submit a written daily report to the Client’s Representative (PIU Head).



The COVID-19 Officer shall certify that the Contractor and all subcontractors are in full compliance with these guidelines.

- The COVID-19 officer (The existing safeguards officer OR health & safety officer OR supervisor of the contractor can be designated as COVID-19 officer) should be present on-site at all times by undergoing the training available at:
  - <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/training/online-training>
  - <https://openwho.org/courses/eprotect-acute-respiratory-infections>,
  - <https://openwho.org/courses/COVID-19-IPC-EN>
- Any issue of non-compliance with these guidelines shall be a basis for the suspension of work. The Contractor will be required to submit a corrective action plan (on the next day or immediately as per the nature of issue) detailing each issue of non-conformance and a plan to rectify the issue(s). The Contractor will not be allowed to resume work until the plan is approved by the Client (PIU). Any additional issues of non-conformance may be subject to action against the Contractor's as health & safety/safeguard clauses of the contract.
- Construction sites operating during the Covid-19 pandemic need to ensure they are protecting their workforce and minimizing the risk of spread of infection.
- This guidance is intended to introduce consistent measures on sites of all sizes in line with the Government's recommendations on social distancing.
- These are exceptional circumstances and the industry must remain abreast of and comply with the latest Government advice on COVID-19 at all times.
- The health and safety requirements of any construction activity must also not be compromised at this time. If an activity cannot be undertaken safely due to a lack of suitably qualified personnel being available or social distancing being implemented, it should not take place.
- It is to be noted that emergency services are also under great pressure and may not be in a position to respond as quickly as usual.
- Sites should remind the workforce at every opportunity of the Worksite Procedures which are aimed at protecting them, their colleagues, their families and the Assam population.

**If a worksite is not consistently implementing the measures as mentioned in the health & safety plan, it may be required to shut down.**

#### 5.8.4.2 Principles of Worker Protection

- Consistently practice social distancing
- Cover coughs and sneezes
- Maintain hand hygiene
- Clean surfaces frequently

#### 5.8.4.3 Maximum Precaution for Persons/Labourers Reporting to Work

- IF SICK, STAY HOME!
- IF SICK, GO HOME!
- IF SOMEONE SICK, SEND THEM HOME!



Contractor to provide face masks (of the type approved by Government for use to protect persons from COVID-19) to all persons working in or visiting the worksite. This along with procedures set out in this document is for maximum precaution to protect all persons/labourers at all times.

#### 5.8.4.4 Covid-19 Typical Symptoms

- Fever
- Cough
- Shortness of Breath
- Sore Throat

All persons at the worksite should have their temperature screened by COVID-19 officer with Infrared Thermometer (handheld non-contact).

#### 5.8.4.5 Self-Attestation by Persons/Labour Prior to Work

Prior to starting a work (on daily basis), each labour/ worker will self-attest to the supervisor:

- No signs of COVID-19 symptoms within the past 24 hours.
- No contact with an individual diagnosed with COVID-19. (contact means living with a positive person, being within 6 ft of positive person OR sharing things of positive person)
- Not undergone quarantine or isolation (in case of any labourer /worker who has been quarantined or isolated previously, the engagement shall be only after obtaining the requisite clearance)

The engagement of workers falling in the high-risk category such as workers over the age of 55 years, with underlying medical conditions or health issues, etc. should be done only after obtaining the requisite clearance from trained and registered medical practitioners.

The self-attestation would be verified in collaboration with trained and registered medical practitioners deployed at site through discussions with laborers /workers and/or preliminary checks such as temperature checks, etc. prior to their engagement at site.

In addition, the Contractor shall mandatorily follow all medical test requirements for the workers prior to their engagement and/or mobilization at site as per the guidelines issued by the Central and State government agencies and WHO from time to time.

**Persons/Labourers showing COVID-19 symptoms or not providing self-attestation shall be directed to leave the work site and report to the fever clinic/ quarantine centre immediately. Labour not to return to the work site until cleared by fever clinic/quarantine centre.**

#### 5.8.4.6 General Direction

- No handshake, Only Namaste
- Non-essential physical work that requires close contact between workers should not be carried out
- Work requiring physical contact should not be carried out
- Plan all other work to minimize contact between workers



- Wash hands often (every 1-2 hrs. or frequently as possible) with soap for at least 20 seconds
- Use hand sanitizer
- No person should enter the work site other than the authorized persons mentioned by supervisor during start of work
- All must implement social distancing by maintaining a minimum distance of 6-feet from others at all times to eliminate the potential of cross contamination.
- Avoid face to face meetings – critical situations requiring in-person discussion must follow social distancing i.e., 6 ft from others.
- Conduct all meetings via conference calls, if possible. Do not convene meetings of more than 10 people. Recommend use of cell phones, texting, web meeting sites and conference calls for project discussion
- All individual work group meetings/ talks should follow social distancing
- At each job briefing/toolbox talk, employees are asked if they are experiencing any symptoms, and are sent home if they are
- Each worksite should have laminated COVID-19 safety guidelines and handwashing instructions
- All restroom/toilet facilities should be cleaned (min twice a day), and handwashing facility must be provided with soap, hand sanitizer and paper towels
- All surfaces should be regularly cleaned, including mobiles, tabletops /surfaces, door handles, laptops, records, etc.
- All common areas and meeting areas are to be regularly cleaned (min twice a day) and disinfected at least twice a day
- All persons to maintain their own water bottle, and should not be shared.
- To avoid external contamination, it is recommended everyone bring food from home
- Please maintain Social Distancing separation during breaks and lunch.
- Cover coughing or sneezing with a tissue, then throw the tissue in the trash and wash hands, if no tissue is available then cough /sneeze into your upper sleeves or elbow. Do not cough or sneeze into your hands.
- Clean your hands after coughing or sneezing thoroughly by using soap and water (minimum for 20 seconds). If soap and water are not available, please use a hand sanitizer. The Contractor shall ensure adequate quantities of sanitizer and soap are made available at all locations including site offices, meeting rooms, corridors, washrooms /toilets, etc. as appropriate.
- Avoid touching eyes, nose, and mouth with your hands
- To avoid sharing germs, please clean up after Yourself. DO NOT make others responsible for moving, unpacking and packing up your personal belongings
- If you or a family member is feeling ill, stay home!
- Work schedules are adjusted to provide time for proper cleaning and disinfecting as required.

#### 5.8.4.7 Work-Site Prevention Practices

- At the start of each shift, confirm with all employees that they are healthy and inform all workers of reusable and disposable PPE.



- Outside person(s) should be strictly prohibited at worksite
- All construction workers will be required to wear cut-resistant gloves or the equivalent.
- Use of eye protection (reusable safety goggles/face shields) is recommended. The supply of eye protection equipment to the workers is considered as a standard part of PPE during construction works.
- In work conditions where required social distancing is impossible to achieve, such employees shall be supplied with standard face mask, gloves, and eye protection.
- All employees shall drive to work site as per the prevailing guidelines of the Government.
- When entering a machine or vehicle which you are not sure you were the last person to enter, make sure that you wipe down the interior and door handles with disinfectant (with 1% sodium hypochlorite solution daily) prior to entry. Adequate quantity of the disinfectant shall be provided by the Contractor at all such site-specific locations.
- Workers should maintain separation of 6' from each other.
- Multi person activities will be limited where feasible (two persons lifting activities)
- Gathering places on the site such as sheds and/or break areas will be eliminated, and instead small break areas will be used with seating limited to ensure social distancing.
- Contact the cleaning person of the worksite and ensure proper COVID-19 sanitation processes. Increase cleaning/disinfection visits to at least 2 times a day. Cleaning person(s) to be provided with gloves, gown and face mask for each cycle of cleaning.
- The Contractor shall make available adequate supply of PPE and chemicals while the threat of COVID-19 continues.
- Clean all high contact surfaces a minimum of twice a day in order to minimize the spread of germs in areas that people touch frequently. This includes but is not limited to desks, laptops and vehicles
- All employees to maintaining good health by getting adequate sleep; eating a balanced, healthy diet, avoid alcohol; and consume plenty of fluids.
- Continuation of works in construction project with workers available on site and no workers to be brought in from outside
- The site offices shall have adequate ventilation. The air conditioning or ventilation systems installed at the site offices would have high-efficiency air filters to reduce the risk of infection. The frequency of air changes may be increased for areas where close personal proximity cannot be fully prevented such as control rooms, elevators, waiting rooms, etc.
- The Contractor shall carry out contactless temperature checks for the workers prior to site entrance, during working hours and after site works to identify persons showing signs of being unwell with the COVID-19 symptoms.

#### 5.8.4.8 Washing Facility

- All worksites should have access to toilet and hand washing facility.
- Providing hand cleaning facilities at entrances and exits. This should be soap and water wherever possible or hand sanitizer if water is not available
- Washing facility with hot water, and soap at fire hydrants or other water sources to be used for frequent handwashing for all onsite employees



- All onsite workers must help to maintain and keep stations clean
- If a worker notices soap or towels are running low or out, immediately notify supervisors. Proactively supervisor should make sure shortage situation never occurs.
- Garbage bins will be placed next to the hand wash facility for discarding of used tissues/towels with regular removal and disposal facility (end of each day)

#### 5.8.4.9 Cleaning Procedures

Increase cleaning/disinfection visits to at least 2 times a day. Cleaning person(s) to be provided with gloves, gown and face mask for each cycle of cleaning.

Each worksite should have enhanced cleaning and disinfection procedures that are posted and shared including sheds, gates, equipment, vehicles, etc. and shall be posted at all entry points to the sites, and throughout the project site. These include common areas and high touch points like

- Taps and washing facilities
- Toilet flush and seats
- Door handles and push plates
- Handrails on staircases and corridors
- Lift and hoist controls
- Machinery and equipment controls
- Food preparation and eating surfaces
- Telephone equipment / mobiles
- Keyboards, photocopiers and other office equipment

Re-usable PPE should be thoroughly cleaned after use and not shared between workers

#### 5.8.4.10 Labour Camp

Contractor shall follow a zero-tolerance policy on wearing of masks.

Masks to be provided to all the persons/labourers for use at the camp site as well as at the worksite. Increase cleaning/disinfection visits to at least 2 times a day. Cleaning person(s) to be provided with disposable gloves, gown and face mask for each cycle of cleaning.

##### Toilet Facility

- Restrict the number of people using toilet facility at any one time e.g. appoint one welfare attendant among the labours.
- Wash hands before and after using the facilities
- Enhance the cleaning regimes for toilet facilities particularly door handles, locks and the toilet flush
- Portable toilets should be avoided wherever possible, but where in use these should be cleaned and emptied more frequently
- Provide suitable and sufficient rubbish bins for hand towels with regular removal and disposal.

##### Eating/snacks Arrangements

- With eateries having been closed (restricted) across Assam, providing permanent (till society is safe from COVID-19) on-camp/ off-camp cook/ helpers can be implemented. Make sure that the "Guidelines for food handling, preparation and distribution during COVID-19" and its regular updates are being followed.



- Whilst there is a requirement for construction camps to provide a means of heating food and making hot water, these are exceptional circumstances and where it is not possible to introduce a means of keeping equipment clean between use, etc. must be removed from use.
- Contractor to arrange all daily need items and grocery at site itself and no worker is allowed to go to shops for daily need items.
- Dedicated eating areas should be identified on camp to reduce food waste and contamination
- Break times should be staggered to reduce congestion and contact at all times
- Hand cleaning facilities or hand sanitizer should be available at the entrance of any room where people eat and should be used by workers when entering and leaving the area
- Workers should sit “6 feet” apart from each other whilst eating and avoid all contact
- Where catering is provided on camp, it should provide pre-prepared and wrapped food only
- Payments should be taken by contactless options wherever possible
- Crockery, eating utensils, cups etc. should be avoided wherever possible
- Drinking water should be provided with enhanced cleaning measures of the tap mechanism introduced
- Tables should be cleaned between each use
- All rubbish should be put straight in the bin and not left for someone else to clear up; only covered pedal operated bins should be used and the bins should be cleared and cleaned regularly, with strict adherence to safety protocols for disposal and hygiene maintenance (including proper PPE’s such as gloves, mask and apron worn by the waste handler/cleaner and disposal at a designated place);
- All areas used for eating must be thoroughly cleaned at the end of each break and shift, including chairs, door handles, etc.

#### **Changing Facilities, Showers and Drying Areas**

- Introduce staggered start and finish times to reduce congestion and contact at all times
- Introduce enhanced cleaning of all facilities throughout the day and at the end of each day
- Consider increasing the number or size of facilities available on camp if possible
- Based on the size of each facility, determine how many people can use it at any one time to maintain a distance of two meters
- Provide suitable and sufficient garbage bins in these areas with regular removal and disposal.
- Visitor log should be strictly maintained that the labour camp.

**COVID-19 officer will ensure compliance with prevention issues at the labour camp(s).**

#### **5.8.4.11 Updates on Covid-19**

The Contractor shall be in touch with the Department of Health & Family Welfare and Labour Department to identify any potential worksite exposures relating to COVID-19, including:

- Strictly follow the guidelines issues by Ministry of health and OSHA



- Other workers, vendors, inspectors, or visitors to the worksite with close contact to the individual
- Labour Camps / Work areas such as designated workstations or rooms/sheds
- Work tools and equipment
- Common areas such as break rooms, tables and sanitary facilities

Also refer the following websites from time to time for regular updates.

<https://www.mohfw.gov.in/>

<https://covid19.assam.gov.in/>

#### 5.8.4.12 Training

- PIU to ensure all workers get training on above requirements before start of any construction activity
- During construction period frequent visual and verbal reminders to workers can improve compliance with hand hygiene practices and thus reduce rates of infection. Handwashing posters should also be displayed at work site and labour camps

#### 5.8.4.13 EMERGENCY CONTACT

- Provide emergency contact number(s) at work site and labour camp for reporting COVID-19 symptoms

**Ensure all staff and personal use the Aarogya Setu app, recommended by GOI for tracking COVID-19 patients.**



## 6. Climate Change Impacts and Risks

A rapid increase in the number of motor vehicles on road in Assam has been observed over the past decade. Due to the lack of adequate public transport systems where buses comprise only 1% of the total population of vehicles on road, and due to the availability of easy loans, most of the people are aspiring to buy their vehicles. As a result, two-wheelers are 57% of the total vehicle mix in the State, and cars follow suit with a 21% share in 2013-14. The road transport sector is a direct consumer of fossil fuel, emits GHG into the atmosphere. With an increase in population and per capita rise in the number of personal vehicles, GHG emissions are likely to rise. The use of the public transport system needs to control future emissions in the future and to ease off the pressure of vehicles on the roads, hence. This would require policy changes in the way lending is done by banks, enabling fuel mix with biofuels, and behavioral changes of the population whereby they use more and more non- motorized transport at short distances and public transport for long distances. The Guwahati city is already in the process of developing the Bus Rapid Transit system, but further development of the public transport system is required. Other major cities also need to embrace the same for an orderly functioning road transportation system in the cities of Assam.

### 6.1 Climate Change Mitigation

The Transport Emissions Evaluation Model for Projects (TEEMP) developed by Clean Air Asia was utilized to assess the CO<sub>2</sub> gross emissions with and without the project improvements. The main improvement from the project that was considered for the model are better surface roughness with initially 6 m/km which may deteriorate over a period but not less than 2 m/km and widening of roads from the single/intermediate lane (3.5/5.5 m) to two lanes with paved shoulder (7 m). These were translated into impacts on traffic speed and hence fuel consumption. The model also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes, and volume/capacity saturation limit.

Information that was fed into the model for projecting the CO<sub>2</sub> emissions were:

- The project will rehabilitate and widen approximately 23.958 km of the Major District Road in the State of Assam.
- The road configuration will change from a single lane to two lanes with a carriageway width of 7-14 m with 1.5 m shoulder on both sides.
- The surface road roughness is mostly 6 m/km and will be improved to 2.0 m/km, which may further reach up to 3.5 m/km during 5 years of road operations. Resurfacing of the road would be required after 5 years.
- Construction will take place over 30 months in 2021/2022 and road operation will begin in 2023/2024.
- The design life of the road is 20 years.



- Other improvements include the repair or reconstruction and improvement of culverts, longitudinal and cross drains, and removal of irregularities on the existing vertical profile and road safety appurtenances.

**Table 65: Vehicle Composition on subproject road**

Vehicle Type	Traffic Composition (%)
Two Wheelers	51.09
3 Wheelers	0.34
Car/ Vans/ Jeeps	31.77
Mini Buses	0.33
Standard Buses	0.56
Tempo	5.49
LCV's (Goods)	1.12
2-Axle Trucks	1.26
3-Axle Trucks	0.17
Multi-Axle Trucks	0.15
Tractors with Trailer	0.02
Tractors Without Trailer	0.02
Cycle	7.56
Cycle Rickshaw	0.02
Animal Drawn	0.00
Others	0.07

Source: Traffic Study

Traffic forecasts were taken from the detailed project reports prepared for the road section. The volume/capacity saturation limit was taken at 0.85 for optimum travel speed and fuel consumption. Emission factors were taken from the CPCB/MOEF&CC (2007) Draft Report on Emission Factor Development for Indian Vehicles, the Automotive Research Association of India, and C. Reynolds et.al (2011) Climate and Health Relevant Emissions from in-Use Indian for three-wheelers rickshaw as shown in **Table 66**.

**Table 66: CO<sub>2</sub> Emission Factors**

Vehicle Type	Gasoline	Diesel
2-Wheeler	2.28	-
3-Wheeler	2.63	-
Car/Jeeps	2.59	-
LCV	-	3.21
Bus	-	3.61
HCV	-	3.5

It is seen that cycles and animal-drawn carts have an average trip distance of 10 km of the total road length in each section, whereas all other vehicles do use the entire length as average trip distance.

**Estimated carbon emissions:** The proposed road upgrading resulting in lower surface roughness and road capacity improvements have implications in CO<sub>2</sub> emissions. Improved roughness results in higher speed and lesser emissions while increase road users result in



increased emissions from vehicles. These factors are also affected by traffic congestion i.e. the volume/capacity saturation limit.

**Table 67: Emission Standards of Fleet (%)**

Vehicle Type	Current Scenario				Year 2051		
	Pre-Euro	Euro I	Euro II	Euro III	Euro I	Euro II	Euro III
2-Wheel	-	50%	50%	-	30%	70%	-
3-Wheel	80%	20%	-	-	40%	60%	-
Cars/ Jeeps	-	40%	40%	20%	-	40%	60%
LCV/Bus/HCV	-	70%	20%	10%	10%	40%	50%

Emissions from road construction were estimated by using the emission factor for rural/urban roads, by using ADB - Carbon footprint report, which is equivalent to 48,400 kg CO<sub>2</sub>/km of road construction

Source: <http://www.adb.org/documents/reports/estimating-carbon-footprints-road-projects/default.asp>

**Estimated Carbon Emissions**

The proposed road upgrading resulting in surface roughness and road capacity improvements have implications in CO<sub>2</sub> emissions. Improved roughness results in higher speed and lesser emissions while increase road users increase emissions. These factors are further affected by traffic congestion once the volume/capacity saturation limit.

CO<sub>2</sub> emissions will also result from the processing and manufacturing of raw materials needed to upgrade the project road and in the case of a project, to upgrade and strengthen the road length of 23.958 km, total CO<sub>2</sub> emissions will be of the order of 1159.57 tons.

**Table 68: Estimated Total CO<sub>2</sub> Emissions during Road Construction**

Road	Length (km)	Emission Factor (ton CO <sub>2</sub> /km)	CO <sub>2</sub> Emission (tons)
A30_2	23.958	48.4	1159.57

The design life of roads is 20 years. Total CO<sub>2</sub> emission at the Business-As-Usual scenario was estimated at 6208.96 tons/year, with and without induced traffic is 12329.51 tons/year and 10632.08 tons/year respectively. These values are below the 100,000 tons per year threshold. Therefore, it is not necessary to implement options to reduce or offset CO<sub>2</sub> emissions under the project.

**Table 69: CO<sub>2</sub> emissions prediction using TEEMP**

Scenario	Length (km)	Emissions (tons CO <sub>2</sub> /km/year)	CO <sub>2</sub> Emissions (tons/year)
Business as usual	23.958	259.16	6208.96
Project + Induced	23.958	514.63	12329.51
Project - Induced	23.958	443.78	10632.08



Table 70: Project CO<sub>2</sub> Emissions Intensity Indicators

Particulars	Business-As-Usual	Project (without Induced Traffic)	Project (with Induced Traffic)
tons/km	7,774.73	13,313.52	15,438.76
tons/year	6,208.90	10,632.18	12,329.39
tons/km/year	259.16	443.78	514.63
g/pkm	106.31	73.26	73.47
g/tkm	1,122.02	1,019.51	886.23

The with-project scenarios will be having higher CO<sub>2</sub> emissions. Furthermore, with project scenarios (both without and with induced traffic), there will be an increase in the CO<sub>2</sub> emission levels over the time due to the increase in the traffic volume, however, the emissions will be controlled by maintaining the road roughness below 3.0 m/km during the entire project life as well as the enhanced capacity of the road. This will result in annual CO<sub>2</sub> emissions of the project road much below the threshold limit of 100,000 tons/year.

#### Climate Change Impacts & Risks

As per the Assam State Action Plan on Climate Change, in today's world, climate change is considered the most serious global challenge. Changes in the atmosphere have been detected that could drastically alter the climate system and the balance of ecosystems. Atmospheric changes are linked to an increase in greenhouse gases (GHGs), chiefly on account of anthropogenic releases attributed to fossil fuel consumption, land-use changes, deforestation, etc. Research has established that carbon dioxide (CO<sub>2</sub>) levels in the atmosphere have risen by 35% since the pre-industrial era. Rising CO<sub>2</sub> concentrations increase the energy retention of Earth's atmosphere, leading to a gradual rise in average temperatures and global warming. Sector-specific climate risk screening has been done based on secondary sources to analyze the impact on road components due to likely change in climatic variables, mainly temperature and precipitation.

*Source: Assam State Action Plan on Climate Change (2015-2020)*

**Temperature & Precipitation:** With the "Tropical Monsoon Rainforest Climate", Assam is temperate (summer max. at 35–39°C and winter min. at 5–8°C) and experiences heavy rainfall and high humidity. The climate is characterized by heavy monsoon downpours, which reduce summer temperatures, enable the formation of foggy nights and mornings in winters. Spring (Mar-Apr) and autumn (Sept-Oct) are usually pleasant with moderate rainfall and temperature. For ascertaining long term climate trends, State level climate data for the period 1951 to 2010 has been analyzed by the India Meteorological Department. This analysis is based on 282 stations for temperature and 1451 stations for rainfall across the country. In Assam, the analysis is based on data collected from 6 Stations for temperature and 12 Stations for rainfall. The analysis indicates that the mean temperature in the State has increased by +0.01°C/year. There is also an increase in seasonal temperatures across seasons with pronounced warming in post-monsoon and winter temperatures. The annual rainfall has also decreased by -2.96 mm/year during the same period.



**Table 71: Climate trends in Assam between 1951 and 2010**

	Annual	Winter	Summer	Monsoon	Post Monsoon
Mean Max Temp (°C/year)	0.02	0.02	No Trend	0.02	0.02
Mean Min Temp (°C/year)	0.01	0.02	0.02	0.02	0.02
Mean Temp (°C/year)	0.01	0.02	0.02	0.02	0.02
Rainfall (mm/year)	-2.96	0.08	-0.56	-2.19	-0.75

Source: Assam State Action Plan on Climate Change (2015-2020)

Increased temperature and precipitation will have the following impacts:

- **High Precipitation Impacting Roads /Bridge /Embankment:** Heavy rains can cause disruption of the road networks, decreased accessibility, erosion of roads and embankments, surface water drainage problems, slope failures, landslides, among others. Increased river flow resulting from precipitation and storminess may result in damages to bridges, pavements, and other road structures. Bridge/culvert capacities are reduced or exceeded, causing upstream flooding to occur.
- **High Temperature Impacting Road Stability:** Extreme heat, combined with traffic loading, speed, and density can soften asphalt roads, leading to increased wear and tear. There would likely be concerns regarding pavement integrity such as softening, traffic-related rutting, embrittlement, migration of liquid asphalt. Additionally, thermal expansion in bridge expansion joints and paved surfaces may be experienced.
- **Earthquake:** The project road is situated in the Zone V (having high seismic intensity) of the Seismic Map of India (as per IS: 1893, Part I, 2002) and therefore has a high risk of potential damage due to earthquake. Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to Seismic zone V.
- **Drought:** The southern part of Nagaon district in central Assam valley and adjoining parts of Karbi Anglong form a rain-shadow zone where annual rainfall is as low as 800-1200 mm. Water scarcities are a potential constraint for the people living in this rain shadow zone and the absence of effective irrigation systems or water harvesting practices adds to the vulnerability of the people. But what is of immediate concern is that rainfall in this zone is decreasing slowly as found in Lumding where rainfall is on the decline at a rate of 2.15 mm per year (Das, 2004). As a result, the water crisis might aggravate in this region in the coming years.
- **Cyclone:** It can be concluded from the analysis of past meteorological data that cyclone; dust storms are extremely rare in the study area. The impact of the cyclone is likely to be low.
- **Flood:** This is a concern in the plains as floods devastate horticulture produce. In hilly areas flash floods due to heavy precipitation will lead to heavier soil erosion.



The most recent examples of such flash floods originating from extreme rainfall are two events that occurred in the north bank of the Brahmaputra River and caused significant damage to human life and property. The first of the two events occurred during the monsoon season on June 14th, 2008 due to heavy rainfall on the hills of north of Lakhimpur District causing flash floods in the rivers of Ranganadi, Singara, Dikrong and Kakoi that killed at least 20 people and inundated more than 50 villages leading to the displacement of more than 10,000 people. The other that occurred in the post-monsoon season on October 26 affected a long strip of the area of northern Assam valley adjoining foothills of Bhutan causing flash flooding in four major rivers (all are tributaries of the river Brahmaputra) and several smaller rivers. This episode of flash floods caused by heavy downpour originated from the Tropical Depression 'Rashmi', (a depression over the West Central Bay of Bengal adjoining Andhra coast) and affected mainly the catchments of the rivers Puthimari, Jia-Bharali, Ranganadi, and the Subansiri. The study area does not have a flood problem. CWC in association with IMD and Ministry of Jal Shakti has prepared Flood Estimation Reports for small and medium catchments for each hydro meteorologically homogeneous 22 sub-zones. The project area is falling in subzones 2(a) and 2(b). All structures have been designed for a 50year return period with an anticipated risk of rarer flood generally of next higher frequency *i.e.* 100-year return period flood on the designed structures. Roadside toe drains shall be provided to receive a discharge from the embankment surface and countryside runoff and carry it safely to the nearest outfall point ensuring safety to the embankment toe, which is the area most vulnerable to erosion/failure.

Key engineering measures taken to address flood risks in the design are:

- Increase in embankment height,
- Construction of new side and lead away drains,
- Construction of new culverts and widening of existing ones and iv) widening of bridges.

Cross drainage structures, embankment, and Roadside drains would have been considered anyway in the conventional design as the issue of flooding is a threat to the sustainability of the road. However, these measures also contribute to the adaptation of the roads for future increases in precipitation. This risk screening and risk identification exercise have helped to ensure that the project road with climate risks have adequate risk mitigation or adaptation measures. Provisions have also been made in the bidding documents for the Contractor to prepare contract package-specific EMP's based on the final detailed design to address a range of issues including climate-related risks and vulnerabilities.

*Source: Assam State Action Plan on Climate Change (2015-2020)*

## **Possible Climate Events, Risks and Adaptation Measures in Road Transport Infrastructure**



The design objective included ensuring that current infrastructure assets are protected from the long term and acute effects of climate change, and wherever necessary upgrading to new infrastructure systems fit for changing climate conditions have been taken into serious consideration. Those adaptive measures to counter possible risks and their likely effects on project road infrastructure as incorporated in the DPRs are summarized in **Table 72**. It must be noted that all these events either simultaneously or in isolation can generate severe disastrous impacts on road infrastructure.



**Table 72: Possible Climate Events, Risks, and Adaptation Measures**

<b>Sr. No.</b>	<b>Climate Change Events</b>	<b>Risks to the Road Infrastructure</b>	<b>Adaptation Measures incorporated in Detailed Design of Project Road</b>
1	Extreme rainfall events	<ul style="list-style-type: none"> <li>i. Overtopping and wash away</li> <li>ii. Increase of seepage and infiltration pass</li> <li>iii. Increase of hydrodynamic pressure of roads</li> <li>iv. Decreased cohesion of soil compaction</li> <li>v. Traffic hindrance and safety</li> </ul>	<ul style="list-style-type: none"> <li>a. Certain critical sections affected by overland flooding of the road raised (vertical alignment, embankment improvement) to be free from the onslaught of flooding events under intense precipitation.</li> <li>b. Road asset survey has considered certain critical road sections where the sub-grade strength and integrity were found to be compromised; the sub-grade strength specification meeting the recent-most IRC specifications has been adopted.</li> </ul>
2	Changes in seasonal and annual average rainfall	<ul style="list-style-type: none"> <li>i. Impact on soil moisture levels, affecting the structural integrity of roads, culverts, bridges standing water on the road base</li> <li>ii. Risk of floods from runoff, landslides, slope failures and damage to roads if changes occur in the precipitation pattern</li> </ul>	<ul style="list-style-type: none"> <li>c. The highest assessment of design discharge for sizing culverts and bridges from among the several discharge methods as outlined in recent IRC guidelines has been adopted.</li> <li>d. In terms of floodwater conveyance to prevent stagnation, lateral drains are proposed along the entire length of the road; closed concrete drains in settlement pockets and earthen drains in the remaining parts of the road.</li> <li>e. Improved cross-drainage capacities required for the quick conveyance of floodwater by replacing small diameter pipes with box culverts with higher discharge openings has been considered.</li> <li>f. The bottom of the sub-grade has been kept 0.6m above HFL, to avoid over topping, water-logging of the road surface.</li> </ul>
3	Increased maximum temperature and a higher number of consecutive hot days (heat waves)	<ul style="list-style-type: none"> <li>i. Concerns regarding pavement integrity, e.g. softening, traffic-related rutting, cracking, fracture, etc.</li> <li>ii. Thermal expansion in</li> <li>iii. bridge expansion joints and paved surfaces Temperature break soil cohesion and increase dust volume which caused health and traffic accidents</li> </ul>	<ul style="list-style-type: none"> <li>a. An adequate binding layer thickness has been proposed to offset the wear, surface fatigue, and rutting under climate stresses.</li> <li>b. In terms of pavement integrity, the choice of viscosity grade VG30 has been maintained.</li> </ul>
4	Extreme wind speed under cyclonic conditions	<ul style="list-style-type: none"> <li>i. The threat to the stability of bridge decks</li> <li>ii. Damage to signs, lighting fixtures and supports</li> </ul>	BAU



## 7. Public Consultation

Meaningful consultations were held early and will be held throughout the project development stage 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. All the five principles of information dissemination, information solicitation, integration, coordination, and participation in the dialogue were incorporated in the consultation process. The analysis of environmental impacts likely from the project has strengthened and modified based on opinions of all those consulted, especially at the micro-level by setting up dialogues with the village people from whom information on-site facts and prevailing conditions were collected. The requirement of public consultation during the implementation of the project has been proposed as part of the mitigation plan.

### 7.1 Objectives of the Consultation

Stakeholder's consultations held with the 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 people a platform to ensure incorporation of their concerns in the decision-making process and foster co-operation among officers of PWRD, 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 held were designed to receive maximum inputs from the participants regarding their acceptability and environmental concerns arising out of the sub-project. They were given a brief outline of the project to which their opinions were required particularly in identifying and mitigating any potential adverse impact.

### 7.2 Methodology for Consultations

Consultation with the stakeholders, beneficiaries, and community leaders had been carried out using standard structured questionnaires as well as unstructured questionnaires. Questionnaire surveys/ discussions were designed to obtain background information and details of general environmental issues that concern people in the project area. Besides, environmental issues were discussed with relevant organizations, government officials, beneficiaries, community leaders, and experts. Besides, personal discussions with officials, on-site discussions with affected stakeholders, and reconnaissance visits have also been made to the project area. Public consultations have been done at four locations during initial surveys as shown in **Table 73**. The total numbers of participants in the consultations were 30.



**Table 73: List of Public consultation and Date**

Sr. No.	Village	Date	Male Participants	Female Participants	Total Participants
1	Golipari	18/01/2020	4	0	4
2	No. 1 Salakataki	18/01/2020	2	0	2
3	Joloni	08/11/2020	5	1	6
4	Da Hukuta	08/11/2020	3	1	4
5	2 No. Chalakotoki	08/11/2020	7	0	7
6	Deesang Kinar Bangali	08/11/2020	5	2	7
<b>Total</b>			<b>26</b>	<b>4</b>	<b>30</b>

## 7.3 Stakeholder Consultations

### 7.3.1 Project Stakeholders

All types of stakeholders were identified to ensure wide coverage as possible.

- Residents, shopkeepers and business people who live and work along the road especially the project affected persons
- All type of road users/commuters
- Executing Agency, Construction Supervision Consultant and Implementing NGOs
- Other government institutions whose remit includes areas or issues affected by the project (state environment and forest department, Pollution Control Board (PCB), Irrigation Department, Public Health Engineering (PHED) Department
- The beneficiary community in general

**Table 74: Identified Stakeholders**

Level	Type	Key Participants	Response	Influence	Affected
<b>Individual</b>	Local Level Consultations	Persons along the road corridor	Supportive	Medium	Yes, Road users
<b>Individual</b>	Door to Door personal contact	People along the road corridor which are likely to be impacted	Supportive	High	Yes, Due to Land or structure acquisition
<b>Settlement</b>	Focus Group Discussion	Including women, Socially and economically vulnerable	Supportive	High	Yes, due to land or structure acquisition
<b>Common Property Resources</b>	FGD with Community owners/ Leaders/ Caretakers	CPR at the road stretch	Supportive	Low	Yes, by or due to land impacted
<b>Departmental Level Consultations</b>	Focus Group Discussion	Including Department Official & Locals	Supportive	Low	Indirectly due to road improvement

### 7.3.2 Consultation with Government Departments

Various Govt. Dept. officials were consulted during Environmental Impact Assessment Study including PWRD Officials, State pollution control board for Air, Noise, and Water quality



information, IMD for the climatic data, the statistical officer for Population and demographic profile, Panchayat department for village level information, Survey of India for the topo sheet requirement, Revenue department for the land record information, PHQ officers for hand pump relocation and quality assessment, Assam SEB offices for electric pole shifting, etc.

These department officials helped to provide various project-related data and information which helped preparation of reports and data analysis.



**Figure 52: Joint Survey and consultation with Tengaghat Circle Mondal**



**Figure 53: Joint Survey and Consultation with Tinsukia RF Office Team**



Figure 54: Joint Survey and Consultation with Range Forest Officer Tinsukia



Figure 55: Joint Survey and Consultation with Oil India Limited Duliajan Team

### 7.3.3 Consultation with Local People and Beneficiaries

The informal consultation was generally started with explaining the project, followed by an explanation of potential impacts. Participant's views were gathered concerning all aspects of the environment which may have a direct or indirect impact on 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 involvement;
- Local disturbances due to project construction work;
- The 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.

The project has immense acceptability among the local people. They perceive that in addition to providing all-weather connectivity, the subproject road will bring positive socioeconomic changes in the area. Local people mainly discussed the issues related to road improvement works, rehabilitation, resettlement, and road safety issues.

The Details of Participants and Public Consultation photographs are attached in Annexure 4. Also, information on the GRM procedures and formats in local language i.e. Assamese was shared with the local people as provided in Annexure 5.

**Table 75: Details of Public Consultation at Golipari**

<b>Date</b>	<b>Issues Discussed</b>	<b>Response</b>	<b>Participant</b>
18/01/2020	<ul style="list-style-type: none"> <li>➤ People questioned about heavy traffic flow to urban places such as Duliajan and Digboi</li> <li>➤ People question about accident prevention on critical locations.</li> <li>➤ People asked about loss of their agricultural land</li> <li>➤ People reported that the air and noise quality at the location is good.</li> <li>➤ Water quality is also good and used for day to day purpose very low iron is found in water.</li> <li>➤ Tree cover in the project area is moderate and agricultural land are present adjacent to the road</li> <li>➤ No Wild animals crossing are observed along the project road. Domestic animals can be sighted such as dogs, pigs etc.</li> <li>➤ Common birds on farms are observed such as hens, cocks, ducks etc. No migratory birds spotted</li> </ul>	<ul style="list-style-type: none"> <li>➤ The road improvement work will take place on the existing road and present and future traffic flows are considered in finalizing the road design</li> <li>➤ After improvement of road there will be a considerable reduction in the number of accidents as road safety will be an important consideration while designing the road.</li> <li>➤ Appropriate compensation will be provided to the beneficiaries.</li> </ul>	Total = 4 Male = 4



**Figure 56: Public Consultation at Golipari**

**Table 76: Details of Public Consultation at No. 1 Salakataki**

<b>Date</b>	<b>Issues Discussed</b>	<b>Response</b>	<b>Participant</b>
18/01/2020	<ul style="list-style-type: none"> <li>➤ Safety measures along the project road were discussed</li> <li>➤ Few of them questioned about provision for road passing nearby school and hospitals</li> <li>➤ People asked about employment opportunities</li> <li>➤ People reported that the air and noise quality at the location is good.</li> <li>➤ Water quality is also good and used for day to day purpose very low iron is found in water.</li> <li>➤ Tree cover in the project area is moderate and agricultural land are present adjacent to the road</li> <li>➤ No Wild animals crossing are observed along the project road.</li> <li>➤ Common birds are observed such as hens, cocks, ducks etc. No migratory birds spotted</li> </ul>	<ul style="list-style-type: none"> <li>➤ Suitable road safety features will be provided</li> <li>➤ No honking zone to be made nearby school and hospital locations</li> <li>➤ Employment to locals will be provided by the contractor to keep size of construction camp small</li> </ul>	Total = 2 Male = 2



**Figure 57: Public Consultation at No. 1 Salakataki**

**Table 77: Details of Public Consultation at Joloni**

Date	Issues Discussed	Response	Participant
8/11/2020	<ul style="list-style-type: none"> <li>➤ People asked about road widening and loss of their shops</li> <li>➤ People asked about modern-day facilities provision on road</li> <li>➤ People asked about employment opportunities</li> <li>➤ People reported that the air and noise quality at the location is good.</li> <li>➤ Water quality is also good and used for day-to-day purpose by the residents</li> <li>➤ Tree cover in the project area is moderate.</li> <li>➤ No Wild animals crossing are observed along the project road. Elephants are sometimes observed in the fields farm away from the road during harvest season as they come to eat the crops.</li> <li>➤ Domestic and farm animals can be sighted such as cow, pigs etc.</li> <li>➤ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted</li> </ul>	<ul style="list-style-type: none"> <li>➤ The road improvement work will take place on the existing road and as per requirement land acquisition will take place and appropriate compensation will be provided</li> <li>➤ Solar street lights and other facilities will be provided along the road</li> <li>➤ Employment to locals will be provided by the contractor to keep size of construction camp small</li> </ul>	Total = 6 Male = 5 Female = 1



**Figure 58: Public Consultation at Joloni**

**Table 78: Details of Public Consultation at Da Hukuta**

Date	Issues Discussed	Response	Participant
8/11/2020	<ul style="list-style-type: none"> <li>➤ People asked about safety provisions in road passing through town section</li> <li>➤ People asked about plantation for loss of trees</li> <li>➤ People asked about employment opportunities</li> <li>➤ People reported that the air and noise quality at the location is good.</li> <li>➤ Water quality is also good and used for day to day activities by the local population</li> <li>➤ Tree cover in the project area is moderate</li> <li>➤ No Wild animals crossing are observed along the project road. Domestic animals can be sighted</li> <li>➤ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted</li> </ul>	<ul style="list-style-type: none"> <li>➤ Speed restrictions and road safety features will be provided for road passing through settlements</li> <li>➤ Ten times plantation will be done in coordination with the forest department</li> <li>➤ Employment to locals will be provided by the contractor to keep size of construction camp small</li> </ul>	<p>Total = 4 Male = 3 Female = 1</p>



**Figure 59: Public Consultation at Da Hukuta**

**Table 79: Details of Public Consultation at 2 No. Chalakotoki**

Date	Issues Discussed	Response	Participant
8/11/2020	<ul style="list-style-type: none"> <li>➤ People asked about measure to maintain existing bridges</li> <li>➤ People asked about precautions while conducting construction near rivers and bridge work</li> <li>➤ People reported that the air and noise quality at the location is good.</li> <li>➤ Water quality is also good and used for day-to-day activities by the local population</li> <li>➤ Tree cover in the project area is moderate and agricultural lands are present adjacent to the road</li> <li>➤ No Wild animals crossing are observed along the project road. Domestic and farm animals can be seen</li> <li>➤ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Good condition bridges will be retained with minor repairs</li> <li>➤ While doing construction near rivers appropriate measures will be taken to avoid polluting the river and no storage of materials will be done near river banks</li> </ul>	Total = 7 Male = 7



**Figure 60: Public Consultation at 2 No. Chalakotoki**

**Table 80: Details of Public Consultation at Deesang Kinar Bangali**

<b>Date</b>	<b>Issues Discussed</b>	<b>Response</b>	<b>Participant</b>
8/11/2020	<ul style="list-style-type: none"> <li>➤ People asked about compensation to proposed road passing through green field area</li> <li>➤ People asked about need of the bypass</li> <li>➤ People asked about solution for loss of vegetation</li> <li>➤ People reported that the air and noise quality at the location is good.</li> <li>➤ Water quality is also good and used for day-to-day activities by the local population</li> <li>➤ Tree cover in the project area is moderate</li> <li>➤ No Wild animals crossing are observed along the project road. Domestic animals can be seen</li> <li>➤ Commons birds are observed such as hens, cocks, ducks etc. No migratory birds spotted.</li> </ul>	<ul style="list-style-type: none"> <li>➤ For road passing through green field area, appropriate consultation will be provided to the beneficiaries.</li> <li>➤ To improve road and reduce time of travel bypass is proposed</li> <li>➤ Ten times plantation will be done with coordination with the forest department to compensate for the loss of vegetation.</li> </ul>	Total = 7 Male = 5 Female = 2



**Figure 61: Public Consultation at Deesang Kinar Bangali**

Most of the people interviewed strongly supported the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, tourism, boost economic development, and thereby provide direct, or indirect, benefits to them.



## 7.4 Public Opinion/ Views Survey

To access the existing environment and likely impacts on the surrounding population, an interview was carried out. A sample of the population was interviewed through a designed questionnaire. Precaution has been exercised during the survey to ensure that the sample interviewed is truly representative of the affected groups and the questions are worded so as not to generate a bias response.

### Public Consultation Questionnaire

Name of Project:			
Name of Project Road:			
Project package no.:			
Chainage:		Date:	
Place:		District:	
No of Participants			

#### Questions to be Asked?

- How is the Water quality of rivers, ponds, wells, and canals?  
 Positive:                      Negative:                      No Response:
- Status of Noise quality in the area?  
 Positive:                      Negative:                      No Response:
- How is the Air quality in the area?  
 Positive:                      Negative:                      No Response:
- Are there any Archaeological sites in the vicinity?  
 Positive:                      Negative:                      No Response:
- Any history of Natural disasters?  
 Positive:                      Negative:                      No Response:
- Any Rare species of animals and birds found in the area?  
 Positive:                      Negative:                      No Response:
- Are there any Cultural sites in vicinity?  
 Positive:                      Negative:                      No Response:

Figure 62: Public Consultation Questionnaire

It is observed from the interview survey that there is increased environmental awareness among the people. It can also be seen from **Table 81** that about most of the people are in the opinion that the environmental condition of the area is good. Poor road condition and vehicular emissions are the major sources they feel responsible for this. People are unaware of the presence of archaeological, historical, and cultural sites. There is no major history of natural disasters in the region and local people have mixed responses about natural



disasters. Overall, the general environmental conditions in the region are good and people have increased environmental awareness. **Table 81** shows the result of the public opinion survey carried out in the region.

**Table 81: Peoples' Perception of Environmental Scenario**

Sr. No.	Question Asked About	No. of People Interviewed	Positive Response	Negative Response	No Response
1	Water quality of rivers, ponds, wells, and canals	30	25	5	0
2	Noise quality of the area	30	30	0	0
3	Air quality of the area	30	30	0	0
4	Archaeological sites	30	0	30	0
5	Natural disaster	30	10	12	8
6	Rare species of animals and birds found	30	0	30	0
7	Cultural sites	30	21	9	0

*Source: From Public Consultation Response*

Overall, most of the people interviewed strongly support the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, tourism, boost economic development, and thereby provide direct, or indirect benefits to them. Construction camps may however put stress on local resources and infrastructure nearby especially on water resources. The construction camps that will be installed during construction will exert more demand on the existing water source and would pose a threat to the quality of water bodies and groundwater resources. To prevent such problems contractor needs to provide camps with proper drinking water and sanitation facility.

The following are the consultants' initial findings regarding likely positive and negative impacts.

**Positive Impacts:**

- Improved road conditions will reduce travel time, fuel consumption, and emissions from base traffic volumes.
- Economic development and access will be stimulated.
- Access to Health, agriculture, and education facility will be improved.

**Negative Impacts:**

- Disturbance to existing traffic during the construction phase.
- Fugitive dust emissions during the construction stage thus harming the air quality. Similarly, noise quality can be affected during construction as well as operation stage.

Based on available information, field visits throughout the project, discussions with project authorities, and other discussions amongst project team and local officials it has been



concluded that overall, the project will be beneficial, all negative impacts during and post-construction can be properly mitigated.

## **7.5 Disclosure**

### **7.5.1 State Level**

PMU and the PIUs shall disclose this entire EIA Report and all Safeguards related documents and mitigation plans at their website.

### **7.5.2 District Level**

PMU will also arrange to disclose the final versions of the EIA and ESMP in English and Executive Summary in Assamese in all the District Collectors Offices, PIUs and the local offices of the implementing agencies. These would be in place once the final versions are ready. When this document is updated, then the copies in the different locations would also be updated.

### **7.5.3 Disclosure requirements of AIIB**

The Bank requires the Client to disclose: (a) draft environmental and social assessment reports, ESMPs, ESMPFs, resettlement plans, RPFs, Indigenous Peoples plans and IPPFs, or other approved forms of documentation; and (b) other documents described above, as soon as they become available. The Bank also requires the Client to disclose any material changes to the disclosed environmental and social information for the Project as soon as they become available.

### **7.5.4 Disclosure by AIIB**

The AIIB will disclose the EIA and ESMP in the bank's website. During the implementation phase, all the subproject EIA report shall be disclosed by PMU and the PIUs both at the local level and at the state level.



## 8. Grievance Redress Mechanism

A project-specific Grievance Redress Mechanism (GRM) will be established to receive, acknowledge, evaluate and facilitate the resolution to the complainant with corrective actions proposed using understandable and transparent processes on the social and environmental aspects that are gender responsive, culturally appropriate and readily accessible to all segments of the affected people. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. Records of grievances received, corrective actions taken and their outcomes shall be properly maintained. The complainant may take recourse to the Court of law, if dissatisfied with the verdict of the GRM.

### A. Mechanism for Grievance Redressal

The GRM shall be established at four levels viz. Site Level (First Level Grievance), PIU Level (Second Level Grievance), PMU Level (Third Level Grievance) and Court of Law (Third Level Grievance) to address grievances/ complaints. The grievance redress mechanism is given in **Figure 63**. The project-specific GRM is not intended to bypass the government's own redress process; rather it is intended to address affected people's concerns and complaints promptly, making it readily accessible to all segments of the affected people, and is scaled to the risks and impacts of the project.

**First Level:** When grievances arise, complainant will first need to contact the respective person of the Contractor, CSC and the site engineers. The site level resolution of complaints shall be done within 2 weeks. The Contractor will maintain the records of complaints and the outcome of the solutions.

**Second Level:** The complainant will need to contact PIU to file complaints on non-resolution at the site level. The address and contact number of the PMU office will be provided in the project information leaflet. The PIU, supported by CSC, is the second tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The Environmental officer of PIU, supported by CSC, will be designated as the key officers for grievance redress. Resolution of complaints will be done within 2 weeks. At this stage, Environmental officer will inform the PMU for additional support and guidance in grievance redress matters, if required. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, etc.). Grievances will be documented and personal details of the complainant (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number will be assigned to each grievance. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 2 weeks. The contractor will have observer status on GRC.

**Third Level:** The Environmental Officer of each PIU will activate the second tier of GRM by referring the unresolved issues (with written documentation) to the PMU, who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). A hearing will be



called by the GRC, if necessary, where the affected person may present his/her concern/issues. The process will facilitate resolution through mediation.

**Fourth Level:** Alternatively, the affected person can also seek alternative redress through the appropriate court of law. If unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the Government's judicial or administrative remedies.

The PMU and PIUs, supported by CSC, will make the public aware of the GRM through public awareness campaigns. The grievances can be raised through various methods:

- Modules in e-portal/ website of Asom Mala.
- Dropping complaints in grievance boxes placed in the offices of a) PMU, b) respective PIUs and c) Site offices/ CSC.
- E-mails to respective email address.
- SMS or WhatsApp to respective mobile number(s) dedicated for GRM.
- Using the complaint register and complaint forms (Figure 4) available at the office of PMU/ PIU/ Site offices/ CSC.

All the documents will be made available to the public including information on the contact number, e-mail addresses, addresses of the respective offices of PMU/ PIU/ Site offices/CSC/AE/ RP Implementing Agency and contact person for registering grievances, and will be widely disseminated throughout the project area by the safeguard officers in the PMU and PIUs supported by the CSC/AE/RP Implementing Agencies.

## **B. Grievance Redress Committee (GRC)**

A Grievance Redress Committee (GRC) will be established at the PWRD state level and at the PIU level to assure accessibility for APs. The GRCs are expected to resolve grievances within a stipulated time period of 2 weeks each at the Site level and PIU level, and one month at the PMU level. If the displaced person is not satisfied with the decision of the GRC, the complainant can approach the court of law. At any point in the redressal process the aggrieved person can approach the Land Acquisition and Resettlement and Rehabilitation Authority.

The PMU level GRC will comprise of the:

- Chief Engineer (EAP), PWRD, GoA or any authorised person, who should not below the rank of Executive Engineer
- Nodal Officer, Asom Mala – Member Secretary
- Resettlement Officer, PMU supported by RP Implementation Agency and/ or PCMC
- Environmental Officer, PMU supported by CMC and/ or PCMC
- Representatives from local person of repute and standing in the society or elected representative from Panchayat/ Zilla Parishad /District Council
- Representative from the PIU, supported by RP Implementation Agency
- A representative from IP community for IP related issue, if any



- Representative from local forest authority, if grievances of forest aspects
- Representative from Pollution Control Board, if grievances of environmental aspects
- Representative of the Land Revenue department, if grievances of land related issues

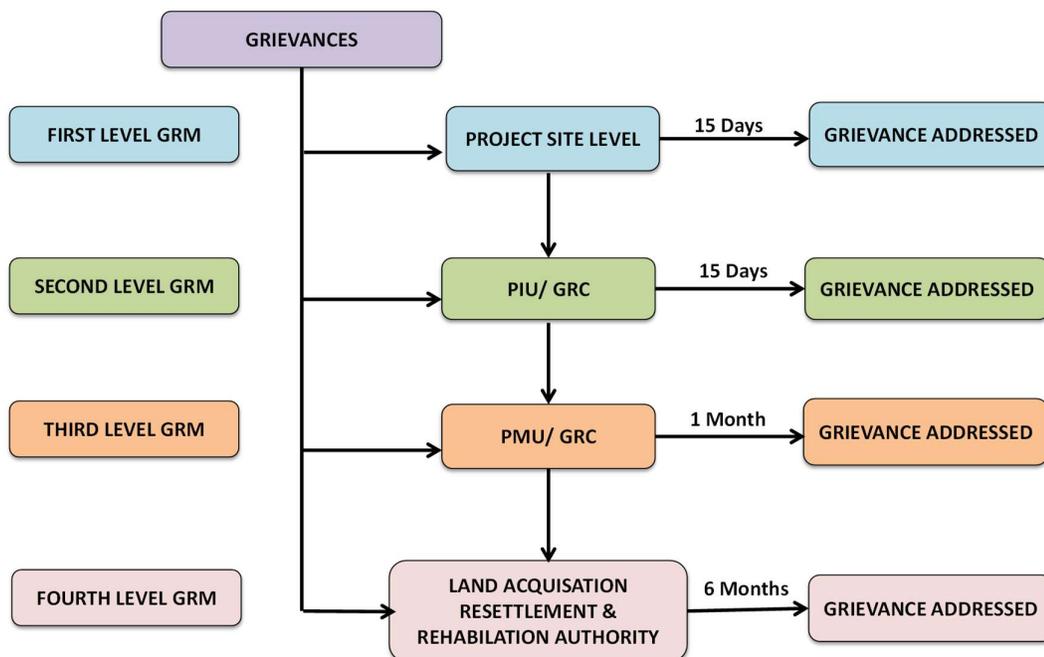
The PIU level GRC will comprise of the:

- Representative of PIU, above the rank of Sub-Divisional Officer
- Resettlement Officer, PIU supported by RIA
- Environmental Officer, PIU supported by CSC/AE
- A representative from local person of repute and standing in the society or elected representative from Panchayat/ Zilla Parishad /District Council.
- A representative for women from a relevant agency which could be from the government, or RP Implementation Agency or local community
- A representative from Vulnerable DPs
- A representative of the local Deputy Commissioners office (land), if the grievance is of acquisition land related issues
- A representative of local Pollution Control Authority (for environmental issues related grievances)
- A representative from IP community for IP related issue, if any.

The functions of the GRC are as follows: (i) resolve problems quickly and provide support to affected persons arising from various issues of water supply, waste disposal, traffic interference and public safety as well as social and resettlement related issues such as land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

### **C. Grievance Redressal Process**

The Grievance Redress Process is presented in **Figure 63**.



**Figure 63: Environmental and Social Grievance Redressal Process**

The grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested. A tracking number will be assigned to each grievance, including the following elements:

- initial grievance sheet (including the description of the grievance) with an acknowledgement of receipt given to the complainant when the complaint is registered;
- grievance monitoring sheet with actions taken (investigation, corrective measures); and
- closure sheet, one copy of which will be handed over to the complainant after he/she has agreed to the resolution and signed off.

The updated register of grievances and complaints will be available to the public at the PMU office. Should the grievance remain unresolved, the person can seek alternative redress through the appropriate court of law which will be the last level recourse or the AIIB's redress mechanism.

During preparation of EIA or at least during pre-construction stage local communities in project areas shall be informed on grievance redress procedure and contact persons for lodging complaint/s. All the parties involved in project implementation i.e. contractor, CSC/AE, and PIU shall maintain complaint registers at their respective offices.

Environment Safety Officer of contractors and Construction Supervision Consultant shall promptly investigate and review environmental complaints and implement appropriate corrective actions to mitigate cause of the complaints. However, in all cases, it shall be responsibility of contractors to act immediately upon receiving any complaint related to construction activities at site and camps.



The GRC meeting shall be conducted within 30 days of constitution and subsequently it shall be conducted every month to review status of pending cases.

The PMU, with the assistance of the PCMC will be responsible for processing, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

The monitoring reports of the ESMP implementation will include the following aspects pertaining to progress on grievances: (i) number of cases registered with the PIU, at what level of jurisdiction, number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared, with details such as name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance(i.e., open, closed, or pending).

All costs involved in resolving the complaints (meetings, consultations, communication, and information dissemination) shall be borne by the PMU.



## 9. Environmental and Social Management Plan

### 9.1 Introduction

The environmental impacts associated with any development project are eliminated or minimized to an acceptable level through the development of appropriate mitigation measures based on the most suitable techno-economic options. The Environmental and Social Management Plan (ESMP) is a well-established tool to ensure effective implementation of the recommended mitigations measures throughout the project development stages. The ESMP also ensures that the positive impacts are conserved and enhanced. An ESMP provides location and time-specific actions to be taken with defined responsibility. It also provides measures for institutional strengthening and effectiveness assessment through a defined monitoring plan, reporting corrective & preventive action planning.

### 9.2 Objectives of Environmental and Social Management Plan

A sub-project road-specific Environmental and Social Management Plan has been formulated which consists of a set of mitigation; monitoring and institutional measures applicable to the design, construction, and operation stages of the project. The components of this ESMP includes (i) mitigation of potentially adverse impacts (ii) monitoring of impacts and mitigation measures during project implementation and operation (iii) institutional capacity building and training (iv) compliance to statutory requirements (v) integration of ESMP with project planning, design, construction, and operation.

### 9.3 Impacts and Mitigation Measures

The identified environmental, social, health & safety issues and recommended mitigation measures with institutional arrangements for implementation, supervision, and monitoring have been provided in **Table 82**. The Biodiversity Management Plan is given in **Table 83**. The Environmental Monitoring plan is given in **Table 84**.



**Table 82: Environmental, Social, Health and Safety Management Plan**

**1. Environment**

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
<b>A. Pre-Construction and Design Stage</b>			
<b>1. Tree Cutting</b>			
1.1. Reduction in forest cover, hence deterioration in climatic conditions. Increase in Green House effect/climate change impact	<ul style="list-style-type: none"> <li>Geometric adjustments made to minimize tree cutting.</li> <li>Widening to be accommodated within available ROW such that minimal tree cutting is required</li> <li>Obtain tree cutting permission from forest/Revenue department as the case may be.</li> <li>Compensatory plantation with respect to trees cut (1515) with preference to fast growing species as per the orders of Forest department.</li> <li>Additional Plantation of 15150 trees on both side of the road in non-residential areas will be done with 5m center to center spacing between two trees as per the order of Forest department</li> </ul>	Project areas	PWRD, ASSAM/ Forest Department
<b>2. Joint Field Verification</b>			
2.1.	<ul style="list-style-type: none"> <li>The Engineer - Incharge of Supervision Consultant and the Contractor shall carry out joint field verification to ascertain the necessity of saving trees, environmental and community resources wherever such representations or suggestions in writing have been received and forwarded by the project authority or by the site engineer in accordance with the local situations.</li> <li>The complaints/suggestions together with the observations and expert opinion of the joint verification team containing the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the ESMP shall be summarized in a written document containing all the details with date, time, place and signature of the individuals involved and this shall be sent to PIU/PMU for approval.</li> </ul>	RoW / Col / Project influence areas	Contractor; Environmental Officer of CSC
<b>3. Biodiversity Management Plan</b>			
3.1. Mitigation and management of the local biodiversity.	<ul style="list-style-type: none"> <li>The draft biodiversity management plan (BMP) given in the EIA report (Annexure 21). The BMP must help to enhance the local biodiversity and protect the endangered species on a long-term sustainable basis to result in no "net loss" of biodiversity in the project area due to the project.</li> </ul>	Project influence area	External Monitor for Environment Safeguards or Biodiversity NGO



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Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
<b>B. Construction Stage</b>			
<b>1. Procurement of Machinery - Crushers, Hot-mix Plants &amp; Batching Plants</b>			
1.1. Air, noise and water Pollution	<ul style="list-style-type: none"> <li>Specifications of crushers, hot mix plants and batching plants (existing or new) shall comply with the requirements of the relevant current emission control legislations.</li> <li>The Consent to Establish (CTE) &amp; Consent to Operate (CTO) shall be obtained from the SPCB, Assam for the establishment and operation of these plants.</li> <li>Only Crushers licensed by the State Pollution Control Board (SPCB) shall be used.</li> <li>The Contractor shall submit a detailed layout plan for all such sites and seek prior approval of Engineer - Incharge of CSC before entering into formal agreement with a land owner for setting-up such sites.</li> </ul>	Crushers, Hotmix plants & Batching Plants	Contractor
<b>2. Procurement of Other Construction Vehicles, Equipment and Machinery</b>			
2.1. Air, noise and water Pollution	<ul style="list-style-type: none"> <li>The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. All vehicles, equipment and machinery to be procured for construction shall conform to the relevant Bureau of Indian Standard (BIS) norms.</li> <li>Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of ASPCB.</li> <li>Noise limits for construction equipment's to be procured such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A), when measured at one metre distance from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986.</li> <li>The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced to the PIU for verification whenever required.</li> <li>Ambient Air Quality monitoring has to be performed by the Contractor as per the Environmental Monitoring Program and in accordance with the general and specific condition of CTO.</li> </ul>	Through out the project area	Contractor
<b>3. Air Quality</b>			
3.1. Emission of air pollutants (HC, SO <sub>2</sub> , NO <sub>x</sub> , CO etc.) from vehicles due to traffic congestion and use of	<ul style="list-style-type: none"> <li>Regular maintenance of machinery and equipment.</li> <li>Batching and asphalt mixing plants and crushers at downwind direction (1 km) from nearest settlement.</li> </ul>	Built-up-Stretches are: Deesang Kinar Bangali, Duliajan, Kathalguri	Contractor



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Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
equipment and machinery	<ul style="list-style-type: none"> <li>Only licensed crushers be used.</li> <li>DG sets with stacks of adequate height should be used.</li> <li>Ambient air quality monitoring</li> <li>Following traffic management</li> <li>Construction work should be carried out in non-peak hours.</li> <li>LPG should be used as fuel source in construction camps instead of wood</li> <li>Contractor to prepare traffic management and dust suppression plan duly approved by PWD.</li> <li>The contractor shall maintain a separate file and submit PUC certificates for all vehicles/ equipment/ machinery that are being used for the project</li> </ul>	<p>Sensitive Receptors in close vicinity are:</p> <p>Educational Institutions (11+600, 12+000, 14+550, 15+000, 15+950, 18+200, 19+900, 20+850, 22+400)</p>	
<b>4. Land and Soil</b>			
4.1. Land use Change and Loss of productive/ top soil	<ul style="list-style-type: none"> <li>No agricultural areas to be used as borrow areas to the extent possible.</li> <li>Land for temporary facilities like construction camp, storage areas etc. shall be brought back to its original land use.</li> <li>If using agricultural land, top soil to be preserved and laid over either on embankment slope for growing vegetation.</li> </ul>	<p>Throughout project section and borrow areas</p> <p>Land identified for construction camp</p>	Contractor
4.2. Slope failure and soil erosion due to construction activities, earthwork and cut and fill stockpiles etc.	<ul style="list-style-type: none"> <li>Care should be taken that the slope gradient shall not be steeper than 2H:1V.</li> <li>Earth stockpiles to be provided with gentle slopes to avoid soil erosion.</li> </ul>	Throughout the project road	Contractor
4.3. Borrow area management	<ul style="list-style-type: none"> <li>Non-productive barren land shall be used for borrowing earth with the necessary permissions/consents.</li> <li>Depths of borrow pits to be regulated and sides not steeper than 25%.</li> <li>The 15 cm topsoil to be stockpiled within the site of identified borrow area for use at the rehabilitation stage as preventive measure. The stockpiles shall be covered with gunny bags / tarpaulin.</li> <li>Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation</li> <li>Borrow areas not to be dug continuously</li> <li>Redevelopment of borrow areas shall be taken up in accordance with the plans approved by the Authority Engineer</li> </ul>	Borrow site location as identified in DPR or any selected borrow area	Contractor
4.4. Quarry Operations	<ul style="list-style-type: none"> <li>No quarry and/or crusher units shall be established, which is within 1000m from the residential/ settlement locations, forest boundary, wildlife movement path, breeding and nesting habitats and national parks/sanctuaries.</li> <li>Aggregates should be sourced from existing licensed quarries.</li> </ul>	Location specified as per DPR or another quarry source selected.	Contractor



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Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> <li>Copies of consent/approval/ rehabilitation plan for new quarry or use of existing quarries should be sought.</li> <li>The contractor will develop a quarry redevelopment plan as per mining rules of state.</li> <li>Obtain environmental clearance from DEIAA in case of opening new quarry.</li> <li>Contractor shall work out haul road network to be used for transport of quarry materials and report to Authority Engineer who shall inspect and approve the same.</li> </ul>		
<p>4.5. Contamination of soil due to leakage/spillage of oil, bituminous debris generated from demolition and road construction</p>	<ul style="list-style-type: none"> <li>Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil.</li> <li>Fuel storage and refueling sites to be kept away from drainage channels.</li> <li>Unusable debris shall be dumped in ditches and low-lying areas.</li> <li>To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas.</li> <li>Waste oil and oil-soaked cotton/ cloth shall be stored in containers labelled 'Waste Oil' and 'Hazardous' sold off to MoEF&amp;CC/SPCB authorized vendors</li> <li>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.</li> <li>Bituminous wastes shall be disposed of in identified dumping sites approved by State Pollution Control Board.</li> <li>Soil quality monitoring</li> </ul>	<p>Fueling station, construction sites, construction camps and disposal location</p>	<p>Contractor</p>
<p>4.6. Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment</p>	<ul style="list-style-type: none"> <li>Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil</li> <li>Fuel storage and refueling sites to be kept away from drainage channels</li> <li>Unusable debris shall be dumped in ditches and low-lying areas</li> <li>To avoid soil contamination Oil-Interceptors shall be provided at wash down and refueling areas</li> <li>Construction vehicles, machinery and equipment to be stationed in the designated ROW to avoid compaction.</li> <li>Approach roads/haul roads shall be designed along the barren and hard soil area to reduce the compaction</li> <li>Transportation of quarry material to the dumping site through existing major roads to the extent possible to restrict wear and tear to the village</li> </ul>	<p>Parking area, haulage roads and construction yards</p>	<p>Contractor</p>



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Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>roads.</p> <ul style="list-style-type: none"> <li>Land taken for construction camp and other temporary facility shall be restored to its original facility.</li> </ul>		
<b>5. Water Resources</b>			
5.1. Sourcing of water during construction	<ul style="list-style-type: none"> <li>Requisite permissions shall be obtained for abstraction of groundwater if used.</li> <li>Water availability to nearby communities should remain unaffected.</li> <li>Water intensive activities not to be carried out during summer</li> <li>Provision of water harvesting structures to augment groundwater condition in the area</li> </ul>	Throughout the project site especially construction sites/camps.	Contractor
5.2. Disposal of water during construction	<ul style="list-style-type: none"> <li>Provisions shall be made to connect road side drains with existing nearby natural drains.</li> <li>The Contractor shall take all precautionary measures to prevent the generated wastewater from entering into streams, water bodies or the irrigation channels arising due to construction activity</li> <li>Contractor shall avoid construction works close to the streams or water bodies during monsoon.</li> </ul>	Throughout the Project section	Contractor
5.3. Alteration in surface water hydrology due to embankment	<ul style="list-style-type: none"> <li>Existing drainage should be maintained and enhanced.</li> <li>Provision shall be made for adequate size and number of cross-drainage structures esp. in the areas where land is sloping towards road alignment.</li> <li>Culverts reconstruction shall be done during lean flow period. In some cases, these minor channels may be diverted for a very short period and shall be brought back to its original course immediately after construction</li> <li>Road level shall be raised above HFL level as per IRC MORTH guidelines</li> </ul>	Waterways streams/nallahs along the section	Contractor
5.4. Siltation in water bodies due to construction activities/earthwork.	<ul style="list-style-type: none"> <li>Embankment slopes to be modified suitably to restrict the soil debris entering water bodies</li> <li>Provision of Silt fencing shall be made at water bodies.</li> <li>Earthworks and stone work to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system.</li> <li>Silt and sediments shall be collected and stockpiled for possible reuse.</li> <li>Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be re-vegetated</li> <li>Earthwork should be prevented from impeding natural flow of rivers, streams for existing drainage system.</li> </ul>	Ponds located at Ch. 10+450 (R), 14+100 (R), 16+325 (R), 18+700 (L), 21+125 (R)	Contractor
5.5. Deterioration in surface water quality due to leakage from vehicles	<ul style="list-style-type: none"> <li>No vehicles or equipment should be parked or refueled near water bodies to avoid contamination from fuel and lubricants.</li> </ul>	Ponds located at Ch. 10+450 (R), 14+100 (R), 16+325 (R), 18+700 (L),	Contractor



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Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
and equipment and wastes from construction camps.	<ul style="list-style-type: none"> <li>Oil and grease traps and fueling platforms to be provided at re-fueling locations</li> <li>All chemicals and oil shall be stored away from water bodies. and concreted platform with catchment pit for spills collection</li> <li>All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors Construction camps shall be sited away from water bodies.</li> <li>Wastes must be collected, stored and taken to approve disposal site only.</li> <li>Water quality to be monitored periodically.</li> </ul>	21+125 (R)	
<b>6. Flora and Fauna</b>			
6.1. Vegetation loss due to site preparation and construction activities.	<ul style="list-style-type: none"> <li>Compensatory plantations in the ratio as per Assam Government's policy and their maintenance.</li> <li>Plantation of 15150 nos. trees on both sides of the road with 5m center to center distance in non-residential areas along the stretch on both sides. Trees should be offset 1m back from the ultimate edge of the roadway to prevent safety hazard and provide adequate sight distance.</li> <li>Use of LPG for cooking in camps to avoid tree cutting</li> <li>Integrate vegetation management (IVM) with the carriage way completely clear of vegetation Controlled use of pesticides and fertilizers.</li> </ul>	Throughout the project corridor	PWRD, ASSAM/ Forest Department
<b>7. Construction Camps/ Occupational Health</b>			
7.1. Impact associated with location	<ul style="list-style-type: none"> <li>Layout of camps shall be prepared by contractor and reviewed by PWD.</li> <li>All camps should be established with prior permission from PCB.</li> <li>Construction camps shall not be proposed within 1000m of Ecologically sensitive areas</li> <li>Location's for stockyards for construction materials shall be identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp shall be designed, built and operated such that no odour is generated.</li> <li>Layout of the campsite shall be approved by the CSC prior to its establishment</li> <li>Top soil shall be preserved as mentioned in the Clause 12</li> </ul>	Construction camps	Contractor
<b>8. Dismantling of Bridgework / Culverts</b>			
8.1. Generation of C & D waste, air and	<ul style="list-style-type: none"> <li>Bridges and culverts shall be planned for demolition during dry season</li> </ul>	Bridge and Culvert locations	Contractor



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Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
water pollution	<p>when the flows are lowest.</p> <ul style="list-style-type: none"> <li>In case of perennial streams, water shall be diverted away from the work area temporarily and water way shall be protected from contamination through silt fencing.</li> <li>Prevent earthwork, stonework, materials and appendage from impeding cross-drainage at rivers, streams, water canals and existing irrigation and drainage systems</li> </ul>		
<b>9. Management of Construction Debris</b>			
9.1. Selection of dumping site	<ul style="list-style-type: none"> <li>Contractor to submit a waste/spoil disposal plan and get it approved by AE and EA.</li> <li>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.</li> <li>Unproductive/ waste land shall be selected for dumping sites away from residential areas and water bodies.</li> <li>Dumping sites must be having adequate capacity equal to the number of debris generated.</li> <li>Public perception and consent from the village Panchayats has to be obtained before finalizing the location.</li> </ul>	Throughout the project corridor	Contractor
9.2. Reuse and disposal of construction and dismantled waste	<ul style="list-style-type: none"> <li>All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping.</li> <li>Unusable and non-bituminous debris materials should be suitably disposed of at pre-designated disposal locations, with approval of the concerned authority.</li> <li>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.</li> <li>Unusable and surplus materials, as determined by the Project Engineer, will be removed and disposed off-site.</li> </ul>	Throughout the project corridor	Contractor
<b>10. Site Restoration and rehabilitation</b>			
10.1. Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> <li>Contractor will prepare site restoration plans, which will be approved by the 'AE'.</li> <li>The clean-up and restoration operations are to be implemented by the contractor prior to demobilization.</li> <li>All construction zones including culverts, road-side areas, camps, hot mix</li> </ul>	Throughout the project corridor, construction camp sites and borrow areas	Contractor



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Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>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 AE.</p> <ul style="list-style-type: none"> <li>All the opened borrow areas will be rehabilitated and 'AE' will certify.</li> </ul>		
<b>C. Operation Stage</b>			
<b>1. Air Quality</b>			
1.1. Air pollution due to vehicular movement.	<ul style="list-style-type: none"> <li>Compensatory tree plantations considered as roadside plantation shall be maintained as prescribed by Assam Governments' Policy.</li> <li>Regular maintenance of the road will be done to ensure good surface condition</li> <li>Ambient air quality monitoring. If monitored parameters exceeds prescribed limit, suitable control measures must be taken.</li> <li>Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption.</li> <li>Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipment.</li> <li>Ambient Air Quality monitoring</li> </ul>	Throughout the corridor	Operation and Maintenance Agency
<b>2. Noise</b>			
2.1. Noise due to movement of traffic	<ul style="list-style-type: none"> <li>Effective traffic management and good riding conditions shall be maintained</li> <li>The effectiveness of the measures should be monitored and if need be, solid noise barrier shall be placed.</li> <li>Ambient Noise Quality monitoring.</li> </ul>	Sensitive receptors	Operation and Maintenance Agency
<b>3. Land and Soil</b>			
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none"> <li>Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures</li> <li>Necessary measures to be followed wherever there are failures</li> </ul>	At embankment slopes and other probable soil erosion areas	Operation and Maintenance Agency
<b>4. Water resources</b>			
4.1 Siltation	<ul style="list-style-type: none"> <li>Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion.</li> <li>Monitoring of surface water bodies</li> </ul>	Near surface water bodies	Operation and Maintenance Agency
4.2 Water logging due to blockage of drains, culverts or streams	<ul style="list-style-type: none"> <li>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.</li> <li>Monitoring of water borne diseases due to stagnant water bodies</li> </ul>	Near water bodies and cross drainage structures and side drains	Operation and Maintenance Agency
<b>5. Flora</b>			



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Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
5.1 Vegetation	<ul style="list-style-type: none"> <li>Planted trees, shrubs, and grasses to be properly maintained.</li> <li>The tree survival audit to be conducted at least once in a year to assess the effectiveness</li> </ul>	Project tree plantation site	Operation and Maintenance Agency

**2. Social**

Social Issues	Measures to be adopted	Locations	Implementation Responsibility
<b>A. Pre-Construction and Design Stage</b>			
<b>1. Loss of Land and Assets</b>			
1.1. Livelihood loss to affected persons	<ul style="list-style-type: none"> <li>Road improvement work to be accommodated within available ROW to the extent possible</li> <li>Social Impact Assessment and Resettlement Plan to be undertaken as per State, National Act, Rules &amp; policy and AIIB guidelines</li> <li>Complete all necessary land and property acquisition procedures prior to the commencement of civil works in that stretch.</li> <li>Adherence to land acquisition procedure, Compensation and assistance in accordance to approved Resettlement Plan (RP)</li> <li>Implementation of Rehabilitation &amp; Resettlement as per approved RP.</li> </ul>	Land Acquisition involved along the project road. Details to be provided in Social Assessment report	PWRD, ASSAM
<b>2. Relocation of Cultural Property</b>			
2.1. Loss of heritage	<ul style="list-style-type: none"> <li>In case there is an impact on religious and/ or cultural properties, they will be relocated at suitable locations, as desired by the community before construction starts.</li> <li>For partially impacted structures enhancement measures shall be applied at the same sites before construction begins, depending on the availability of space, requirement of the communities and fund availability.</li> <li>As far as possible, the architectural elements of the structure should be conserved/ reflected/ translated into the design of new structures in accordance with consultations with the community</li> <li>Meaningful Community meetings shall be conducted to discuss relocation aspects, siting of structures etc.</li> <li>Relocation sites for all cultural properties shall be selected in consultation with concerned communities, local administrative authorities/departments as the case may be.</li> </ul>	Throughout project corridor, if any	Civil Construction Contractor
<b>B. Construction Stage</b>			
<b>1. Labour Codes</b>			



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Social Issues	Measures to be adopted	Locations	Implementation Responsibility
1.1. Labour	<ul style="list-style-type: none"> <li>All the Labour Codes and Acts in effect will have to be maintained properly.</li> <li>No Child labour (person below 14 years of age) will be allowed to work in any capacity in the construction.</li> </ul>	Construction site, offices, Labour Camp etc.	Contractor
<b>2. Procurement of Machinery - Crushers, Hot-mix Plants &amp; Batching Plants</b>			
1.2. Air, noise and water Pollution	<ul style="list-style-type: none"> <li>Hot-mix and batching plants shall be sited sufficiently away (1000m) away from residential / settlement locations, forest areas, wildlife movement areas and commercial establishments, preferably in the downwind direction.</li> <li>Hot mix plant should be fitted with dust extraction unit.</li> <li>DG sets with stacks of adequate height and use of low sulphur diesel as fuel.</li> </ul>	Crushers, Hotmix plants & Batching Plants	Contractor
<b>3. Flora and Fauna</b>			
2.1 Vegetation loss due to site preparation and construction activities.	<ul style="list-style-type: none"> <li>Preference to locals in plantation activities</li> <li>Regular maintenance of all trees planted.</li> </ul>	Throughout the project corridor	Contractor with Forest Department
<b>4. Construction Camps/ Occupational Health</b>			
3.1 Impact associated with location	<ul style="list-style-type: none"> <li>Construction camps shall not be proposed within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community.</li> </ul>	All construction camp	Contractor
<b>C. Operation Stage</b>			
<b>1. Noise</b>			
1.1. Noise due to movement of traffic	<ul style="list-style-type: none"> <li>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.</li> </ul>	Sensitive receptors	Operation and Maintenance Agency

**3. Health**

Health Issues	Measures to be adopted	Locations	Implementation Responsibility
<b>A. Construction Stage</b>			
<b>1. Air Quality</b>			
1.1. Dust Generation due to construction activities, transport, storage and handling of construction materials	<ul style="list-style-type: none"> <li>Contractor to submit location and layout plan for storage areas of construction materials approved by Authorities</li> <li>Transport, loading and unloading of loose materials through covered vehicles.</li> <li>Storage areas to be located downwind of the habitation area.</li> </ul>	Throughout the project corridor	Contractor



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Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	<ul style="list-style-type: none"> <li>Dust Suppression/ water spraying using tankers on earthworks, unpaved haul roads and other dust prone areas twice a day using minimum four tankers a day, during construction period.</li> <li>Provision of PPEs to workers.</li> </ul>		
<b>2. Noise</b>			
1.2. Noise from construction vehicles, equipment and machinery.	<ul style="list-style-type: none"> <li>The contractors will provide prior notification to the community on the schedule of noisy construction activities.</li> <li>All equipment to be timely serviced and properly maintained.</li> <li>Timing of noisy construction activities shall be done during night time and weekend near schools,</li> <li>Implement noisy operations intermittently to reduce the total noise generated</li> <li>Bottlenecks to be removed.</li> <li>Construction equipment and machinery to be fitted with silencers and maintained properly.</li> <li>Only IS approved equipment to be used for construction.</li> <li>Construction activities should be carried out in non-peak hours.</li> <li>High noise producing machineries should be placed at least 500 m away from residences.</li> <li>Contractor shall provide noise barriers to the suggested locations of identified schools/ Temples/health centers prior to commencement of work.</li> <li>Honking restrictions near sensitive areas.</li> <li>Noise monitoring as per EMOP, based on the monitoring results, the Engineer, if required, shall recommend any additional noise mitigation measures required to be implemented by the Contractor.</li> </ul>	Built-up-Stretches are: Deesang Kinar Bangali, Duliajan, Kathalguri  Sensitive Receptors in close vicinity are:  Educational Institutions (11+600, 12+000, 14+550, 15+000, 15+950, 18+200, 19+900, 20+850, 22+400)	Contractor
<b>2. Land and Soil</b>			
2.1. Borrow area management	<ul style="list-style-type: none"> <li>Transportation of earth materials should be done in covered vehicles.</li> <li>Borrow area 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 prevent it from mosquito breeding.</li> </ul>	Borrow site location as identified in DPR or any selected borrow area	Contractor
<b>3. Construction Camps/ Occupational Health</b>			
3.1. Impact associated with location	<ul style="list-style-type: none"> <li>Unless otherwise arranged by the local sanitary authority, arrangements for disposal of excreta suitably approved by the local medical health or municipal authorities or as directed by Engineer shall be provided by the contractor</li> </ul>	All construction camp	Contractor



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Health Issues	Measures to be adopted	Locations	Implementation Responsibility
1.3. Worker's Health in construction camp	<ul style="list-style-type: none"> <li>• The location, layout and basic facility provision of each labor camp will be submitted to AE and approved by EA.</li> <li>• The contractor will maintain necessary living accommodation and ancillary facilities in hygienic manner.</li> <li>• Adequate water and sanitary latrines (separate for males and females) with septic tanks and soak pits shall be provided.</li> <li>• Preventive medical facilities including health personal in camp along with tie ups with nearest hospital or health facility</li> <li>• 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.</li> <li>• No liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community.</li> <li>• Awareness raising to immigrant workers/local community on communicable diseases such as COVID-19 and sexually transmitted diseases such as HIV, AIDs and others.</li> <li>• No material will be so stacked or placed as to cause danger or inconvenience to any person or the public.</li> <li>• All necessary fencing and lights will be provided to protect the public in construction zones.</li> <li>• All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the „ Engineer“.</li> </ul>	All construction camp	Contractor
1.4. Covid-19 Health & Safety (General Directions to the workers)	<ul style="list-style-type: none"> <li>• Avoid handshake, Only Namaste</li> <li>• Non-essential physical work that requires close contact between workers should not be carried out</li> <li>• Work requiring physical contact should not be carried out</li> <li>• Plan all other work to minimize contact between workers</li> <li>• Wash hands often (every 1-2 hrs. or frequently as possible) with soap for at least 20 seconds</li> <li>• Use hand sanitizer</li> <li>• No person should enter the work site other than the authorized</li> </ul>	All construction camp	Contractor



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Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	<p>persons mentioned by supervisor during start of work</p> <ul style="list-style-type: none"> <li>• All must implement social distancing by maintaining a minimum distance of 6-feet from others at all times to eliminate the potential of cross contamination.</li> <li>• Avoid face to face meetings – critical situations requiring in-person discussion must follow social distancing i.e., 6 ft from others.</li> <li>• Conduct all meetings via conference calls, if possible. Do not convene meetings of more than 10 people. Recommend use of cell phones, texting, web meeting sites and conference calls for project discussion</li> <li>• All individual work group meetings/ talks should follow social distancing</li> <li>• At each job briefing/toolbox talk, employees are asked if they are experiencing any symptoms, and are sent home if they are</li> <li>• Each worksite should have laminated COVID-19 safety guidelines and handwashing instructions</li> <li>• All restroom/toilet facilities should be cleaned (min twice a day), and handwashing facility must be provided with soap, hand sanitizer and paper towels</li> <li>• All surfaces should be regularly cleaned, including mobiles, tabletops /surfaces, door handles, laptops, records, etc.</li> <li>• All common areas and meeting areas are to be regularly cleaned (min twice a day) and disinfected at least twice a day</li> <li>• All persons to maintain their own water bottle, and should not be shared.</li> <li>• To avoid external contamination, it is recommended everyone bring food from home</li> <li>• Please maintain Social Distancing separation during breaks and lunch.</li> <li>• Cover coughing or sneezing with a tissue, then throw the tissue in the trash and wash hands, if no tissue is available then cough /sneeze into your upper sleeves or elbow. Do not cough or sneeze into your hands.</li> <li>• Clean your hands after coughing or sneezing thoroughly by using soap and water (minimum for 20 seconds). If soap and water are not available, please use a hand sanitizer. The Contractor shall ensure adequate quantities of sanitizer and soap are made available at all locations including site offices, meeting rooms, corridors, washrooms /toilets, etc. as appropriate.</li> </ul>		



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Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	<ul style="list-style-type: none"> <li>• Avoid touching eyes, nose, and mouth with your hands</li> <li>• To avoid sharing germs, please clean up after Yourself. DO NOT make others responsible for moving, unpacking and packing up your personal belongings</li> <li>• Work schedules are adjusted to provide time for proper cleaning and disinfecting as required.</li> </ul>		
<p>1.5. Workplace prevention practices (Safety measures for ongoing Covid-19 Pandemic)</p>	<ul style="list-style-type: none"> <li>• At the start of each shift, confirm with all employees that they are healthy and inform all workers of reusable and disposable PPE.</li> <li>• Outside person(s) should be strictly prohibited at worksite</li> <li>• All construction workers will be required to wear cut-resistant gloves or the equivalent.</li> <li>• Use of eye protection (reusable safety goggles/face shields) is recommended. The supply of eye protection equipment to the workers is considered as a standard part of PPE during construction works.</li> <li>• In work conditions where required social distancing is impossible to achieve, such employees shall be supplied with standard face mask, gloves, and eye protection.</li> <li>• All employees shall drive to work site as per the prevailing guidelines of the Government.</li> <li>• When entering a machine or vehicle which you are not sure you were the last person to enter, make sure that you wipe down the interior and door handles with disinfectant (with 1% sodium hypochlorite solution daily) prior to entry. Adequate quantity of the disinfectant shall be provided by the Contractor at all such site-specific locations.</li> <li>• Workers should maintain separation of 6' from each other.</li> <li>• Multi person activities will be limited where feasible (two persons lifting activities)</li> <li>• Gathering places on the site such as sheds and/or break areas will be eliminated, and instead small break areas will be used with seating limited to ensure social distancing.</li> <li>• Contact the cleaning person of the worksite and ensure proper COVID-19 sanitation processes. Increase cleaning/disinfection visits to at least 2 times a day. Cleaning person(s) to be provided with gloves, gown and face mask for each cycle of cleaning.</li> <li>• The Contractor shall make available adequate supply of PPE and</li> </ul>	<p>All construction camp</p>	<p>Contractor</p>



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Health Issues	Measures to be adopted	Locations	Implementation Responsibility
	<p>chemicals while the threat of COVID-19 continues.</p> <ul style="list-style-type: none"> <li>• Clean all high contact surfaces a minimum of twice a day in order to minimize the spread of germs in areas that people touch frequently. This includes but is not limited to desks, laptops and vehicles</li> <li>• All employees to maintaining good health by getting adequate sleep; eating a balanced, healthy diet, avoid alcohol; and consume plenty of fluids.</li> <li>• Continuation of works in construction project with workers available on site and no workers to be brought in from outside</li> <li>• The site offices shall have adequate ventilation. The air conditioning or ventilation systems installed at the site offices would have high-efficiency air filters to reduce the risk of infection. The frequency of air changes may be increased for areas where close personal proximity cannot be fully prevented such as control rooms, elevators, waiting rooms, etc.</li> <li>• The Contractor shall carry out contactless temperature checks for the workers prior to site entrance, during working hours and after site works to identify persons showing signs of being unwell with the COVID-19 symptoms.</li> </ul>		

**4. Safety**

Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
<b>A. Pre-Construction and Design Stage</b>			
<b>1. Alignment</b>			
1.1. Risk due to constricted sections, pavement damage due to use of unsuitable sub-grade material and inadequate drainage provisions in habitat area	<ul style="list-style-type: none"> <li>• CBR value of subgrade adopted in consistent to MORTH guidelines</li> <li>• Increase in vent size of cross drains with inadequate waterways</li> <li>• Maintain road level above HFL as per site conditions and MORTH guidelines</li> <li>• Provision of new cross drainage structures</li> <li>• Cover drains in built up area</li> <li>• Side drains on hill side in Ghat section and open lined drain in open areas all along the alignment</li> </ul>	Geometric improvement of curves 63 CD structures proposed for improvement Covered drain = 3.128 km	DPR Consultant during preliminary and detailed design
1.2. Safety along the proposed alignment	<ul style="list-style-type: none"> <li>• Horizontal and vertical profile to be improved as per MORTH/IRC specifications considering land availability.</li> <li>• Speed limitations near built up sections and sensitive locations by</li> </ul>	Built-up-Stretches are: Deesang Kinar Bangali, Duliajan, Kathalguri	DPR Consultant during preliminary and detailed design



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	installing rumble strips/speed breakers etc. <ul style="list-style-type: none"> <li>Provision of side-walks in built up sections over cover drains.</li> <li>Provision of cautionary and warning signs, boards near built up sections, sensitive receptors and forest areas</li> <li>Provision of safety kerb at all bridges.</li> <li>Signs and marking viz. delineators, object markers, safety barriers at hazardous locations.</li> <li>Improvement of all major junctions as per MORTH guidelines</li> <li>Provision of Solar blinkers and Solar street lights</li> </ul>	Sensitive Receptors in close vicinity are:  Educational Institutions (11+600, 12+000, 14+550, 15+000, 15+950, 18+200, 19+900, 20+850, 22+400)	
<b>2. Natural Hazards</b>			
2.1. Damage to pavement integrity like rutting, embankment softening and migration of liquid asphalt.	<ul style="list-style-type: none"> <li>Design considers the risk of climate change in the region and accordingly uses asphalt specifications</li> </ul>	Entire stretch	DPR Consultant
2.2. Earthquake	<ul style="list-style-type: none"> <li>Relevant IS codes have been adopted in designing the structures to sustain the magnitude of earthquake corresponding to seismic zone of the project area</li> </ul>	Entire stretch	DPR Consultant during preliminary and detailed design
2.3. Flooding/Water Logging	<ul style="list-style-type: none"> <li>CD structures designed and improved for 50-year return period</li> <li>Roadside drains improved</li> <li>60 CD structures to be reconstructed/ improved</li> <li>3 CD structures are proposed for new construction</li> </ul>	No Anticipated water logging location as per TCS. Covered drain = 3.128 km	DPR Consultant during preliminary and detailed design
<b>3. Shifting of Utilities and common property resources</b>			
3.1. Disruption of utility services and common property resources to local community	<ul style="list-style-type: none"> <li>Geometric adjustments made to minimize shifting needs or loss to any facilities</li> <li>All telephone and electrical poles/wires, underground cables/pipelines should be shifted before start of construction.</li> <li>Necessary permissions and payments should be made to relevant utility service agencies to allow quick shifting and restoration.</li> <li>Local people must be informed through appropriate means. about the time of shifting of utility structures and potential disruption of services if any</li> <li>Relocation of. wells, hand pumps at suitable locations with consent from local community.</li> <li>Early completion of works for schools, colleges and health centres including shifting of gates and construction of boundary walls shall be planned during holidays so that the risk of accidents and disturbance to day-to-day activity of such institutions are minimized.</li> </ul>	Throughout project corridor	Contractor



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	<ul style="list-style-type: none"> <li>Proper placement (as per codes) of passenger shelters/bus stops shall be ensured to prevent distress to the commuters and passengers.</li> <li>Relocation sites for all CPRs shall be selected in consultation with concerned communities, local administrative authorities/departments. Concerned authority, local body and public must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any, so as to ensure that work does not get affected.</li> </ul>		
3.2. Road Safety Audit / Inspection at Design Stage	<ul style="list-style-type: none"> <li>Road Safety Audit (Design Stage) shall be conducted as per IRC SP 88 and all safety interventions shall be complied</li> </ul>	Design Elements of the project roads	Design Consultant with Safety Expert
<b>B. Construction Stage</b>			
<b>1. General</b>			
1.1. Safety Procedures	<ul style="list-style-type: none"> <li>The Contractor shall: <ul style="list-style-type: none"> <li>Comply with all applicable safety regulations,</li> <li>Take care of the safety of all personnel who are entitled to be on the Site</li> <li>Use reasonable efforts to keep the site and works clear of unnecessary obstructions so as to avoid danger to personnel,</li> <li>Fencing, lighting, guarding and supervision of the works shall be carried out and provided until completion and taking over. It is necessary to provide any temporary works (including roadways, footways, guards and fences) as necessary, since the execution of these works, shall not raise a concern for the purpose of use and protection of the public and of owners as well as occupiers of adjacent land.</li> <li>A construction safety checklist to be prepared and implemented</li> </ul> </li> </ul>	All Construction Sites	Contractor
1.2. Care and supply of Documents	<ul style="list-style-type: none"> <li>The contractor shall prepare, submit and obtain approval from the Engineer for construction of the Safety Management Plan, and the same shall be prepared 14 days prior to commencement of construction works at site.</li> </ul>		Contractor
1.3. Contractors general obligations	<ul style="list-style-type: none"> <li>All design calculations and fabrication drawings for temporary works (such as form-work, staging, centring, scaffolding, specialized construction, handling and launching equipment and the like) material lists for structural fabrication as well as detailed drawings for templates, and anchorage and temporary support details for pre stressing cables as well as bar bending and cutting schedules for</li> </ul>		Contractor



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	<p>reinforcement, etc shall be prepared by the contractor at his own cost and forwarded to the Engineer at least six weeks in advance of the actual constructional requirements. The Engineer will check the same for the contractor's use with amendments.</p>		
<p>1.4. Personal Safety Measures for Labour, Material handling , Painting etc</p>	<p>Construction Safety Plan shall be prepared by the Contractor as per Factory Act, 1948, Factories (Amendment) Act, 1987 (Chapter -5 Safety Building and Other Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996. The safety plan shall be prepared during mobilization and approved by Engineer and shall be adhered to by the Contractor throughout the construction period, and shall include provision of:</p> <ul style="list-style-type: none"> <li>• Protective footwear and protective goggles to all workers employed in mixing asphalt materials, cement, lime mortars, concrete etc.</li> <li>• Welders protective eye-shields to the workers engaged in welding works</li> <li>• Protective goggles and clothing to workers engaged in stone breaking activities and workers shall be seated at sufficiently safe intervals</li> <li>• The contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.</li> <li>• The contractor shall ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.</li> <li>• Contractor shall provide facemasks to the workers when paint is applied in the form of spray or a surface having dry lead paint when it is rubbed and scrapped.</li> <li>• The Contractor shall mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance.</li> </ul>	<p>All Construction Sites</p>	<p>Contractor</p>
<p>1.5. Health and Safety</p>	<ul style="list-style-type: none"> <li>• The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the contractor's personnel. In collaboration with local health authorities, the contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the site.</li> <li>• The contractor shall appoint an accident prevention officer at the site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the</li> </ul>	<p>All construction sites and labor camps</p>	<p>Contractor</p>



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility				
	<p>authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the works, the contractor shall provide whatever is required by this person to exercise this responsibility and authority.</p> <ul style="list-style-type: none"> <li>The contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence.</li> <li>The contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require</li> </ul>						
1.6. Risk from Electrical Equipment(s)	<ul style="list-style-type: none"> <li>No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public.</li> <li>All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer</li> </ul>	All construction equipment	Contractor				
1.7. Deployment of Personnel and Safety compliance	<p><b>The flagmen or flaggers shall be deployed (Ref : IRC SP 55) where:</b></p> <ul style="list-style-type: none"> <li>Workers or equipment intermittently block an unprotected traffic lane</li> <li>One lane is used for two direction of traffic</li> <li>Guidance, warning and control of traffic is considered necessary</li> <li>Hand flashers are tough and durable working on normal or rechargeable batteries with LED bulbs.</li> <li>To provide warning signal for impending hazard or danger on construction work zone, repair sites, trenches, digging of road tunnels etc.</li> </ul> <p><b>Reflective Clothing</b></p> <ul style="list-style-type: none"> <li>The reflective clothing shall meet the requirements of standards set up in IS: 15809-2008 or EN 471:2003.</li> </ul> <table border="1"> <thead> <tr> <th>User</th> <th>Colour of fluorescent jacket</th> </tr> </thead> <tbody> <tr> <td>Workers exposed to traffic</td> <td>Red, Orange</td> </tr> </tbody> </table>	User	Colour of fluorescent jacket	Workers exposed to traffic	Red, Orange	All the construction sites	Contractor
User	Colour of fluorescent jacket						
Workers exposed to traffic	Red, Orange						



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility				
	<table border="1" style="width: 100%;"> <tr> <td style="width: 70%;">Operators of road construction machineries</td> <td style="width: 30%;">Orange</td> </tr> <tr> <td>Supervising engineer and visiting higher officials</td> <td>Yellow</td> </tr> </table> <p><b>Roll up Signs</b></p> <ul style="list-style-type: none"> <li>• Mounting of the roll up sign on the portable stand</li> <li>• Mounting of the roll up sign on construction or maintenance vehicles</li> <li>• Mounting of the roll up sign on barricades</li> </ul> <p><b>Protective Gear to the workers</b></p> <ul style="list-style-type: none"> <li>• All the workers, exposed to moving roadway traffic or equipment in road construction zones shall wear high-visibility safety apparel, headgear, boots, gloves and protective gears for their protection.</li> </ul>	Operators of road construction machineries	Orange	Supervising engineer and visiting higher officials	Yellow		
Operators of road construction machineries	Orange						
Supervising engineer and visiting higher officials	Yellow						
1.8. Accessibility	<ul style="list-style-type: none"> <li>• The Contractor shall provide safe and convenient passage for vehicles; pedestrians and livestock to and from roadsides and property accesses by providing temporary connecting road, as necessary.</li> <li>• Construction activities that shall affect the use of side roads and existing accesses to individual properties, whether public or private, shall not be undertaken without providing adequate provisions to ensure uninterrupted access, as approved by the Engineer.</li> <li>• The Contractor shall take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up in a manner that traffic movement in any given area does not get affected.</li> </ul>	Through the project corridor	Contractor				
1.9. Planning for Traffic diversions and detours	<ul style="list-style-type: none"> <li>• As per Clause 112 of MoRTH</li> <li>• Detailed traffic control plans shall be prepared by the contractor and the same shall be submitted to the Engineer.</li> <li>• The Contractor shall provide specific measures for safety of pedestrians and workers as a part of traffic control plans. The Contractor shall ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.</li> <li>• The Contractor shall inform local community of changes in traffic routes and pedestrian access arrangements with assistance from</li> </ul>	All along the project corridor, access roads, bridges	Contractor				



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	Engineer and PIU.		
1.10. First Aid	<ul style="list-style-type: none"> <li>First aid measures shall be provided in the construction zones and labour camps.</li> </ul>	All the construction sites and labor camps	Contractor
1.11. Sensitive Receptors	<ul style="list-style-type: none"> <li>Sensitive receptors like schools, hospitals are provided with permanent noise barriers prior to the start of work in order to minimize the dust and noise impacts due to vehicle movement (during / post construction). Their effectiveness needs to be checked during operation phase.</li> <li>Construction activities shall be confined within the present available Col, regular strict monitoring/ supervision shall be done to minimize/control air-noise pollution and abatement of dust particles at minimum level possible using well maintained modern machineries</li> </ul>	Built up areas and public amenities	Contractor
<b>2. Noise</b>			
2.1. Noise from construction vehicles, equipment and machinery.	<ul style="list-style-type: none"> <li>PPEs to workers</li> </ul>	Built-up-Stretches are: Deesang Kinar Bangali, Duliajan, Kathalguri  Sensitive Receptors in close vicinity are:  Educational Institutions (11+600, 12+000, 14+550, 15+000, 15+950, 18+200, 19+900, 20+850, 22+400)	Contractor
<b>3. Traffic Management and Safety</b>			
3.1. Management of existing traffic and safety	<ul style="list-style-type: none"> <li>Traffic Management Plan shall be submitted by the contractor and approved by the AE.</li> <li>The traffic control plans shall contain 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.</li> <li>The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to</li> </ul>	Throughout the project corridor	Contractor



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	<p>avoid disruption to traffic flow.</p> <ul style="list-style-type: none"> <li>On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed.</li> <li>Restriction of construction activity to only one side of the existing road</li> <li>The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from "AE".</li> <li>Use of adequate signage's to ensure traffic management and safety. Conduct of regular safety audit on safety measures.</li> </ul>		
3.2. Safety during road works	<ul style="list-style-type: none"> <li>The contractor shall provide adequate signage and markings as per the instruction of the Engineer in the construction zones. The Clauses 112.4. of MoRTH (Traffic safety)</li> <li>Clause 112.5. of MoRTH (Maintenance and Diversions)</li> <li>IRC:SP:55 (Road signage and markings) shall be referred to for preparation of the relevant signage.</li> </ul>	All along the project corridor and haul roads	contractor
3.3. Traffic Safety and Pedestrian Safety	<ul style="list-style-type: none"> <li>Pedestrian Safety shall be ensured. Pedestrian circulation shall be demarcated prior to start &amp; unsafe areas shall be cordoned off. Ref Clause 112. of MoRTH (Arrangement for traffic during construction)</li> </ul>	All along the project corridor	Contractor
3.4. Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> <li>Contractors to adopt and maintain safe working practices.</li> <li>Usage of fluorescent and retroreflector signage, in local language at the construction sites.</li> <li>Training to workers on safety procedures and precautions.</li> <li>Mandatory appointment of safety officer.</li> <li>All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe entry and egress shall be complied with.</li> <li>Provision of PPEs to workers.</li> <li>Provision of a readily available first aid unit including an adequate supply of dressing materials.</li> <li>The contractor shall not employ any person below the age of 18 years for any work and also declare at site.</li> <li>Use of hazardous material should be minimized and restricted.</li> <li>Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or emergencies.</li> </ul>	Construction sites	Contractor



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
3.5. Accident risk to local community	<ul style="list-style-type: none"> <li>Accident Prevention Officer must be appointed</li> <li>Restrict access to construction sites only to authorized personnel.</li> <li>Physical separation must be provided for movement of vehicular and human traffic.</li> <li>All measures for the safety of traffic during construction viz. signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken.</li> <li>Provision of temporary diversions and awareness to locals before opening new construction fronts.</li> <li>Alternate access facility to common properties near construction zones</li> <li>Speed limitation wherever animal movement is anticipated.</li> </ul>	Throughout the project corridor, construction sites	Contractor
3.6. Pedestrians, cattle movement	<ul style="list-style-type: none"> <li>Temporary access and diversion, with proper drainage facilities.</li> <li>Access to the schools, temples and other public places must be maintained when construction takes place near them.</li> <li>Speed Limitation wherever cattle movement is expected.</li> <li>If any wild animal is found near the construction site at any point of time, the contractor shall acquaint the Engineer and execute the Engineer's instructions for dealing with the same.</li> <li>The Engineer shall report to the nearby forest office (range office) and shall take appropriate steps/ measures in consultation with the forest officials.</li> </ul>	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	Contractor
3.7. Road Safety Audit / Inspections at Construction stage	<ul style="list-style-type: none"> <li>Work zone safety audit as per IR SP 88 shall be carried out and findings of the audit to be complied as per IRC SP 55.</li> <li>The work zone safety audits shall be conducted on quarterly basis</li> </ul>	All along the project corridor, access roads and junctions	Contractor with Safety Expert
3.8. Road Safety Audit / Inspection at Pre opening Stage	<ul style="list-style-type: none"> <li>Road safety audit as per IR SP 88 shall be carried out and findings of the audit to be complied before pre-opening.</li> </ul>	All along the project corridor, access roads and junctions	Contractor with Safety Expert
<b>C. Operation Stage</b>			
<b>1. Noise and Pollution</b>			
1.1. Noise due to movement of traffic	<ul style="list-style-type: none"> <li>Speed limitation and honking restrictions near sensitive receptors locations.</li> </ul>	Sensitive receptors	Operation and Maintenance Agency
1.2. Pollution Monitoring	<ul style="list-style-type: none"> <li>The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination are to be continued at pre-designated locations as identified in the Environmental Monitoring Plan and if necessary, at additional</li> </ul>	All along the project corridor	Operation and Maintenance Agency



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
	locations for comparative study of pre and post operation data in order to ensure further improvement/modification in similar future works		
1.3. Atmospheric Pollution	<ul style="list-style-type: none"> <li>Ambient air concentrations of various pollutants shall be monitored as envisaged in the Environmental Monitoring Plan at pre designated locations to compare the levels with the preconstruction data.</li> <li>Additional data at other location may be collected as per any site specific requirement</li> </ul>	All along the project corridor	Operation and Maintenance Agency
1.4. Soil Erosion and Monitoring of Borrow Areas	<ul style="list-style-type: none"> <li>Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankments and other places expected to be affected, shall be carried to record and monitor the effectiveness of such structures after the completion of project, so as to evaluate the beneficial effects of each type of activity together with the cost involved.</li> </ul>	Borrow areas	Operation and Maintenance Agency
<b>2. Maintenance of Right of Way and Safety</b>			
2.1. Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none"> <li>Maintain shoulder completely clear of vegetation.</li> <li>Minimum offset as prescribed in IRC: SP:21-2009 to be maintained</li> <li>Regular maintenance/trimming of plantation along the roadside</li> <li>No invasive plantation near the road.</li> <li>Ensure no fuel accumulation and clearances of vegetation by burning near forest areas to avoid forest fires</li> </ul>	Throughout the corridor especially near accident prone curves and forest areas	Operation and Maintenance Agency
2.2. Accident risks associated with traffic movement	<ul style="list-style-type: none"> <li>Traffic control measures, including speed limits, will be forced strictly.</li> <li>Further encroachment of squatters within the ROW will be prevented.</li> <li>No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local law</li> <li>Monitor/ensure that all safety provisions included in design and construction phase are properly maintained</li> <li>Highway patrol unit(s) for round the clock patrolling. Help lines for accident reporting and ambulance services with minimum response time for rescue of any accident victims, if possible.</li> </ul>	Throughout the Project route	Operation and Maintenance Agency
2.3. Transport of Dangerous Goods	<ul style="list-style-type: none"> <li>Existence of spill prevention and control and emergency responsive system</li> <li>Emergency plan for vehicles carrying hazardous material</li> </ul>	MI: Status of emergency system – whether operational or not  PT: Fully functional emergency	Operation and Maintenance Agency



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Safety Issues	Measures to be adopted	Locations	Implementation Responsibility
2.4. Road Safety and Maintenance of Assets	<ul style="list-style-type: none"> <li>No advertisement/hoardings shall be allowed within the Right of Way limits of the project road.</li> <li>Regular maintenance and cleaning of assets such as sign boards, bus stops, drains etc. shall be undertaken.</li> </ul>	<p>system</p> <p>All along the project corridor</p>	Operation and Maintenance Agency
2.5. Monitoring and Evaluation of Operational Performance of Environmental Mitigation Measures	<ul style="list-style-type: none"> <li>The PIU shall monitor the operational performance of the various mitigation/ enhancement measures carried out as part of the project. Monitoring and performance indicators have been indicated in Environmental Monitoring Plan</li> </ul>	All along the project corridor	Operation and Maintenance Agency
2.6. Maintenance of Drainage	<ul style="list-style-type: none"> <li>PIU shall ensure that all drains (side drains and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding without damaging the spurs and check dams erected to stabilize the course and flow of all such drainage channels.</li> <li>PIU shall ensure that all the sediment/oil and grease traps set up at the water bodies are cleared once in every three months</li> </ul>	At locations where bridge works, culvert works and side drains (built up areas) proposed	Operation and Maintenance Agency
2.7. Road Safety Audits / Inspections at O&M Stage	<ul style="list-style-type: none"> <li>O&amp;M stage safety audit as per IR SP 88 shall be carried out and findings of the audit to be complied as per IRC SP 55.</li> <li>The O&amp;M stage safety audits shall be conducted on quarterly basis for the first year followed by half yearly in subsequent years.</li> </ul>	All along the project corridor, access roads and junctions	O&M agency with Safety Expert



**Table 83: Biodiversity Management Plan**

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
<b>Pre-construction Stage</b>						
1.	Disturbance to Natural Vegetative community	<ul style="list-style-type: none"> <li>Prior to clearing and grubbing work, the Biodiversity Specialists will conduct pre-construction checks, to avoid accidental injury or death to sensitive species.</li> <li>The Biodiversity Specialists will prepare a monitoring report and sensitive map/ area showing sensitive locations. This will be shared with workers through toolbox talks, regular awareness campaigns so that sensitive areas can be avoided or bespoke mitigation implemented</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
2.		<ul style="list-style-type: none"> <li>Pre-construction checks will include bird nesting within hollow trees and other places of shelter on trees in corridor of impacts.</li> <li>Identification of sites and peak visiting period for migratory birds in the project area of influence.</li> </ul>	Avifauna (Birds)	Throughout the project stretch	Contractor	CSC/ PIU
3.		<ul style="list-style-type: none"> <li>Prior to construction, it is important to determine the area, locations which are preferentially used by Wild animal (large mammals &amp; Amphibians, reptiles, Arboreal) during feeding time possibly Morning and evening near the buffer area of PAs, close to Project areas, so that conservation effort can be focused on these locations.</li> </ul>	Overall Sensitive Fauna	Throughout the project stretch	Contractor	CSC/ PIU
4.	Debris Management	<ul style="list-style-type: none"> <li>Debris management plan as suggested in EIA should be followed strictly at site</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
5.	Location of Labour camp	<ul style="list-style-type: none"> <li>Labour camps should be prohibited in protected and high-biodiversity areas / Buffer areas/Reserve Forest</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
<b>Construction Stage</b>						
6.	Sensitivity among worker and project staff	<ul style="list-style-type: none"> <li>Workers will be made aware of the ecological sensitivities of the areas and will be trained in mitigation for any unforeseen events, including the presence of uncommon habitats and species.</li> <li>Hunting and gathering by Project staff will be prohibited, Hunting by Project staff should be viewed</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		as a serious violation				
7.	Disturbance due to excess light in eco sensitive areas	<ul style="list-style-type: none"> <li>Work during night time will be kept to a minimum where possible. Wherever lighting required, lights will be kept away from areas of woodland and hedges and lighting will be directed to where it is needed with marginal light spillage.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
8.	Waste Management Issue	<ul style="list-style-type: none"> <li>A waste management plan will be implemented. Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Vulture, kites that regularly forage in waste dumps to potentially damaging waste products.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
9.	Dust Issues	<ul style="list-style-type: none"> <li>Vehicle speeds on access and haul roads will be controlled to minimise dust emissions and the risk of mortality of animals.</li> <li>Water sprinkling shall be practised at construction sites, earthen access and haul roads.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
10.	Labour sensitivity	<ul style="list-style-type: none"> <li>Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Waste water from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
11.	Construction Activity	<ul style="list-style-type: none"> <li>Temporary construction material sites, quarries, borrow pits, and storage areas can also have an effect on habitat loss and degradation. Such sites shall be rehabilitated as appropriate, following their use but before construction is completed.</li> </ul>	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
12.	Overall Safety Measure	<ul style="list-style-type: none"> <li>To minimize harm to biodiversity during road construction (or improvement, rehabilitation, or maintenance), it is important to regulate the behaviour of workers in the field. Specifically, workers under the projects should be prohibited from hunting, fishing, wildlife capture (including for pets), plant collection, or burning of vegetation, anywhere in or near the project</li> </ul>	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		area.				
<b>Post Construction Phases</b>						
13.	Monitoring of sensitive species (reported during detailed survey along the corridor)	<ul style="list-style-type: none"> <li>Monitoring must take place under the direction of an appropriately qualified person and the results of the monitoring must be kept in a written record</li> </ul>	Overall	Throughout the project stretch	Contractor	PIU
14.	Landscaping & compensatory afforestation	<ul style="list-style-type: none"> <li>Landscaping and green belt along the corridor will utilize predominantly native vegetation endemic to the region, sourced and consulted from local area. This will attenuate the negative impact originated from construction activities.</li> <li>All re-vegetation carried out for the Project will be carefully reviewed and monitored to avoid accidental introduction of invasive alien species</li> </ul>	Overall	Throughout the project stretch	Contractor	PIU
15.	Accidental discharge in water	<ul style="list-style-type: none"> <li>To avoid Accidental discharge; leakage from oil receptors, refuelling of vehicle, washing of vehicles should follow the approach of routine and periodical maintenance</li> <li>Oil interceptor shall be installed at plant and vehicle workshop</li> </ul>	Fishes	At bridge construction locations	Contractor	PIU
16.	Overall Management oil contamination	<ul style="list-style-type: none"> <li>Automotive workshop establishment shall be avoided and discouraged along the corridor especially which is undergoing commercial activities without maintaining preventive measure of oil contamination/spillage.</li> </ul>	Overall species	At bridge construction locations	Contractor	PIU
17.	Sensitivity among project people, locals etc.,	<ul style="list-style-type: none"> <li>Awareness programme as training, workshop shall be organized to spread the awareness for protection of endangered species and provisions of punishment against poaching or disturbing as per WPA 1972 under GOI.</li> </ul>	Overall species	Throughout the project stretch	Contractor	PIU
18.	Road safety Treatment	<ul style="list-style-type: none"> <li>Wildlife warning signages with flashing lights and variable message boards have the potential to be more effective than static warning signs (As per World Bank</li> </ul>	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		Report). Such signs are most effective if employed during peak wildlife crossing periods (e.g., migration, morning, evening) or are associated with animal-activated detection systems that trigger flashing and/or message signs only when animals are present.				
19.		<ul style="list-style-type: none"> <li>Solar-powered flashing lights (with batteries for night-time operation) can be attached to static signs for operation during key periods such as elephant migration.</li> </ul>	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
20.		<ul style="list-style-type: none"> <li>To effectively reduce wildlife-vehicle collision incidence, lower design speed considerations will be integrated into road design and construction. Specific design speeds are used to engineer various geometric design features into a roadway, with minimum standards applied for different design speeds.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
21.		<ul style="list-style-type: none"> <li>Traffic calming managements, such as curb extensions, raised medians, rumble strips in the pavement, speed bumps, Reduced speed warning shall be undertaken by contractor for stretch close to sensitive areas</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
22.		<ul style="list-style-type: none"> <li>The Endangered species as listed in table will be monitored throughout the Project and additional mitigation implemented if necessary.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
23.		<ul style="list-style-type: none"> <li>To prevent animal casualty during operation phase, care has to be taken by the APWRD in consultation with the wildlife official and DFO. One forest check post has to be erected on both the end of roads falling close to protected area – <b>Dihing Patkai WLS</b>. Forest guards or CCTV cameras has to be installed at both the end and in between to keep eye on the plying vehicles. Sign Board 500 meters ahead of Wildlife Area has to be placed for traveller’s information.</li> <li>No honk zone &amp; speed limits of 20-30km/hr sign board has to be erected at every 500 meters on the roads falling near ecological-sensitive area</li> <li>Sign board of animal’s movement zone and CCTV</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna, Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		<p>Surveillance zone has to be installed before the check posts and in between the road.</p> <ul style="list-style-type: none"> <li>The death of animals if happening has to be reported along with locations. If repetitive deaths are happening at the same location or area, then PWRD has to take some preventive measures like adding animal's underpass or animal's accident zone sign board with speeds breakers.</li> </ul>				

**Table 84: Environmental Monitoring Plan**

Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
Air	Construction	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO	Respirable Dust Sampler to be located 50 m from the selected locations in the downwind direction. Use CPCB specified method	Ambient Air quality standards CPCB	24 hr. continuous for three seasons in a year for 2.5 years (once in a season)	Monitoring near all hot mix plant locations approved by the Engineer  Monitoring at construction sites near sensitive locations (32 Samples)	Contractor through approved monitoring agency
	24 hr. continuous, for three seasons for a year (once in a season)				Ambient Air Quality Monitoring (At 1 location where environmental monitoring during baseline data generation done) (6 Samples)		
Noise	Construction	Noise levels as Leq in dB	IS:4954-1968 as adopted by CPCB for identified study area CPCB/IS:4954-1968 Using Noise Level Meter	National Ambient Standard specified EPA,1986	24 hr. continuous (once in a month) for three seasons in a year for 2.5 years	At equipment yards/ Hot mix plants/ Construction Camps & Sensitive areas (32 Samples)	Contractor through approved monitoring agency
	24 hr. (once in a month) for three seasons in a year				Near Sensitive and residential/Commercial areas as directed by the Engineer		



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Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
					for 1 year	(6 Samples)	
Water Quality	Construction	pH, BOD, COD, Turbidity, Total Hardness, SS and others.	Grab Sample collected from source and analyzed as per Standard Methods for Examination of Water and Wastewater	Water quality standards by CPCB	Once in a Season for three seasons in a year for 2.5 years	Surface Water Quality (16 Samples)	Contractor through approved monitoring agency
	Operation					Discharge Water Quality (As per suggestion in monitoring plan)	
					Once in a Season for three seasons in a year for 1 year	(6 Samples)	
Soil Quality	Construction	NPK (ICAR Standards)	As approved by Authority Engineer	ICAR standards	Once in a Season for three seasons in a year for 2.5 years	At productive agricultural lands abutting traffic detours and traffic diversions, to be identified by the Engineer (16 Samples)	Contractor through approved monitoring agency
	Operation					At accident/spill locations involving bulk transport carrying hazardous material (6 Samples)	
Drainage Congestion	Construction	As approved by Authority Engineer	Visual Checks	None Specific	Throughout the Project Corridor especially Probable drainage congestion areas	Once in a year before rainy season	Contractor
	Operation			None Specific		Once in a year before rainy season	Contractor
Borrow Areas	Construction	IRC guidelines	Visual Checks	IRC guidelines + Compliance conditions of SEIAA	Borrow areas to be operated	Once in a month	Contractor with approval from PWD, Assam.
	Operation	Rehabilitation as per IRC guidelines	Visual Checks		Closed Borrow Areas	Quarterly for 1 year	PWD, Assam / AE
Construction sites and labour camps	Construction	Rapid audit as per reporting format	Hygiene, drainage Medical Facilities Etc.	IRC guidelines	Construction Sites and Camp	Quarterly during construction period	Contractor with approval from PWD, Assam
Tree Plantation	Construction	Surveillance monitoring of trees felling		As approved by Authority Engineer	Throughout the Project Section	During site clearance in construction phase	Compensatory: PWRD, Assam / Local Forest Departments



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Attribute	Project Stage	Parameter	Special Guideline	Standards	Frequency & Duration	Location	Implementation
	Operation	Audit for survival rate of trees plantation		IRC: SP:2009	Throughout the Project Section		The Engineer will be responsible for monitoring up to the Defect Liability Period in any particular stretch. After this period PWRD, Assam will be responsible for monitoring additional plantation
Record of Accident	Construction		Type, nature and cause of accidents. Methodology as approved by Authority Engineer	As approved by Authority Engineer	Throughout the stretch including construction sites, crusher, Hot Mix Plant, earthwork, demolition site etc.	Occurrence of accidents	Contractor
	Operation			-	Throughout the stretch	Occurrence of accidents	Road Safety unit of PWRD, Assam with support from local police



## 9.4 Chance Find Procedures

The Contractor shall inform the PWRD immediately upon discovery of a chance find of archaeological Property/ remains. All work at site should be stopped and follow the instructions of the PWRD in dealing with the same and start the work only after further advice from the PWRD. The PWRD shall seek direction from the Department of Archaeology before instructing the Contractor to recommence work on the site. The contractor shall take precautions to prevent his staff, labours or any other persons from removing and damaging any such article or thing.

## 9.5 Environmental and Social Monitoring and Reporting Program

The purpose of the environmental monitoring program is to ensure that the envisaged objectives of the project are achieved and result in desired benefits. To ensure the effective implementation of the mitigation measures and the Environmental and Social Management Plan (ESMP), an effective monitoring programme must be designed and carried out. The broke objectives of environmental monitoring plan are:

- To evaluate the performance of mitigation measure proposed in the ESMP,
- To evaluate the adequacy of EIA
- To suggest improvements in the management plan, if required,
- To assess change in environmental quality,

A comprehensive monitoring plan has been prepared for all stages of the project. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost, and responsibility for implementation and supervision. The monitoring program is designed for monitoring during construction and operation stages with details on budget and responsible agencies:

- Construction Stage: (30 months of construction period)
- Monitoring shall be carried out by the Contractor
- Six Monthly monitoring by the external agency shall be arranged by PIU from the Project cost budget. The monitoring report will be submitted by the agency to PWRD.
- Monitoring Programme and schedule for Key Performance Indicators (Physical, biological, and environmental management components identified as of its significance) are given in the following section:

### 9.5.1 Ambient Air Quality (AAQ) Monitoring

Ambient air quality parameters recommended for monitoring road development projects are PM<sub>2.5</sub>, PM<sub>10</sub>, Carbon Monoxide (CO), Oxides of Nitrogen (NO<sub>x</sub>), and Sulphur Dioxide (SO<sub>2</sub>). 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 for 3 seasons in a year excluding monsoon at the monitoring locations in accordance with the revised National Ambient Air Quality Standards formulated by MoEF&CC. (Annex 2).



### 9.5.2 Water Quality Monitoring

The physical and chemical parameters recommended for analysis of water quality relevant to road development project are pH, total solids, total dissolved solids, total suspended solids, and oil & grease. The monitoring of the water quality is to be carried out at all identified locations in accordance with the Indian Standard Drinking Water Specification – IS 10500: 2012 (Annexure 3). The locations, duration, and pollution parameters to be monitored are detailed in the Environmental Monitoring Plan.

### 9.5.3 Noise Levels Monitoring

The measurements for monitoring noise levels would be carried out at designated locations in accordance with the ambient Noise Standards formulated by the Ministry of Environment Forests and Climate Change (MoEF&CC) as given (Annexure 2). The noise level would be monitored on a twenty-four hours basis. Noise should be recorded at “A” weighted frequency using a slow time response mode of the measuring instrument. The measurement location, duration, and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan.

### 9.5.4 Tree Plantation

The survival of tree-plantation shall be monitored for three years of the operation phase. If the survival rate is found below 75%, additional compensatory plantation shall be done by the agency responsible for plantation and its maintenance. The survival rate monitoring shall be again taken up after 1 year. This cycle should continue until the 75% survival rate is achieved. Tree plantation would be done through the forest department, monitoring shall be carried out by PWRD.

### 9.5.5 Soil Erosion and Drainage Congestion

No significant soil erosion problem is anticipated due to the project either in the construction phase or in the operation phase. However, in the construction phase, some localized soil erosion may be noticed owing to construction activities. However, if soil erosion is noticed during the construction and operation phase, the corrective action shall be initiated and the frequency of check be increased to assess the tendency of occurrence.

### 9.5.6 Social Monitoring

The most crucial components/ indicators to be monitored are specific contents of the activities and entitlement matrix. The Resettlement Action Plan will contain indicators and benchmarks for achievement of the objectives under resettlement program. These indicators and benchmarks are of three kinds:

- Process indicators including project inputs, expenditures, staff deployment, etc.
- Output indicators indicating results in terms of numbers of displaced people compensated and resettled, training held, credit disbursed, etc. and
- Impact indicators related to the longer-term effect of the project on people's lives.



## 9.6 Environmental and Social Reporting System

The monitoring plan covering various performance indicators, frequency, and institutional arrangements of the project in the construction and operation stages, along with the estimated cost, is summarized in the Environmental Monitoring Plan.

The reporting system will operate linearly with the contractor who is at the lowest rank of the implementation system reporting to the CSC's Engineer, who in turn shall report to the PIU of PWRD, Assam. All reporting by the contractor and CSC's Engineer shall be quarterly. The PIU shall be responsible for preparing targets for each of the identified ESMP activities.

The environmental compliance monitoring and the progress reports on environmental components may be clubbed together and submitted to the PIU quarterly during the implementation period. The operation stage monitoring reports may be annual or biannual provided the Project Environmental Completion Report shows that the implementation was satisfactory. Otherwise, the operation stage monitoring reports will have to be prepared as specified in the said Project Environmental Completion Report.

Responsibilities for overseeing ESMP implementation will rest with the CSC's Engineer staff reporting to the PIU. Capacity to quantitatively monitor relevant ecological parameters would be an advantage but monitoring will primarily involve ensuring that actions taken are in accordance with contract and specification clauses, and specified mitigation measures as per the ESMP.

During the implementation period, a compliance report may include a description of the items of ESMP, which were not complied with by any of the responsible agencies. It would also report to the management about actions taken to enforce compliance. It may, however, be noted that certain items of the ESMP might not be possibly complied with for a variety of reasons. The intention of the compliance report is not to suppress these issues but to bring out the circumstances and reasons for which compliance was not possible (such as jurisdictional issues). This would help in reinforcing the implementation of the ESMP.

Photographic records will also be established to provide useful environmental monitoring tools. A full record will be kept as part of normal contract monitoring. Reporting and Monitoring Systems for various stages of construction and related activities have been proposed to ensure timely and effective implementation of the ESMP.

The reporting system has been prepared for each of the stages of road construction namely:

- Preconstruction stage
- Construction Stage
- Operation Stage

This reporting shall be done through:

- Reporting by the Contractor to the CSC's Engineer
- Reporting by CSC's Engineer to PIU.
- Reporting by PIU to PMU.
- Reporting by the PMU to AIIB



**Table 85: Detailed stage-wise reporting system**

Format No.	Item	Contractor	Construction Supervision Engineer		PWRD, Assam PIU	
		Implementation and Reporting to Construction Supervision Engineer	Supervision	Reporting to PIU	Oversee/ Field Compliance Monitoring	Reporting to Environment Officer of PIU
C1	Monitoring of construction site and construction camp	Before the start of work	-	Quarterly	-	Quarterly
C2	Target sheet for pollution monitoring	-	As required	After Monitoring	-	After Monitoring
C3	Target sheet for roadside plantation	-	Monthly	Quarterly	Quarterly	Bi-Annual
C4	Target sheet for monitoring of cleaning water bodies	-	Monthly	Quarterly	Quarterly	Bi-Annual
O1	Target sheet for pollution monitoring	-	-	-	As per Monitoring plan	After Monitoring
O2	Target sheet for survival reporting of roadside plantation	-	-	-	Quarterly	After Monitoring
O3	Target sheet for monitoring of cleaning water bodies	-	-	-	Quarterly	After Monitoring

Formats will be developed and provided by Construction Supervision Engineer to the contractor.

### **Social Reporting Requirements**

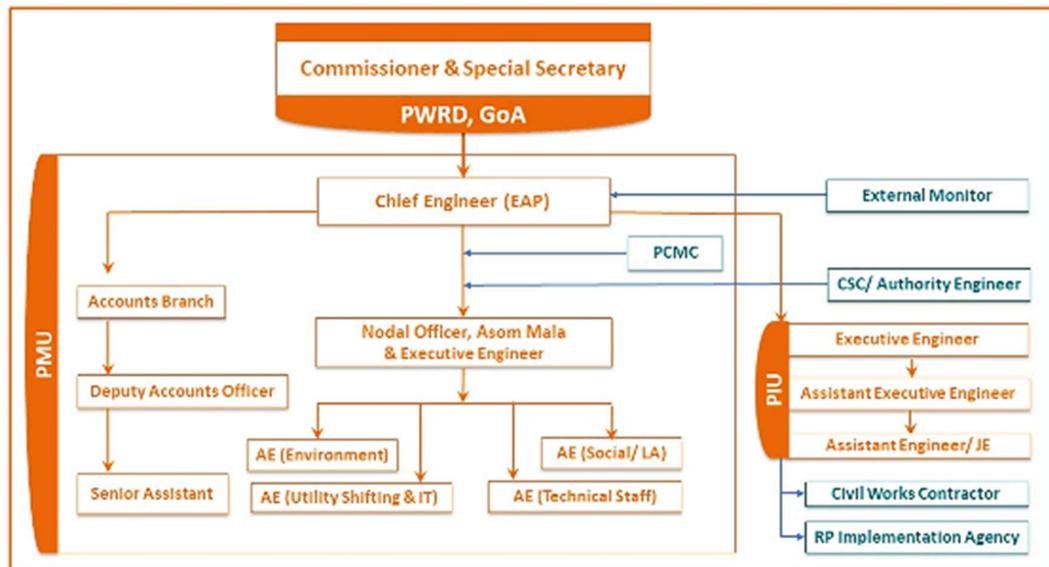
Project Division Office responsible for supervision and implementation of the Resettlement Action Plan will prepare monthly progress reports on resettlement activities and submit to PWRD. PWRD will submit semi-annual reports to AIIB.

The external monitoring expert responsible for monitoring of the Resettlement Action Plan implementation will submit a semi-annual review report to PWRD to determine whether resettlement goals have been achieved, more importantly whether livelihoods and living standards have been restored/ enhanced and suggest suitable recommendations for improvement.

The Independent Monitor for process monitoring under land being purchased under Mutual consent. The report shall be prepared and submitted to PWRD and AIIB on requirement basis till the process for purchase is complete.

## **9.7 Institutional Requirements**

Public Works Roads Department (PWRD), Government of Assam will be the executing agency. The Chief Engineer (EAP) will be the Project Director (PD) of state level Project Management Unit (PMU). PD PMU will be assisted by an Assistant Executive Engineer as Nodal Officer of Asom Mala Program. **Figure 64** shows the implementation arrangement for Asom Mala Program.



**Figure 64: Implementation Arrangement for Environmental and Social Safeguards**

### **9.7.1 Responsibilities of the Program Management Unit (PMU)**

The PMU will oversee overall execution and technical supervision, monitoring, and financial control of the project. The PMU shall be assisted by Program Coordination and Management Consultant (PCMC). The PMU will be responsible for the following:



- appointing Independent External Monitors, RP Implementing Agencies, Authority Engineers, Contract Supervision Consultants, Civil work contractors, other Implementing Agencies for PIU level/ Contract level/ Sub-project level/ PMU level, as and when where required;
- Liaising with district administration for direct purchase or land acquisition
- Preparation of ESMPF, Resettlement Planning Framework (RPF), Indigenous Peoples Planning Framework (IPPF) for ASRIP projects of Asom Mala program;
- Review and approving of Resettlement Plan (RP), Environmental and Social Management Plan (ESMP) and all other social and environmental safeguards documents and reports;
- Ensuring timely disbursement of compensation and assistance to the displaced persons in close coordination with the concerned line departments;
- Monitoring of implementation and monitoring of RP and ESMP;
- Proactive and timely measures to address all social and environment safeguards including measures and clearances;
- monitoring, addressing and resolving grievances;
- ensuring availability of budget for implementation activities; and
- ensuring disclosure of relevant frameworks, implementation and management plans and monitoring documents.

The PMU will seek government clearances for submission and disclosure of the environmental, social and resettlement report to AIIB. It will also coordinate with national and state agencies to resolve inter-departmental issues, if any.

### **9.7.2 Responsibilities of the Project Implementation Units (PIUs)**

The PWRD had already established separate state road divisions in each district. These will be responsible to implement all the project related activities in their respective districts/divisions including the road strengthening and widening works, implementation of road rehabilitation works, land acquisition and forest clearances, data-collection, preparation and implementation of contracts and coordination with local administration and local communities to seek their support.

The PWRD's Superintending Engineers (SEs) in the field will closely monitor and guide the field divisions in implementing all the project related activities in their respective jurisdiction. The SEs will undertake quarterly management meetings with the contractors; coordinate with district administration, forest department, water supply, electricity, and revenue departments to resolve any land acquisition, site readiness, material availability, and law and order or social issue. The PIUs will be supported by CSC and RP Implementation Agency (RIA) to implement environmental and social safeguards activities. The PIU will undertake internal monitoring and supervision and record observations throughout the project period to ensure that the safeguards and mitigation measures are provided as intended.



### 9.7.3 Responsibilities of the Project Coordination and Support Consultant (PCMC)

A PCMC has been mobilized to provide high quality technical advice and implementation support to PWRD for all the project components under Asom Mala program. The PCMC shall support the Program Management Unit (PMU) for all aspects of Asom Mala program. An Environmental Specialist shall also be appointed as part of the PCMC team to (i) prepare ESMPF for sub-project roads under ASRIP; (ii) review the Environmental Assessment and ESMP prepared by the DPR Consultants in the planning phase; (iv) assist in the monitoring and supervision of ongoing subprojects and ESMP implementation; (v) monitor the implementation of ESMP carried out by the PIU level; and (vi) ensure all subprojects meet safeguard requirements as agreed in the loan covenant and in line with this ESMPF. In addition, (s)he shall play a central role in ensuring capacity building on environmental management of the PMU, RP Implementation Agencies and line departments through capacity development support and training.

### 9.7.4 Responsibilities of Construction Supervision Consultant (CSC)/ Authority Engineer (AE)

The CSC is the supervising authority for contractors following item rates and the AE is the supervising authority for contractors that follow the EPC modality. They are also responsible for reviewing and approving the detailed engineering design prepared by the EPC contractor. Other than the difference mentioned above, the following are the responsibilities of the CSC and AE:

- Review the environmental and social reports and management plans to understand the background issues of the respective project corridor
- Review and approve the revised ESMP and other required sub-plans such as traffic management plan, health and safety plan, waste management plan etc. prepared by the contractor
- Conduct regular site inspections and monitor implementation of the ESMP and EMOP by the contractor
- Provide on-site training and technical guidance to the contractor workers as necessary
- Review the monthly reports prepared and submitted by the contractor
- Where necessary identify the need for corrective actions and issue official notices to the contractor to implement the corrective actions with clear timeline
- If there are any complaints or grievances, facilitate consultations with the respective complainant and ensure the grievances are addressed in accordance with the GRM system
- Regularly convene meetings to discuss progress or issues on environment safeguards to ensure that all parties (contractor, PIU, PCMC) are on the same page on requirements and milestones for environment safeguards
- Based on site inspections and review of reports submitted by the contractor prepare semi-annual (for category A project corridors) and annual (for category B project corridors) Environmental Monitoring Reports for review and approval by the



PMU/PCMC. These reports shall be further forwarded to AIIB for disclosure on their website

### 9.7.5 RP Implementation Agency (RIA)

An RP Implementation Agencies will be hired to assist PIU to, (i) implement the Resettlement Plans and Indigenous Peoples Plan, if any (ii) conduct consultations and create public participation in the project and conduct verification surveys and (iii) update respective Resettlement Plan and Indigenous Peoples Plan, if required, in line with the Resettlement Planning Framework and Indigenous Peoples Planning Framework, respectively.

## 9.8 Capacity Building and Training

The Environmental and Social officer of the PMC will provide the basic training required for environmental and social awareness. Specific modules customized for the available skill set will be devised after assessing the capabilities of the members of the Training Programme and the requirements of the project. The entire training would cover basic principles of environmental and social assessment and management; mitigation plans, implementation techniques, monitoring methods and tools. The proposed training program along with the frequency of sessions is presented in **Table 86**.

**Table 86: Environmental and Social Training Modules**

Sr. No.	Training Program	Duration	Target Group	Responsibility
1	Workshop on: <ul style="list-style-type: none"> <li>➤ Introduction to Environment and Society:</li> <li>➤ Basic Concept of surrounding Environment and Society</li> <li>➤ Environmental and Social Regulations and Statutory requirements as per Govt. of India and AIIB</li> </ul>	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
2	Environmental and Social management, environmental provisions, implementation arrangements, methodology of assessment, good engineering practices to be integrated into contract/ bid documents	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
3	Roles and Responsibilities of officials/contractors/consultants towards protection of environment	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
4	Monitoring and reporting system to the target audience such as Engineers and staff of implementing agencies (PWRD, Assam)	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
5	Orientation of contractors at the time of issuing work orders on the implementation of SMF	¼ Working Day	PWRD & Contractor	Environmental and Social officer of the PMC
6	Overview of Land Securing and Entitlement Provisions <ul style="list-style-type: none"> <li>➤ Direct Acquisition</li> <li>➤ Gift Deed / MoU</li> </ul>	¼ Working Day	PWRD, Contractor & Revenue officials	Environmental and Social officer of the PMC



Sr. No.	Training Program	Duration	Target Group	Responsibility
	<ul style="list-style-type: none"><li>➤ Relocation of Common Property Resources</li><li>➤ Avoidance of encroachments during the post-construction scenario</li></ul>			

## 9.9 Environmental and Social Management Budget

An environmental and social management budget of **INR 3,15,45,884** has been estimated for the implementation of the environmental and social management plan. This budget also includes the cost of environmental monitoring and associated training. A detail of the environmental and social management budget is given in **Table 87** (Civil Cost) and **Table 88** (Non-Civil Cost).



**Table 87: Environment and Social Management Cost (Civil Cost)**

Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
1			<b>Sub Head No-1 Environmental Monitoring Costs</b>				
1.1			Ambient air quality monitoring along the project road for particulate matter (PM2.5 and PM10), sulphur dioxide (SO2), oxides of nitrogen (NOX); and carbon monoxides (CO) using standard analysis technique in accordance with the National Ambient Air Quality Standards formulated by MoEF&CC and the World Bank (IFC) Air Quality. Standards				
			Near all hot mix plant locations approved by the Engineer	No. of Samples	16	2,500	40,000
			Construction sites near sensitive locations	No. of Samples	16	2,500	40,000
			At 2 location during operation stage where monitoring had been done during construction stage	No. of Samples	6	2,500	15,000
1.2			Sound Pressure Level (SPL) measurements along the project road using standard analysis technique in accordance with the National Ambient Air Quality Standards in respect of noise formulated by MoEF&CC and the World Bank (IFC) Air Quality. Standards				
			At equipment yards/ Hot mix plants/ Construction Camps	No. of Samples	16	1,000	16,000
			Near known nesting sites - as directed by the Engineer	No. of Samples	16	1,000	16,000
			During Operation Stage as directed by the Engineer	No. of Samples	6	1,000	6,000
1.3			Water Quality Testing for parameters as per IS: 10500-2012 along the road in accordance with CPCB norms				
			Surface Water Quality testing during Construction Stage	No. of Samples	16	4,000	64,000
			Discharge Water Quality testing during Operation Stage	No. of	6	4,000	24,000



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Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
				Samples			
1.4			Soil Quality Testing along the project road in accordance with CPCB norms				
			During Construction stage at productive agricultural lands abutting traffic detours and traffic diversions, to be identified by the Engineer	No. of Samples	16	4,200	67,200
			During Operation stage At accident/spill locations involving bulk transport carrying hazardous material.	No. of Samples	6	4,200	25,200
<b>Total monitoring Cost</b>							<b>313,400</b>
2			<b>Mitigation / Enhancement Cost</b>				
2.1			<b>Sub Head No-2 Enhancement of Road side ponds</b>				
	3.22	307	Turfing with Sods (Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of rods and watering)				
			5 m width turfing on outer side of ponds located at chainage 10+450 (R), 14+100 (R), 16+325 (R), 18+700 (L), 21+125 (R)	sqm	1456	31	45,136
	3.24	309	Surface Drains in Soil (Construction of unlined surface drains of average cross sectional area 0.40 sqm in soil to specified lines, grades, levels and dimensions to the requirement of clause 301 and 309. Excavated material to be used in embankment within a lead of 50m ( Average lead 25m )				
			Construction of surface drains on outer side of ponds located at chainage 10+450 (R), 14+100 (R), 16+325 (R), 18+700 (L), 21+125 (R)	Meter	6780	81	549,180
2.2			<b>Sub Head No-3 Oil Interceptors</b>				
			Oil interceptors at parking/ servicing of construction vehicles	No.	1	60,000	60,000



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Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
2.3			<b>Sub Head No-4 Noise Barriers at Sensitive locations</b>				
			Provision of Noise barrier at sensitive areas like schools and hospitals. The noise barriers of hollow brick wall/ reinforced concrete panels with height of 3.5m. School location: 11+600 (RHS) and 15+950 (RHS)	Rm	100	4,000	400,000
<b>Total Mitigation / Enhancement Cost during Construction phase</b>							<b>1,054,316</b>
<b>Total Environmental and Social Management Cost</b>							<b>1,367,716</b>
<b>Total Environmental and Social Management Cost (Including GST @ 12%)</b>							<b>1,531,842</b>

**Table 88: Environmental and Social Management Cost (Non-Civil Cost)**

Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
			<b>Sub Head No-1 Pre-construction Activity (Tree Cutting)</b>				
1			Tree cutting along the project road [Letter No. B/ Axom Mala/ 2021/1351 dated 08/06/2021]	m3	863.81	3,450	2,980,145
			Tree cutting along the project road [Letter No. B/ GC/ 87/ R.S.T.-A30: A/ Gen/2020/5785 dated 13/12/2020]	m3	73.6373		1,096,950
			<b>Sub Head No-2 Compensatory Plantation</b>				
2	11.9	307	Planting of Trees and their Maintenance for one Year (Planting of trees by the road side (Avenue trees) in 0.60 m dia holes, 1 m deep dug in the ground, mixing the soil with decayed farm yard/sludge manure, planting the saplings, backfilling the trenches, watering, fixing the tree guard and maintaining the plants for one year.	No.	15150	831	12,589,650
3	11.13		Making Tree Guard 53 cm dia and 1.3 m high as per design from empty bitumen drum (Making tree guard 53 cm dia and 1.3 m high as per design from empty bitumen drum, slit suitably to permit sun and air, (supplied by the department at stock issue rate) including providing and fixing 2 nos MS sheet rings 50mmX0.5mm with rivets, complete in all respects.	No.	15150	359	5,438,850
			<b>Sub Head No-3 Administrative Charges including logistics</b>				
4			Data processing, administrative support, stationery etc.	LS			360,000
			Digital Camera for the Environment Cell	No.	1	35,990	35,990



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Sr. No.	SOR Item No.	Ref. of MoSRT&H	Description	Unit	Quantity	Rate (INR)	Amount (INR)
			<b>Sub Head No-4 Biodiversity Management</b>				
5			Budget for Biodiversity Management Plan				4,056,667
			<b>Sub Head No-5 Environmental Awareness and Training</b>				
6			Providing Environmental awareness and training during first 5 years of project implementation		Past Project Experience		240,000
<b>Total Cost</b>							<b>2,67,98,252</b>
<b>Total Cost @ 12% GST</b>							<b>3,00,14,042</b>



## 10. Conclusions and Recommendations

The proposed project A30\_2 Deesang Kinar Bangali to Kathalguri falls under Category B as per AIIB's ESP and ESS. The project road corridor is neither a new State Highway nor a State Highway expansion project in hilly areas (above 1000 MSL) and not located within any eco-sensitive area. Environmental Clearance from MOEF&CC is not required as per EIA Notification 2006 (amended to date) and NOC from the Standing Committee of National Board for Wildlife is also not required. The project is unlikely to cause any major significant environmental impacts, few impacts are identified, all of which are localized, temporary, and easy to mitigate. Most of the impacts are short term and limited to the construction stage. Key conclusions on the environmental implications of the project are given in the paras below.

### Environmental Gains Due to Proposed Work Justifying Implementation

The project entails various impacts on the project setting. There are many positive impacts bearing benefits to the area against the limited number and magnitude of negative impacts. These include (i) The project will substantially improve the transport efficiency on the roads. (ii) The project once implemented will improve the overall environmental conditions with better roads, fuel efficiency, and environmental protection measures (iii) will reduce traffic congestion particularly at junctions hence, air pollution due to the idling of the vehicles.

### Potential Impacts and Mitigation

The finding of EIA indicates that the project is unlikely to cause any significant adverse environmental impacts. While some of the minor impacts are negative, there are many bearing benefits to the area. Most of the impacts are likely to occur during the construction stage and are temporary. Anticipated minor impacts will be mitigated through the implementation of mitigation measures summarized in the Environmental and Social Management Plan.

Factors contributing to minimal impacts include the widening of the project road confined within the available RoW with minimum land acquisition at some locations, the impacts would not be severe and will be mitigated as per the Environmental and Social Management Plan (ESMP). However, some of the impacts are unavoidable. These impacts with mitigation measures are indicated below:

- **1515** trees will need to be cut with the prior permission of forest authorities. Compensatory Tree plantation of **15150** trees in non-residential areas along the project road on both sides as per the direction of the forest department will be made to compensate for this loss. Preventive measures shall be taken during the construction phase especially in rainy months, to prevent soil erosion because of tree cutting and alteration of ground flora.
- There are 4 identified trees of cultural importance along the road which may be required to be felled due to constraints in geometric improvement of the alignment.
- Air pollution due to construction activities and operation of hot mix plant will be controlled through the adoption of dust suppression measures and provision of the high stack for good dispersion of gaseous emission from hot mix plants.
- Noise levels may increase during the construction phase due to the operation of construction machinery. All the construction equipment and DG set will be well maintained and fitted with silencers.



- Waste materials generated during the construction phase may contaminate soil, surface, and groundwater resources. Waste shall be segregated and reused or disposed of in an environmentally safe manner.
- Along the project stretch, few schools, hospitals, and religious structures are located. Appropriate design options are exercised to minimize the loss of such structures.
- The social issues are addressed through Social Safeguards Due Diligence reports prepared as per AIIB's ESP and ESS.

Application of these measures in parallel with MoRTH environmentally friendly road construction practices will reduce significantly any potential environmental impact. Impacts remaining on the physical environment (air and water pollution) are temporary and often occur away from the presence of people.

### **Irreplaceable Resources**

The project road does not pass through any protected areas in the state. The construction material will also be sourced from identified and approved sources. As such, there are no environmentally sensitive resources found in the project area, which is likely to be affected due to the project.

### **Post EIA Study Surveillance and Monitoring**

While an EIA is meant to provide a comprehensive understanding of the environment status of the area under the study, post surveillance is the means to ensure that the significant impacts identified are adequately mitigated as per the proposed mitigation plan. A detailed monitoring plan has been provided as part of the Environmental and Social Management Plan. Air, water quality, noise, soil erosion, and tree survival rate monitoring and reporting along with the follow-up actions in case of deviation from the norms have been detailed out. The frequency has been set in consideration of the likely impacts.

### **Recommendations**

Adequate mitigations shall be taken up both during the construction and operation stage of the project road to avoid/minimize adverse environmental impacts due to this event and any such event in the future as suggested in the EAR. Effective ESMP implementation is essential for the elimination or minimization of the identified impacts. The PWRD shall ensure that ESMP and EMoP are included in the Bill of Quantity (BOQ) and forms part of the 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. PWRD needs capacity building and practical exposure. Adequate training shall be imparted as proposed under the environmental and social management plan to enhance the capability of concerned EA officials.



## Annexure 1: Ambient Air Quality Standards

### National Ambient Air Quality Standards

Pollutant	Concentration in ambient Air			Methods of Measurement
	Average	Industrial, Residential and other rural area	Ecologically Sensitive Area (Notified by Central Government)	
SO <sub>2</sub> ug/m <sup>3</sup>	Annual*	50	20	- Improved West and Geake - Ultraviolet Fluorescence
	24 hours**	80	80	
NO <sub>x</sub> ug/m <sup>3</sup>	Annual*	40	30	- Modified Jacob and Hochheiser - Chemiluminescence
	24 hours**	80	80	
PM <sub>10</sub> ug/m <sup>3</sup>	Annual*	60	60	- Gravimetric - TEOM - Beta Attenuation
	24 hours**	100	100	
PM <sub>2.5</sub> ug/m <sup>3</sup>	Annual*	40	40	- Gravimetric - TEOM - Beta Attenuation
	24 hours**	60	60	
Ozone (O <sub>3</sub> ) ug/m <sup>3</sup>	8 Hours**	100	100	- UV Photometric - Chemiluminescence - Chemical Method
	1 Hour**	180	180	
Lead ug/m <sup>3</sup>	Annual*	0.50	0.50	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
	24 hours**	1.0	1.0	
CO ug/m <sup>3</sup>	8 Hours**	2000	2000	- Non-Dispersive Infra-Red Spectroscopy
	1 Hour**	4000	4000	
NH <sub>3</sub> ug/m <sup>3</sup>	Annual*	100	100	- Chemiluminescence - Indophenol blue method
	24 hours**	400	400	
Benzene (C <sub>6</sub> H <sub>6</sub> ) ug/m <sup>3</sup>	Annual*	05	05	- Gas Chromatography based Continuous Analyzer - Adsorption followed by GC Analysis
Benzo Pyrene-Particulate Phase only ug/m <sup>3</sup>	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
Arsenic ng/m <sup>3</sup>	Annual*	06	06	- AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel ng/m <sup>3</sup>	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 will be complied with 98% of the time in the year. However, 2% of the time, it may exceed but not on two consecutive days.

### WHO Ambient Air Quality Guidelines

<b>Sulphur dioxide (SO<sub>2</sub>)</b>	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
<b>Nitrogen dioxide (NO<sub>2</sub>)</b>	1-year	40 (guideline)
	1-hour	200 (guideline)
<b>Particulate Matter PM<sub>10</sub></b>	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
<b>Particulate Matter PM<sub>2.5</sub></b>	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
<b>Ozone</b>	8-hour daily maximum	160 (Interim target-1) 100 (guideline)



## Annexure 2: Ambient Noise Level Standards

### Govt. of India Ambient Noise level standards

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

### The maximum permissible sound level (LAeq) according to the receiving zones (WHO)

Category	Noise level, Leq dBA	
	Day Time	Night time
Noise sensitive area, low density residential, institutional (School, Hospital), workshop areas	50	40
Suburban residential, Medium density areas, public spaces, parks, recreational areas	55	45
Urban residential, high density areas, designated mixed development areas (commercial)	60	50
Commercial business zones	65	55
Designated industrial zones	70	60



## Annexure 3: Indian Standard Drinking Water Specification IS: 10500-2012

Sr. No.	Parameter and Unit	Desirable Limit	Permissible Limit in Absence of Alternate Source
1.	Colour (Hazen units)	5	15
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	Turbidity (NTU)	1	5
5.	pH	6.5-8.5	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)	0.5	No relaxation
10.	Free Residual Chlorine (mg/L)	0.2	1
11.	Cyanide (mg/L as CN)	0.05	No relaxation
12.	Phenol (mg/L C <sub>6</sub> H <sub>5</sub> OH)	0.001	0.002
13.	Total Hardness (mg/L as CaCO <sub>3</sub> )	200	600
14.	Total Alkalinity (mg/L as CaCO <sub>3</sub> )	200	600
15.	Chloride (mg/L as Cl)	250	1000
16.	Sulphate (mg/L as SO <sub>4</sub> )	200	400
17.	Nitrate (mg/L as NO <sub>3</sub> )	45	No relaxation
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	No relaxation
23.	Manganese (mg/L as Mn)	0.1	0.3
24.	Zinc (mg/L as Zn)	5	15
25.	Boron (mg/L as B)	0.5	1
26.	Aluminium (mg/L as AL)	0.03	0.2
27.	Arsenic (mg/L as As)	0.01	0.05
28.	Mercury (mg/L as Hg)	0.001	No relaxation
29.	Lead (mg/L as Pb)	0.01	No relaxation
30.	Cadmium (mg/L as Cd)	0.003	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)	0.0001	No relaxation
35.	Pesticides (µg/L)	Absent	0.001
36.	Alpha Emitters (Bq/L)	0.1	No relaxation
37.	Beta Emitters (Bq/L)	1.0	No relaxation



## Annexure 4: Record of Public Consultation

### Environmental Assessment Study

### Public Consultation Attendance

Name of Project:	Axom Male		
Name of Project Road:	A30-2		
Project package no.:	Group 3		
Chainage:		Date:	8/11/2020
Location:	Jolani 27.324320 95.363832	District:	Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1.	Pablu Dutta	Jolani	Shop owner	9678886395	
2.	Sidharma Barua	-11-	Student	9678005321	
3.	Pomoni Ranjan Borsoloi	-11-	Teacher	9435392708	
4.	Minul Saikia	-11-	Welder		
5.	Raji Dutta	Naharkatia	Driver	9873142599	
6.	Sanju Teeka	Jolani	Welder	7400069124	



## Environmental Assessment Study Public Consultation Attendance

Name of Project:	Asom Mala		
Name of Project Road:	A30-2		
Project package no.:	Group 3		
Chainage:		Date:	8/11/2020
Location:	Da Hulekha (Baruah Tiniali)	27-527826 95-339819	District: Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1.	Apurba Saikia	Da-Hulekha	Business	9954245004	Apurba Saikia
2.	Bhasgov Dutta	- - -	shopkeeper	7002708955	Bhasgov Dutta
3.	Jagat Borah	- - -	- - -	7002023371	J. Borah
4.	Nilmoni Das	Baruah Tiniali	shopowner	6000795467	Nilmoni Das



## Environmental Assessment Study Public Consultation Attendance

Name of Project:	A <del>E</del> Axom Mala		
Name of Project Road:	A30-2		
Project package no.:	Group 2		
Chainage:		Date:	8/11/2020
Location:	2No. 27-332405 Chalabotoki 95-308112	District:	Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1.	Kimud Rajkumar	Chalabotoki	Shop owner	9954766055	
2.	Dinku Bagti	-  -	Driver	9135856298	J. Bagti
3.	Ranjit Panika	-  -	Worker	-	
4.	Nikrom Singh Rajput	-  -	Worker	-	
5.	Baby Kalav	-  -	-  -	-	Baby Kalav
6.	Subar Teli	-  -	-  -	-	
7.	Pravin Farwan	-  -	-  -	-	P. Farwan



## Environmental Assessment Study

### Public Consultation Attendance

Name of Project:	Asom Mala		
Name of Project Road:	A30-2		
Project package no.:	Group 3		
Chainage:		Date:	8/11/20
Location:	Disang Kinar 22.25032 Bangal 15.250399	District:	Dibrugarh
No of Participants			

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.	Signature
1.	Jituli Debra	Disang Kinar	Service	9706056693	
2.	Mamunhan Gogoi	-  -	Business	911616374	Mamunhan Gogoi
3.	Lakhiram Taki	-  -	Gakkeeper	9134898682	Lakhiram Taki
4.	Lombit Gogoi	-  -	Shopowner	7896105251	Lombit Gogoi
5.	Bablu Kumar	-  -	Shopowner	9678123297	Bablu Kumar
6.	Isna Gogoi	-  -	-  -	8901401328	Isna Gogoi
7.	Himanti Medhi	-  -	-  -	8472960255	Himanti Medhi



## Public Consultation Meeting Attendees List

Name of Project: Improvement of SH and MDPS under Asom Mala

Name of Project Road: A20-1

Project package no.: 3

Chainage:

Date: 18-01-2020

Place: Kaliapari

District: Dibrugarh

List of Stakeholders/Participants who attended public consultation meeting

Sr. No.	Name of Respondent	Village Name	Occupation	Mobile No.
1	Kamal <del>Sharma</del>	Kaliapari	Shopowner	
2	Arjun	Kaliapari	workers	
3	Deva	Kaliapari	workers	
4	Deepu	Kaliapari	workers	





**Public Consultation at Golipari**



**Public Consultation at No. 1 Salakataki**



**Public Consultation at Joloni**



**Public Consultation at Joloni**



**Public Consultation at Da Hukuta**



**Public Consultation at Da Hukuta**



**Public Consultation at 2 No. Chalakotoki**



**Public Consultation at 2 No. Chalakotoki**



**Public Consultation at Deesang Kinar Bangali**



**Public Consultation at Deesang Kinar Bangali**



**Public Consultation at Deesang Kinar Bangali**

### **Details of Public Consultation**

The Consultant has explained to the Community about the scope and purpose of consultation, the Asom Mala initiative of Govt. of Assam. Participants were encouraged to tell about the problems faced due to the existing condition of the roads.

Majority of the villagers who participated in the consultation were farmers. People were very positive about the road works being carried out. They believed the road helped them in accessing urban areas and market places on the project road where modern-day facilities are easily available. The Community also requested for minimum loss of their properties and adequate rehabilitation and resettlement measures.



<b>Key Issues/ Perception of Community</b>	<b>Response from Consultant</b>
People facing problems due to the poor condition of the roads	The Consultant explained the proposed widening and strengthening of the road which provide a better level of services in terms of improved riding quality and smooth traffic flow.
People asked about provision of speed breakers in areas where project road passes through settlements	Adequate safety measures that will be implemented to prevent accidents such as provision of speed breakers, crash barriers, and sign boards were explained.
The road section passes through green field alignment	Appropriate measures will be taken into consideration to improve the road geometry and achieve safe travel at desired design speed and loss of trees will be compensated by plantation
The project road is in proximity of wildlife sanctuary	The locals were informed about the boost in tourism which will occur due to improved road facilities.
Safety provisions particularly at locations where project road passes by schools, hospitals etc.	Appropriate measures such as provision of speed breakers, sign boards will be provided as safety measures.
Green belt development	The compensatory plantation will be done as per the orders of the state forest department and following National policies.

**Community Perception about the Project road:**

- The project will not only help in economic development of the region, it will provide better access to education and health facilities
- The road improvements will result in reduced traffic congestion, savings in travel time and enhancing the value of the land
- The road project should provide employment opportunities to the local people.
- The villagers are willing to part with their land and structures for road improvement provided adequate compensation is paid.



## Annexure 5: GRM Information Sheet

### SAMPLE GRIEVANCE REGISTRATION FORM

*(To be available in Hindi, Assamese or any other local languages, if any)*

We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing **\*(CONFIDENTIAL)\*** above your name. Thank you.

<b>Date:</b>	<b>Place of Registration:</b>	
<b>Contact Information/Personal Details:</b>		
<b>Name:</b>	<b>Gender:</b>	<b>Age:</b>
<b>Home Address:</b>		
<b>Village/Town:</b>		
<b>District:</b>		
<b>Phone No.:</b>		
<b>Email:</b>		
<b>Complaint/Suggestion/Comment/Question Please provide the details (who, what, where and how) of your grievance below:</b>		
<b>If included as attachment/note/letter, please tick here:</b>		
<b>How do you want us to reach you for feedback or update on your comment/grievance?</b>		



**For Official Use only**

<b>Registered by:</b> (Name of Official Registering Grievance)
<b>If :</b> <ul style="list-style-type: none"><li>❖ Note/Letter</li><li>❖ E-mail</li><li>❖ Verbal/Telephonic</li></ul>
<b>Reviewed by:</b> (Names/ Positions of Official(s) reviewing grievance)
<b>Action taken:</b>
<b>Whether Action taken disclosed:</b> <ul style="list-style-type: none"><li>❖ Yes</li><li>❖ No</li></ul>
<b>Means of Disclosure:</b>



### অভিযোগ পঞ্জীয়ন প্র-পত্ৰৰ নমুনা

প্রকল্প ৰূপায়ণ সম্পৰ্কত অসম চৰকাৰৰ গড়কাপ্তানী বিভাগে অভিযোগ, পৰামৰ্শ, অনুসন্ধান, মন্তব্য বিচাৰে। স্পষ্টীকৰন আৰু প্ৰতিক্ৰিয়াৰ বাবে অভিযোগকাৰীৰ লগত যোগাযোগ কৰিবলৈ সক্ষম হবলৈ আমি অভিযোগকাৰী সকলক তেওঁলোকৰ নাম আৰু ঠিকনাৰ তথ্য দিবলৈ আহ্বান জনাওঁ।

আপুনি যদি আপোনাৰ ব্যক্তিগত তথ্য দিব বিচাৰে আৰু সেই তথ্য গোপন ৰাখিব বিচাৰে, তেনেহলে আপোনাৰ নামৰ ওপৰত (গোপনীয়/CONFIDENTIAL) লিখি দিব/টাইপ কৰি দিব।

তাৰিখ:	পঞ্জীয়নৰ স্থান:	
যোগাযোগৰ তথ্য/ব্যক্তিগত তথ্য:		
নাম:	লিঙ্গ:	বয়স:
ঠিকনা:		
গাওঁ/চহৰ:		
জিলা:		
ফোন নং		
ই-মেইল:		
অভিযোগ/পৰামৰ্শ/মন্তব্য/প্ৰশ্ন - আপোনাৰ অভিযোগৰ সবিশেষ (কোন, কি, ক'ত আৰু কেনেকৈ) তলত দিব:		
যদি সংযোজন/চিঠি/টোকা আদি গাথি দিয়া হৈছে, তেনেহলে ইয়াত টিক চিন্হ দিব:		
প্ৰতিক্ৰিয়া অথবা আপোনাৰ অভিযোগ/মন্তব্য সংক্ৰান্তত নতুন তথ্যৰ বাবে আমাক আপোনাৰ লগত কেনেধৰণে যোগাযোগ কৰাটো বিচাৰে?		



কাৰ্য্যালয়ৰ ব্যৱহাৰৰ বাবে

পঞ্জীয়ন কৰোতাঃ (অভিযোগ পঞ্জীয়নকাৰী বিষয়াৰ নাম)
যদিঃ <ul style="list-style-type: none"><li>• টোকা/চিঠি</li><li>• ই-মেইল</li><li>• মৌখিক/টেলিফোনযোগে</li></ul>
পৰ্যবেক্ষণকাৰীঃ (পৰ্যবেক্ষণকাৰী বিষয়াৰ নাম আৰু পদবি)
ইতিমধ্যে লোৱা ব্যৱস্থাঃ
ইতিমধ্যে লোৱা ব্যৱস্থা প্ৰকাশ কৰা হৈছে নে নাইঃ <ul style="list-style-type: none"><li>❖ হৈছে</li><li>❖ হোৱা নাই</li></ul>
প্ৰকাশ কৰাৰ ধৰণঃ



## Annexure 6: Guidelines for Borrow Area Management

### A. Selection of Borrow Areas

The location of borrow areas shall be finalized as per IRC: 10-1961 guidelines. The finalization of locations in case of borrows areas identified in private land shall depend upon the formal agreement between landowners and contractors. If the agreement is not reached between the contractor and landowners for the identified borrow areas sites, arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environment requirements in respect of excavation and borrow areas as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local bodies, as applicable shall be the sole responsibility of the contractor. The contractor in addition to the established practices, rules, and regulations will also consider the following criteria before finalizing the locations.

- The borrow area should not be located in the agriculture field unless unavoidable i.e. barren land is not available.
- The borrow pits preferably should not be located along the roads.
- The loss of productive and agricultural soil should be minimum.
- The loss of vegetation is almost nil or minimum.
- The Contractor will ensure that suitable earth is available.

### B. Contractor's Responsibility

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing program approved by the Engineer. It shall be ensured that the sub-grade material when compacted to the density requirements shall yield the design CBR value of the sub-grade. Contractor shall begin operations keeping in mind following;

- Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plants are operating at the place of deposition.
- No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. The contractor should be permitted to remove acceptable material from the site to suit his operational procedure, then shall make a consequent deficit of material arising therefrom.
- Where the excavation reveals a combination of acceptable and unacceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, excavate in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the unacceptable materials. The acceptable material shall be stockpiled separately.
- The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, the use of plants is siting of temporary buildings or structures.



## C. Borrowing from Different Land-Forms

### Areas located in Agricultural Lands

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrowing of the earth will be carried out up to a depth of 1.5m from the existing ground level.
- Borrowing of the earth will not be done continuously throughout the stretch.
- Ridges of not less than 8m widths will be left at intervals not exceeding 300m.
- Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal).
- The depth of borrow pits will not be more than 30 cm after stripping the 15 cm topsoil aside.

### Borrow Areas located in Elevated Lands

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- At the location where private owners desire their fields to be leveled, the borrowing shall be done to a depth of not more than 1.5m or up to the level of surrounding fields

### Borrow Areas near River Side

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow area near to any surface water body will be at least at a distance of 15m from the toe of the bank or high flood level, whichever is maximum.

### Borrow Areas near Settlements

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pit location will be located at least 0.75 km from villages and settlements. If un-avoidable, the pit will not be dug for more than 30 cm, and drains will be cut to facilitate drainage.
- Borrow pits located in such locations will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with layers of



stockpiled topsoil in accordance with compliance requirements with respect to MOEF&CC/SPCB guidelines.

#### **Borrow Pits along the Road**

Borrow pits along the road shall be discouraged and if deemed necessary and permitted by the Engineer; following precautions are recommended

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Ridges of not less than 8m widths should be left at intervals not exceeding 300m.
- Small drains shall be cut through the ridges of facilitating drainage.
- The depth of the pits shall be so regulated that their bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontals projected from the edge of the final section of bank, the maximum depth of any case being limited to 1.5m.
- Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10m.

#### **Rehabilitation of Borrow Areas**

- The objective of the rehabilitation program is to return the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits in a stable condition is the fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit floor to approximately the access road level.
- Re-development plan shall be prepared by the Contractor before the start of work in line with the owners will require and to the satisfaction of the owner. The Borrow Areas shall be rehabilitated as per following;
- Borrow pits shall be backfilled with rejected construction wastes and will be given a vegetative cover. If this is not possible, then excavation sloped will be smoothed and depression will be filled in such a way that it looks more or less like the original round surface.
- Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such a borrow area will be photographed after their post-use restoration and Environment Expert of Supervision Consultant will certify the post-use redevelopment.

The Contractor will keep records of photographs of various stages i.e., before using materials from the location (pre-project), for the period borrowing activities (construction Phase) and after rehabilitation (post-development), to ascertain the pre and post borrowing status of the area.



## Annexure 7: Guidelines for Emergency Management System

Many emergencies can occur in construction sites and will need to be effectively handled. The environmental and occupational health and safety aspects and related emergency can include incidences such as subsidence of soil / Fire / Explosion / Gas Leak, Collapse of Building / Equipment, and other Occupational Accidents. Onsite and off-site emergency management plans will be developed to effectively handle them. The following guidelines will be used to develop these plans.

### Guidelines:

#### Availability of 'On-Site Emergency Management Plan'

- The contractor will have a written-on site emergency management plan. The contractor should submit a copy of this plan to PWRD, Assam, and the Supervision Consultant before the start of the work.
- The contractor will develop an onsite emergency plan considering the potential environmental, occupational health, and safety emergency at the site.
- The contractor will include a list of potential emergencies in the emergency management plan including potential Environmental and Occupational Health and Safety Emergency Situations during construction, operation, and maintenance stages.

Examples of potential emergencies have been defined below for guidance purposes.

The contractors may follow refer to this for developing site-specific on-site emergency preparedness plans.

Emergency conditions/ situations	Sources
Collapse/subsidence of soil and structures	<ul style="list-style-type: none"><li>• Civil structures</li><li>• Heavy construction machinery</li></ul>
Bulk spillage	<ul style="list-style-type: none"><li>• Hazardous substance / inflammable liquid storage</li><li>• Vehicular movement on Highway</li></ul>
Fire and explosion	<ul style="list-style-type: none"><li>• Inflammable Storage Areas</li><li>• Gas Cylinder Storage Areas</li><li>• Electrical Circuits</li><li>• Isolated Gas Cylinders (LPG/DA) Welding / Gas Cutting Activity</li></ul>
Flooding	<ul style="list-style-type: none"><li>• Heavy Monsoons</li><li>• Upstream activities of irrigation and damming</li><li>• Glacial lake outburst Flood at the source of the river</li></ul>
Electrical Shocks	<ul style="list-style-type: none"><li>• HT line</li><li>• LT distribution</li><li>• Electrically operated machines/ equipment's/ Hand tools/ Electric cables</li></ul>
Gaseous leakage	<ul style="list-style-type: none"><li>• Gas cylinder storage areas</li><li>• Gas cylinder used in Gas cutting / Welding purposes</li></ul>
Accidents due to Vehicles	<ul style="list-style-type: none"><li>• Heavy earth moving machinery</li><li>• Cranes</li><li>• Fork lifts</li></ul>



<b>Emergency conditions/ situations</b>	<b>Sources</b>
	<ul style="list-style-type: none"> <li>• Trucks</li> <li>• Workman Transport Vehicles (cars/ scooters/ motorcycles/ cycles)</li> <li>• Collapse, toppling or collision of transport equipment</li> </ul>
Slips & Falls (Man & Material)	<ul style="list-style-type: none"> <li>• Work at Height (Roof works, Steek Erection, Scaffold, Repair &amp; Maintenance, Erection of equipment, Excavation etc.)</li> <li>• Slips (Watery surface due to rain)</li> <li>• Lifting tools &amp; Tackles (Electric hoist &amp; Forklifts)</li> </ul>
Collision with stationary or moving objects	<ul style="list-style-type: none"> <li>• Vehicular movement on highway</li> </ul>
Other Hazards	<ul style="list-style-type: none"> <li>• Cuts &amp; Wounds</li> <li>• Confined Space (under &amp; inside machinery etc)</li> <li>• Hot burns</li> <li>• Pressure impacts (Plant contains several pressure vessels &amp; pipefittings containing CO<sub>2</sub>, air, water, product &amp; steams, which can cause accident &amp; injuries to person)</li> </ul>

### **Design of ‘On-Site Emergency Plan’**

The ‘On-site emergency plan’ to be prepared by the contractor will include a minimum of the following information:

- Name & Address of Contractor
- Updation sheet
- Project Location
- Name, Designation & Contact Numbers of the organization, nearby hospitals, fire agencies etc. and key personnel including their assigned responsibilities in case of an emergency.
- The roles and responsibilities of executing personnel
- Site Layout Diagram
- Identification of Potential Emergencies Situations/ preventive measures / control & response measures
- Location of Emergency Control Centre (or designated area for emergency control / coordination) with requisite facilities.
- Medical services / first aid
- List of emergency equipment including fire extinguishers, fire suits, etc.

### **Emergency Control Centre**

The emergency control center will be equipped with the following facilities:

- Copy of current on-site emergency plan
- Display of the name of site emergency controller
- Appropriate numbers of artificial respiratory sets
- Appropriate numbers of Stretchers
- Vehicle/ambulances on each construction site for 24 hours
- Adequate and reliable communication facilities (phone, handset, etc.)
- Site layout diagram with entry and exit routes / Assembly points
- Directory of internal/external emergency phone Numbers
- Fire extinguishers (DCP type / Foam Type / CO<sub>2</sub>) on all construction camps and yards



- List of fire extinguishers installed in the construction sites and yards including maintenance records
- A set of personal protective equipment (PPE) for every member of the construction team
- First-aid boxes with prescribed first-aid medicines in every construction campsite and yard
- List of competent first-aiders
- List of fire trained personnel
- Appropriate numbers of blankets, rescue ropes, and high beam torches
- Drinking water
- Gas leak detectors
- Lifeboats & jackets

**Records:**

The following records will be maintained:

- Record of emergency preparedness plan with emergency contact numbers
- Mock drill/emergency preparedness exercise records
- Corrective preventive action record after the emergency occurs

**Reporting:**

The accident and incident records and emergency preparedness drill reports will form part of the quarterly report to PWRD, Assam, and the Supervision Consultant.

**Responsibility:**

- Prime Responsibility: Contractor will be responsible for implementing the Emergency plan and reporting
- Supervisory Responsibility: The Supervision Consultant will check compliance of the contractor with the above guidelines



## Annexure 8: Guidelines for Waste Disposal and Management

Waste disposal and management plan will be prepared by the contractor before the start of construction works and submitted to PWRD, Assam, and the Supervision Consultant for their review and approval. The management plan will follow the guidelines as given below:

- The debris disposal site should be identified which are preferably barren or low-lying areas away from settlements.
- Prior concurrence will be taken from concerned Govt. Authorities or landowner
- Due care should be taken during site clearance and disposal of debris so that public/ private properties are not damaged or affected, no traffic is interrupted.
- All efforts should be made to use debris in road construction or any other public utilities.
- The debris should be stored at the site ensuring that existing water bodies and drains within or adjacent to the site are kept safe and free and no blocking of drains occurs.
- All dust prone material should be transported in a covered truck.
- All liquid waste like oils and paint waste should be stored at identified locations and preferably on a cemented floor. The provision of a spill collection pit will be made on the floor to collect the spilled oil or paint. These should be sold off to authorized recyclers.
- All domestic waste generated at construction camp preferably be composted in a portable mechanized composter. The composted material will be used as manure.
- In case composting is not feasible, the material will either be disposed of through a waste disposal system or disposed of through land burial. The dumpsite must be covered up with at least a six-inch thick layer of soil.
- Only appropriately design, engineered and compliant landfills will be used for disposing of waste. Engineered dump sites mean clay or other non-permeable liners to prevent water and soil contamination.
- All efforts should be made that no chemical/ oily waste spill over to ground or water bodies.
- All precautions should be followed for emergency preparedness and occupational health & safety during construction and handling waste.
- Provision of fire extinguishers will be made at the storage area
- Adequate traffic control signals and barriers should be used in case traffic is to be diverted during debris disposal. All efforts should be made to ensure avoidance of traffic jams, which otherwise results in air pollution, noise pollution, and public unrest.
- Hazardous waste and chemicals should be stored in a dedicated storage area that has: 1) weather protection, 2) solid impermeable surface and drainage to the treatment system, 3) security fence/lock, 4) primary and secondary containment with 110% volume for liquids.

**Records:** The following records will be maintained

- Generation and disposal quantity with the location of disposal
- Recyclables waste generation and disposal
- Domestic waste disposal locations details

**Reporting:**

- The waste generation and disposal details will form part of the quarterly report to PWRD Assam.

**Responsibility:**

- Prime Responsibility: Contractor will be responsible for waste management and reporting
- Supervisory Responsibility: Supervision Consultant will check the contractor's adherence to the above guidelines



## Annexure 9: Outline of an Environmental Monitoring Report

### 1. Introduction

(Report Purpose, Brief project background including organizational setup, list of roads, planned project schedule, etc., Details on Project Implementation Progress with details on current site works, location, earthworks, vegetation clearing, spoils disposal, the establishment of construction camp and other construction-related facilities (e.g., concrete mixing plant, asphalt batching plant, crushing plant, etc.), establishment and operation of quarry/borrow areas, etc., including locations, schedules, dates, etc., Schedule of construction activities for the subsequent months).

### 2. Compliance on Environment Safeguards Requirements

(Status of compliance with AIB loan covenants: provide a list of environmental loan covenants and specify the level of compliance).

Status of compliance with government environmental requirements: provide a list of government environmental requirements (permits, etc.) for the project as well as construction-related facilities/ activities and specify the level of compliance, indicate any required environmental permit/license/consent obtained to date and to be obtained (including the schedule) for the project and construction-related facilities/activities).

### 3. Changes in project scope

(Such as a change in alignment or footprint in case of horizontal infrastructure, implementation of additional Project component/s, etc. (with reference to the Project scope identified in the AIB cleared environmental impact assessment report, i.e., EIA) and corresponding safeguard measures are undertaken, if applicable).

### 4. Implementation of Environmental and Social Management Plan

Indicate how ESMP requirements are incorporated into contractual arrangements, such as with contractors or other parties.

Summary of Environmental Mitigations and Compensation Measures Implemented.

Based on ESMP; it may include measures related to air quality, water quality, noise quality, pollution prevention, biodiversity, and natural resources, health and safety, physical cultural resources, capacity building, and others. Provide a table/matrix showing a summary of each environmental mitigation measure specified in the ESMP.

ESMP Requirement (list all mitigation measures specified in the EMP)	Compliance Attained (Yes, No, Partial)	Comment on Reasons for Partial or Non-Compliance	Issues for Further Action and Target Dates
1			
2			



ESMP Requirement (list all mitigation measures specified in the EMP)	Compliance Attained (Yes, No, Partial)	Comment on Reasons for Partial or Non-Compliance	Issues for Further Action and Target Dates
3			
4			
5			
etc.			

## 5. Environmental Monitoring Activities

(Compliance Inspections, Summary of Inspection Activities, Mitigation Compliance Mitigation Effectiveness. Findings of Environmental Monitoring Plan (EMOP) on quality of air, noise, water, etc. and Results Assessment)

## 6. Key Environmental Issues

(Key Issues Identified (e.g., non-compliance to loan covenants, ESMP and/or government environmental requirements, insufficient mitigation measures to address Project impacts, incidents, accidents, etc.) Actions Taken and Corrective Action Plan (specify actions taken and corrective action plans to be implemented to address non-compliance and other identified issues. Such an action plan should provide details of specific actions to be undertaken to resolve identified issues, responsible persons who will carry out such actions and timeframe/target date to carry out and complete required actions. The action plan could be presented in a tabular/matrix form (see below). Timeframe and responsibilities for reporting to AIIB on the progress of implementation of the corrective action plan should also be specified under this section.)

Issue	Cause	Required Action	Responsibility	Timing (Target Dates)	Description of Resolution and Timing (Actual)
Old Issues from Previous Reports					
1					
2					
New Issues from this Report					
1					
2					

Complaints: Details of Complaint/s (Provide details of any complaints that have been raised by the local population and other stakeholders regarding environmental performance and Overall compliance with mitigation implementation requirements could be described in qualitative terms or be evaluated based on a ranking system, such as the following:

- Very Good (all required mitigations implemented)
- Good (the majority of required mitigations implemented)
- Fair (some mitigations implemented)
- Poor (few mitigations implemented)



- Very Poor (very few or no mitigations implemented)

Additional explanatory comments should be provided as necessary.

Effectiveness of mitigation implementation could be described in qualitative terms or be evaluated based on a ranking system, such as the following:

- Very Good (mitigations are fully effective)
- Good (mitigations are generally effective)
- Fair (mitigations are partially effective)
- Poor (mitigations are generally ineffective)
- Very Poor (mitigations are completely ineffective)

Additional explanatory comments should be provided as necessary.

Discharge levels should be compared to the relevant discharge standards and/or performance indicators noted in the ESMP. Any accidents should be highlighted for attention and follow-up. Besides, discharge levels could be compared to baseline conditions (if baseline data is available) and described in qualitative terms or be evaluated based on a ranking system, such as the following:

- Very Good (overall conditions are generally improved)
- Good (conditions are maintained or slightly improved)
- Fair (conditions are unchanged)
- Poor (conditions are moderately degraded)
- Very Poor (conditions are significantly degraded)

Additional explanatory comments should be provided as necessary.

Environmental impacts (complainant, nature of the complaint, date complaint was filed, which office received the complaint, etc.)

Action Taken (Document how the complaints were addressed or will be addressed by indicating the following:

- Names and designation of specific staff or officials within the Grievance Redress Committee, executing agency, project management unit, local government, contractor, and/or supervision consultant involved in receiving, documenting, and resolving the complaint (s).
- Specific actions are taken to be taken to resolve the complaint and corresponding timeframe

## 7. Conclusion and Recommendation

- Overall Progress of Implementation of Environmental and Social Management Measures
- Problems Identified and Actions Recommended
- Monitoring adjustment (recommended monitoring modifications based on monitoring experience/trends and stakeholder's response)

## 8. Appendices

- Site Inspection / Monitoring Reports
- Source and Ambient Monitoring Results (Laboratory Analysis)



- Photographs
- Location Map of Sampling Stations
- Copies of Environmental Permits/Approvals
- Other relevant information/documents

Overall sector environmental and social management progress could be described in qualitative terms or be evaluated based on a ranking system, such as the following:

- Very Good
- Good
- Fair
- Poor
- Very Poor

Additional explanatory comments should be provided as necessary.



## Annexure 10: Impacts of Climate Change on Road Transport in the State of Assam

### 1. Introduction

The PWRD road project is mainly linked to road transport engineering aspects of augmentation, rehabilitation, and widening initiatives with the primary objective of supporting the State's accelerated economic development. This climate risk and vulnerability Adaptation (CRVA) is an essential component, the study needs to demonstrate that climate considerations have been integrated into the DPR of the project road.

Projected change in the global climate is almost certain to have a significant impact on the appraisal, planning, design, construction, operation, and maintenance of road infrastructure. The environmental impact reports of the project roads state that climate change and its associated impacts will be experienced through changing temperatures and precipitation, changes in the frequency and severity of climate extremes, and the dynamics of hazardous conditions. Existing roads designed and constructed decades ago were meant to typically withstand local weather and climate but now underexposures and sensitivities to climate-related extremes, the need for the adaptation to climate change has been recognized by the State Government.

As per the Assam State Action Plan on Climate Change, Rapid increase in numbers of motor vehicles on road in Assam has been observed over the past decade. The on-road vehicle population in the State reached 1.98 million in 2013-14 from 0.53 million in 2001-01. The growth has been at a compounded annual growth rate of 12.7%. The number of Motor vehicles registered in the State is 6360 per lakh of population.

Due to the lack of adequate public transport systems where buses comprise only 1% of the total population of vehicles on road, and due to the availability of easy loans, most of the people are aspiring to buy their vehicles. As a result, two-wheelers are 57% of the total vehicle mix in the State, and cars follow suit with a 21% share in 2013-14.

The road transport sector is a direct consumer of fossil fuel, emits GHG into the atmosphere. With an increase in population and per capita rise in the number of personal vehicles, GHG emissions are likely to rise. The use of the public transport system needs to control future emissions in the future and also to ease off the pressure of vehicles on the roads, hence. This would require policy changes in the way lending is done by banks, enabling fuel mix with biofuels, and also behavioral changes of the population whereby they use more and more non-motorized transport at short distances and public transport for long distances. The Guwahati city is already in the process of developing the Bus Rapid Transit system, but further development of the public transport system is required. Other major cities also need to embrace the same for an orderly functioning road transportation system in the cities of Assam. The roads and bridges built for the transport sector are also susceptible to floods and landslides in the State, the intensity of which is likely to increase in the future. In this context therefore roads, bridges need to be built keeping in view the maximum projected intensity of extreme events.



**Suggested Strategies for the transport sector**

Sr. No.	Action	Cost (INR Cr)	Sources of Fund	Priority	Department Responsible
1	Installation of CNG pump stations across major cities of Assam; 100 depots	25	Funded	VH	Department
2	Procurement of CNG enable buses, 1000 buses	250	JNNURM	VH	Department of Transport
3	Assess req of non-motorized transport numbers and Introduce tracks for non-motorized transport along existing roads, 10 major cities	2	State Govt./Central Govt.	H	Department of Transport
4	Retrofitting all Public Vehicles with CNG Kit – Policy regulations to be formulated	100		VH	Department of Transport
5	Introducing intelligent traffic management systems, 10 major cities	10		H	Department of Transport
6	Construct parking slots in Guwahati, Tinsukia, Dibrugarh, Nagaon, Tezpur, Jorhat, and Silchar. Partial cost of construction, 7 major cities	35		H	Department of Transport
7	Promote better driving practices and maintenance of vehicles among truck, bus and car drivers to enhance fuel efficiency	1		H	Department of Transport

*Source: Assam State Action Plan on Climate Change*

**2. Review of Climate Change Literatures Specific to Assam**

With the "Tropical Monsoon Rainforest Climate", Assam is temperate (summer max. at 35–39 °C and winter min. at 5–8 °C) and experiences heavy rainfall and high humidity. The climate is characterized by heavy monsoon downpours, which reduce summer temperatures, enable the formation of foggy nights and mornings in winters. Spring (Mar-Apr) and autumn (Sept-Oct) are usually pleasant with moderate rainfall and temperature.

For ascertaining long term climate trends, State level climate data for the period 1951 to 2010 has been analyzed by the India Meteorological Department. This analysis is based on 282 stations for temperature and 1451 stations for rainfall across the country. In Assam, the analysis is based on data collected from 6 Stations for temperature and 12 Stations for rainfall. The analysis indicates that the mean temperature in the State has increased by +0.01°C/year. There is also an increase in seasonal temperatures across seasons with pronounced warming in post-monsoon and winter temperatures. The annual rainfall has also decreased by -2.96 mm/year during the same period.

**Climate trends in Assam between 1951 and 2010**

	Annual	Winter	Summer	Monsoon	Post Monsoon
Mean Max Temp	+0.02	0.01	No trend	0.01	0.02
Mean Min Temp	+0.01	0.02	0.01	0.01	0.02



Annual	Winter	Summer	Monsoon	Post Monsoon
Mean Temp (°C/yr) +0.01	0.01	No trend	0.01	0.02
Rainfall (mm/yr) -2.96	0.08	-0.56	-2.19	-0.75

*Source: Assam State Action Plan on Climate Change*

**Projected Changes in Climate**

	2021-2050 wrt BL	Remarks
Mean Temperature	1.7-2.0°C	All across Assam
Annual Rainfall	-5 to 5%	North-western districts
	5-10%	North-Eastern districts
	10-25%	Central, South Eastern districts
Extreme rainfall days	5-38%	Rainfall >25 to 150 mm
Drought weeks	-25% to >75%	Southern districts show a marginal reduction in drought weeks but rest of the district show an increase by more than 75% wrt BL

*Source: Assam State Action Plan on Climate Change*



## Annexure 11: Tree Inventory

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
1	Krishnasura	170	8.00	722	Peepal	230	7.90
2	Sadina	110	4.80	723	Mango	100	6.80
3	Bogori	80	7.00	724	Mango	100	8.00
4	Jackfruit	100	8.00	725	Mango	110	6.90
5	Keselo	80	6.10	726	Borum	80	5.60
6	Azhar	130	5.90	727	Krishnasura	90	5.40
7	Azhar	130	8.00	728	Krishnasura	70	6.50
8	Sirish	120	6.80	729	Amora	60	6.00
8	Koronjo	60	3.60	730	Amora	60	6.00
9	Koronjo	50	3.60	733	Koronjo	40	4.60
11	Koronjo	60	3.60	734	Koronjo	70	4.50
12	Tejpatta	60	5.70	735	Koronjo	90	4.10
14	Sirish	90	4.40	745	Koronjo	100	7.00
15	Koronjo	80	4.40	746	Demaru	330	7.20
16	Koronjo	50	4.40	747	Sirish	100	7.10
17	Koronjo	80	6.00	748	Koronjo	130	7.80
18	Sadina	90	7.00	750	Koronjo	50	7.80
19	Amora	140	8.00	755	Demaru	600	6.70
20	Guwal	70	5.60	756	Koronjo	50	7.00
23	Demaru	200	5.30	757	Koronjo	70	7.10
24	Demaru	60	7.00	758	Honaru	100	6.50
25	Demaru	70	7.00	763	Koronjo	60	5.20
26	Demaru	70	7.00	764	Guwal	80	6.10
27	Demaru	70	7.00	767	Seva	90	6.20
28	Demaru	70	7.00	770	Koronjo	50	6.00
29	Demaru	70	7.00	771	Honaru	30	3.90
30	Demaru	70	7.00	772	Seva	100	6.50
31	Demaru	60	7.00	773	Koronjo	30	4.50
32	Demaru	60	7.00	774	Sashi	50	7.00
33	Demaru	60	7.00	775	Koros	40	5.20
34	Demaru	60	7.00	778	Sirish	90	5.10
35	Demaru	50	7.00	779	Sirish	50	6.40
36	Demaru	50	6.90	780	Azhar	130	8.00
37	Demaru	50	6.90	781	Demaru	80	8.00
38	Demaru	50	6.90	782	Azhar	100	6.00
39	Demaru	50	6.90	783	Azhar	100	8.00
40	Demaru	50	6.90	784	Bokul	70	5.40
41	Demaru	60	6.90	785	Honaru	60	5.10
42	Demaru	60	6.90	786	Krishnasura	100	5.90
43	Demaru	60	6.90	787	Peepal	440	5.30
45	Demaru	80	6.90	788	Koros	130	7.90
46	Demaru	80	6.90	789	Koros	90	7.90
47	Koronjo	100	6.80	790	Koros	120	7.90
48	Demaru	90	6.80	791	Koros	120	6.20
49	Demaru	70	5.00	792	Koros	110	6.10



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
50	Demaru	70	5.00	793	Koros	120	6.10
52	Sirish	110	5.10	794	Koros	110	6.00
53	Krishnasura	80	5.10	795	Koros	90	6.00
54	Nahar	50	5.30	796	Koros	120	6.00
55	Akasi	110	5.60	797	Koros	180	6.20
56	Ritha	110	7.00	798	Boga sirish	70	0.50
58	Moj	110	6.70	799	Azhar	80	0.50
63	Boga sirish	70	7.10	800	Azhar	130	3.00
66	Sationa	70	6.20	801	Paniyal	90	6.00
67	Demaru	100	6.20	723	Shirish	230	4.50
68	Honaru	60	6.20	724	Koros	122	4.30
69	Hilika	80	8.00	725	Amora	65	5.90
71	Moj	120	6.80	726	Gomari	100	4.70
72	Sirish	180	6.70	729	Amora	50	4.70
73	Koronjo	90	5.80	733	Amora	62	4.70
74	Bonpitha	100	5.90	738	Koros	90	5.30
76	Jackfruit	100	8.00	739	Gomari	123	4.00
80	Hemalu	90	6.70	267	Satiana	240	7.60
81	Boga sirish	110	6.80	266	Krishnosura	70	5.60
82	Azhar	60	5.20	265	Dimaru	100	6.90
83	Moj	80	5.40	264	Himolu	220	6.00
84	Bokul	90	6.00	263	Satiana	310	4.40
85	Bokul	90	6.00	262	Satiana	110	5.00
87	Azhar	60	6.70	261	Gomari	250	3.20
88	Bogori	70	6.60	260	Karanja	100	5.20
89	Honaru	100	6.40	259	Shirish	140	6.50
90	Boga sirish	80	6.60	258	Shirish	170	5.00
91	Boga sirish	100	6.60	257	Karanja	70	6.00
92	Boga sirish	100	6.60	256	Shirish	260	4.60
93	Boga sirish	80	6.30	255	Gomari	170	5.10
94	Boga sirish	80	4.20	254	Shirish	180	5.30
96	Boga sirish	120	2.20	253	Shirish	130	6.30
999	Amora	50	6.00	252	Shirish	140	5.10
5	Sationa	65	7.00	251	Amora	50	5.80
6	Bhoklo	40	7.00	249	Gomari	180	4.90
8	Bhoklo	80	5.40	248	Gomari	210	4.40
13	Sewatamol	40	7.50	247	Shirish	100	5.40
14	Sewatamol	75	7.20	246	Gomari	180	4.60
15	Moadhs	110	5.50	245	Shirish	100	5.40
16	Sewatamol	50	7.60	244	Shirish	130	5.90
19	Bhoklo	33	5.50	243	Karanja	100	4.20
20	Sirish	34	5.60	242	Krishnosura	120	6.10
21	Bhoklo	115	4.80	241	Gomari	130	5.10
22	Moadhs	30	6.00	240	Shirish	110	4.90
23	Mango	30	5.50	239	Krishnosura	120	7.00
24	Gomare	85	5.20	238	Shirish	80	7.30
25	Gomare	80	5.10	237	Krishnosura	130	7.30
26	Bhoklo	73	5.60	236	Shirish	90	7.20
27	Gomare	90	5.90	233	Bel	80	7.60



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EIA & ESMP

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
28	Gomare	34	5.80	232	Gomari	100	5.10
29	Amora	40	6.40	230	Mowaliya	130	5.50
30	Amora	45	6.40	229	Shirish	440	4.60
31	Amora	60	7.00	227	Dhoma	180	5.60
32	Amora	85	7.00	225	Gomari	70	7.70
33	Amora	60	7.20	224	Debodaru	70	8.00
34	Amora	100	7.10	221	Karanja	100	7.00
35	Bhoklo	60	7.40	219	Gomari	200	5.10
36	Bhoklo	40	7.40	218	Karanja	110	5.60
37	Hunaru	50	7.40	217	Karanja	120	4.60
38	Sirish	95	7.30	216	Karanja	190	5.10
39	Sirish	110	5.30	215	Karanja	100	4.60
40	Sirish	65	7.60	214	Karanja	110	4.70
41	Gomare	60	7.00	212	Hunaru	50	5.00
252	Krishnasura	110	7.30	211	Karanja	200	5.00
251	Guwal	90	5.80	210	Karanja	100	5.50
250	Himolu	90	6.30	209	Karanja	110	6.10
249	Sirish	40	6.30	208	Karanja	120	6.20
248	Gorakhiya	30	6.30	206	Karanja	100	5.00
247	Sirish	40	6.30	205	Shirish	190	4.30
246	Koros	40	6.50	204	Karanja	80	4.40
245	Guwal	90	5.90	203	Karanja	90	5.10
244	Sirish	230	3.90	202	Shirish	320	4.90
243	Sirish	110	4.50	201	Karanja	130	6.00
242	Sirish	180	4.10	200	Karanja	220	5.80
241	Gomare	140	6.50	199	Dhoma	140	5.50
240	Sirish	210	4.20	198	Karanja	140	5.50
239	Sirish	170	4.10	197	Karanja	110	6.40
238	Sirish	180	4.50	196	Shirish	320	5.00
237	Gomare	170	4.60	195	Shirish	340	5.10
236	Gomare	170	4.70	194	Karanja	140	5.20
235	Gomare	110	4.80	192	Karanja	130	5.40
234	Sirish	70	5.20	191	Gomari	80	5.80
233	Sirish	70	5.30	190	Gomari	70	7.30
232	Koros	40	5.90	189	Shirish	120	4.90
231	Koros	40	5.00	188	Dhoma	130	4.10
230	Sirish	110	5.40	187	Dimaru	70	6.10
229	Guwal	40	6.80	186	Karanja	50	7.60
228	Koros	150	4.80	185	Karanja	140	4.50
227	Koros	140	4.70	184	Dhoma	440	4.60
226	Gomare	140	4.20	183	Peepal	200	5.50
225	Gomare	120	4.30	182	Karanja	100	5.40
224	Koros	80	4.60	181	Bogori	70	5.60
223	Gomare	130	4.50	179	Karanja	120	5.70
222	Koros	130	4.70	178	Karanja	120	5.90
221	Koros	170	4.30	177	Karanja	80	5.30
220	Koros	100	5.90	176	Karanja	110	5.50
219	Koros	150	3.90	175	Karanja	90	5.40
218	Gomare	70	4.80	174	Karanja	170	5.70



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
217	Sirish	280	3.90	172	Peepal	610	5.10
216	Koros	120	4.40	171	Gomari	80	7.60
215	Koros	160	4.50	170	Gomari	80	8.00
214	Gomare	100	4.30	169	Satiana	80	7.60
213	Gomare	180	4.40	168	Gomari	130	8.00
212	Gorakhiya	40	7.50	167	Satiana	230	8.00
211	Moj	50	6.40	166	Moder	120	7.00
210	Jiya	35	6.30	165	Gomari	70	7.10
209	Koros	30	7.40	163	Sojana	60	7.20
208	Gomare	160	6.40	162	Gomari	70	7.20
207	Gorakhiya	35	8.00	161	Amora	70	7.00
206	Gomare	180	6.90	160	Amora	80	7.60
205	Poniyal	30	4.30	159	Amora	50	6.10
204	Katkora	140	6.80	158	Amora	70	6.50
203	Koros	85	6.50	157	Peepal	60	7.30
202	Koros	80	4.60	156	Amora	60	6.40
201	Sationa	90	5.60	155	Amora	80	6.00
200	Sirish	30	7.50	153	Neem	90	6.60
199	Koros	30	6.20	150	Azhar	90	8.00
198	Koros	70	5.00	149	Vatgila	50	8.00
197	Gomare	130	5.40	148	Shirish	50	7.80
196	Moj	110	6.50	147	Vatgila	50	7.20
195	Gomare	110	5.20	146	Shirish	220	7.60
194	Gomare	85	5.50	145	Karanja	80	8.00
193	Gomare	80	5.80	144	Satiana	70	8.00
192	Koros	120	5.50	143	Neem	50	6.60
191	Gomare	140	4.10	141	Bogori	130	5.00
190	Demoru	70	8.00	140	Moulita	80	7.00
189	Moralia	110	6.60	139	Moulita	80	7.20
188	Koros	140	3.90	137	Poing	50	7.40
187	Flower	60	6.80	136	Karanja	170	8.00
186	Azhar	100	6.10	135	Dimaru	100	7.40
185	Bhatgela	80	7.10	134	Karanja	200	5.80
184	Hunaru	90	4.00	133	Karanja	120	6.80
183	Koros	140	4.60	132	Karanja	200	6.60
182	Koros	180	4.00	131	Karanja	140	8.00
181	Koros	180	4.00	130	Karanja	110	8.00
180	Sirish	100	8.00	129	Karanja	230	6.10
179	Ager	30	7.80	128	Karanja	260	6.00
178	Koros	80	4.30	127	Karanja	140	8.00
177	Ager	30	7.80	126	Karanja	110	5.20
176	Ager	80	7.70	125	Karanja	130	5.30
175	Sationa	90	7.80	124	Karanja	190	6.50
174	Koros	80	4.40	123	Karanja	120	6.90
173	Azhar	40	6.50	122	Karanja	110	7.60
172	Dhuma	100	6.40	121	Karanja	200	6.70
171	Bhamlati	40	8.00	120	Dhoma	160	7.70
170	Koros	180	4.40	119	Karanja	100	6.60
169	Koros	100	6.80	118	Peepal	330	7.80



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
168	Sirish	210	4.80	117	Lxaranja	140	6.80
167	Sirish	110	5.00	116	Dhoma	370	8.00
166	Moj	80	6.80	111	Peepal	400	6.40
165	Koros	70	6.00	110	Gango	150	6.60
164	Koros	60	7.40	109	Peepal	90	6.70
163	Gomare	190	4.10	103	Moj	70	7.80
162	Sirish	240	5.10	99	Satiana	220	6.10
161	Sirish	480	4.70	98	Indramalti	60	7.70
160	Guwal	80	6.30	96	Shirish	100	7.40
159	Moj	50	6.00	95	Shirish	110	7.30
158	Jamuk	50	5.70	94	Shirish	160	6.90
157	Moj	50	6.10	93	Shirish	90	6.40
156	Katkora	70	6.30	92	Shirish	100	7.80
155	Krishnasura	80	5.90	91	Shirish	150	7.80
154	Jiya	40	5.80	90	Shirish	190	6.10
153	Neem	70	4.80	89	Shirish	140	8.00
152	Krishnasura	120	4.80	88	Shirish	180	5.50
151	Krishnasura	65	6.30	87	Shirish	140	5.10
150	Sojina	140	5.00	86	Dimaru	90	8.00
149	Hunaru	80	7.50	85	Moj	120	8.00
148	Pepale	130	6.50	84	Gohora	50	7.40
147	Moj	70	6.30	83	Bogori	110	5.40
146	Modor	70	6.20	82	Bogori	110	6.10
145	Pepale	150	7.80	81	Kukuthang	80	7.70
144	Neem	70	5.80	80	Moj	190	8.00
143	Krishnasura	170	7.50	79	Batghula	50	7.40
142	Krishnasura	60	7.50	78	Karanja	150	8.00
141	Sationa	250	6.40	77	Shirish	110	6.50
140	Sationa	170	5.70	74	Neem	120	6.70
139	Amora	80	5.70	73	Dhoma	60	8.00
138	Amora	70	5.50	72	Dhoma	150	7.20
137	Sationa	90	5.20	71	Dimaru	90	7.60
136	Sationa	120	5.00	70	Shirish	70	6.40
135	Bogore	110	4.90	69	Moj	70	6.50
134	Bogore	70	6.20	68	Moj	90	7.50
133	Demoru	30	6.10	67	Peepal	540	6.90
132	Gorakhiya	40	6.60	66	Krishnosura	70	7.50
131	Karabi	30	7.60	65	Katkora	80	5.70
130	Modor	60	6.60	64	Karanja	70	7.50
129	Modor	60	5.90	63	Karanja	80	6.40
128	Bogore	60	5.90	62	Azhar	160	6.70
127	Guwal	50	5.90	61	Bogori	100	7.50
126	Koros	50	6.20	60	Karanja	80	7.80
125	Sirish	90	7.50	59	Karanja	100	8.00
124	Sirish	130	4.40	58	Bogori	140	7.40
123	Koros	90	6.30	57	Karanja	100	8.00
122	Koros	140	5.90	56	Bogori	70	8.00
121	Sirish	150	5.90	55	Bogori	170	6.80
120	Azhar	120	7.80	54	Guwal	80	8.00



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
119	Azhar	210	5.50	53	Bogori	90	7.20
118	Azhar	70	6.70	52	Karanja	70	7.40
117	Azhar	50	7.40	51	Gomari	220	7.70
116	Moj	70	8.00	50	Bogori	180	7.80
115	Amora	140	6.40	49	Karanja	70	8.00
114	Guwal	220	6.70	48	Gomari	150	6.00
113	Sirish	100	5.60	47	Bogori	100	4.90
112	Deaisali	60	6.20	45	Dimaru	60	5.30
111	Jiya	80	4.70	44	Bogori	60	7.00
110	Bogore	120	4.80	43	Dimaru	70	5.40
109	Koros	230	7.00	41	Moder	100	6.90
108	Koros	340	7.00	39	Debodaru	50	6.60
107	Koros	170	7.50	38	Karanja	80	6.90
106	Koros	230	7.90	37	Debodaru	50	5.80
105	Modor	340	8.00	36	Flower	50	7.20
104	Kanchon	100	7.30	35	Satiana	50	7.70
103	Sationa	180	6.30	34	Satiana	60	7.90
102	Mango	50	6.90	33	Katkora	100	5.70
101	Mango	90	6.70	32	Hunaru	50	5.30
100	Sationa	220	7.00	30	Katkora	100	8.00
99	Sationa	170	8.00	29	Krishnosura	80	7.90
98	Katkora	70	6.70	28	Krishnosura	60	8.00
97	Katkora	60	5.50	27	Karanja	120	7.00
96	Moj	70	7.50	26	Karanja	90	6.40
95	Katkora	110	6.10	25	Karanja	130	5.50
94	Katkora	80	6.00	24	Karanja	80	8.00
93	Demoru	70	8.00	23	Satiana	330	7.00
92	Sationa	120	6.80	22	Karanja	60	7.00
91	Demoru	70	8.00	21	Karanja	140	7.20
90	Azhar	90	6.20	20	Karanja	100	7.10
89	Demoru	70	7.80	19	Karanja	120	8.00
88	Koros	130	7.70	17	Karanja	110	6.70
87	Koros	120	5.60	16	Karanja	110	7.70
86	Sirish	110	4.40	14	Katkora	100	8.00
85	Rabab tenga	60	4.40	13	Karanja	90	5.60
84	Demoru	50	8.00	11	Karanja	80	5.20
83	Moj	80	7.20	9	Kukuthang	100	6.50
82	Mardia	80	7.50	8	Batghula	160	5.50
81	Keselo	70	5.80	6	Nunetenga	70	6.60
80	Guwal	40	6.00	5	maj	50	7.30
79	Demoru	40	6.60	4	maj	60	6.60
78	Pines	40	4.10	1	Molia	50	8.00
77	Koros	240	6.80	999	Nunetenga	90	7.30
76	Koros	120	5.30	997	Shirish	70	7.50
75	Rabab tenga	100	5.50	996	Peepal	350	7.20
74	Katkora	60	6.60	995	Karanja	80	5.30
73	Gorakhiya	70	6.90	994	Katkora	200	6.20
72	Gorakhiya	40	7.00	993	Karanja	90	7.00
71	Sationa	160	4.60	991	Karanja	90	7.00



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
70	Sationa	160	4.70	990	Karanja	50	7.40
69	Moj	50	7.50	989	Karanja	70	6.60
68	Sationa	170	5.60	988	Satiana	250	7.00
67	Sationa	170	7.70	987	Katkora	60	7.60
66	Moj	110	6.80	986	Karanja	220	8.00
65	Sationa	170	6.80	985	Karanja	130	7.30
64	Sationa	150	7.00	984	Karanja	130	7.40
63	Sationa	80	7.70	983	Bogori	120	5.20
62	Katkora	110	7.00	982	Karanja	130	7.40
61	Moj	200	7.20	981	Krishnosura	80	6.80
60	Sationa	120	6.00	980	Karanja	60	6.70
59	Bhatgela	100	6.10	979	Guwal	80	8.00
58	Guwal	130	5.40	978	Karanja	180	5.40
57	Katkora	100	5.80	977	Gohora	80	7.60
56	Bhatgela	130	5.90	976	Satiana	90	7.80
55	Sationa	270	5.30	975	hilikha	140	6.50
54	Bhatgela	80	6.90	973	Satiana	210	6.00
53	Sirish	120	6.00	972	Gomari	80	4.40
52	Moj	65	7.70	971	Bogori	80	7.00
51	Sirish	60	6.60	970	maj	70	6.60
50	Krishnasura	80	7.00	969	Nunetenga	70	6.70
49	Bhatgela	100	5.10	968	Maj	90	7.90
48	Krishnasura	60	6.90	967	Lali	90	7.90
47	Hunaru	65	5.50	966	Lali	60	8.00
46	Koros	70	6.00	965	Peepal	350	8.00
45	Koros	95	6.50	964	Bogori	60	6.80
44	Katkora	60	5.70	963	Katkora	150	6.40
43	Moj	130	6.80	961	Satiana	170	4.30
42	Gorakhiya	30	6.30	959	Peepal	420	4.60
41	Katkora	60	6.10	958	Hunaru	100	4.80
40	Bhatgela	60	6.50	953	Shirish	60	7.40
39	Himolu	30	6.10	951	Gomari	50	5.00
38	Koros	90	6.80	948	Shirish	70	7.90
37	Sirish	80	6.40	947	Gomari	50	8.00
36	Moj	100	7.10	945	Shirish	60	6.40
32	Mango	50	7.70	944	Dimaru	60	7.60
31	Silikha	90	7.50	942	Dimaru	50	7.80
30	Sajina	60	6.70	939	Karanja	70	5.80
29	Hengalu	60	6.40	938	Karanja	80	6.50
28	Moj	60	4.40	937	Karanja	140	4.80
27	Moj	120	4.50	935	Karanja	70	4.30
26	Azhar	110	7.30	934	Amora	120	4.30
25	Azhar	30	7.60	933	Karanja	90	6.80
24	Katkora	160	6.40	932	borgos	110	6.80
23	Guwal	100	7.10	931	Amora	120	4.10
22	Koros	30	4.70	930	Karanja	90	6.00
21	Koros	120	8.00	922	Amora	90	8.00
20	Katkora	70	6.50	919	Shirish	100	5.30
19	Azhar	50	6.50	917	Shirish	70	5.70



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
18	Guwal	150	6.50	916	Shirish	50	5.80
17	Sirish	180	5.00	915	Shirish	80	5.30
16	Gorakhiya	70	6.60	912	maj	60	5.50
15	Sirish	50	5.20	911	Molia	60	5.30
14	Krishnasura	80	7.70	910	Neem	50	6.10
12	Krishnasura	80	6.80	909	Shirish	80	5.60
10	Katkora	70	6.00	908	Shirish	70	5.80
9	Jiya	60	3.90	907	Shirish	60	5.90
8	Jiya	40	4.30	905	Krishnosura	120	8.00
7	Modor	70	5.50	903	hilikha	100	5.90
6	Jiya	50	4.20	902	Satiana	140	6.00
5	Demoru	60	6.90	901	Karanja	110	4.10
4	Jiya	50	4.10	900	Karanja	90	4.90
3	Jiya	40	4.10	899	Karanja	130	5.10
2	Jiya	60	3.80	898	Karanja	160	4.20
1	Demoru	70	6.90	897	thekera	60	5.30
999	Jiya	40	3.80	896	Karanja	240	4.40
998	Guwal	80	7.00	895	Shirish	80	6.10
997	Krishnasura	70	6.20	894	Gomari	60	5.40
996	Jiya	40	6.50	891	Shirish	50	5.30
995	Himolu	110	5.20	890	Shirish	90	5.90
994	Moj	80	5.20	889	maj	50	6.10
993	Neem	60	5.10	888	Satiana	120	5.20
992	Jiya	90	4.50	887	Shirish	60	4.30
991	Jiya	30	5.10	886	Gomari	60	4.60
990	Jiya	80	5.20	884	Gomari	80	5.40
989	Jiya	50	5.40	883	Gomari	70	4.20
988	Neem	80	6.60	882	Gomari	90	4.60
987	Jiya	50	5.10	881	Gomari	50	5.30
986	Jiya	100	5.20	880	Karanja	50	6.90
985	Sationa	30	4.90	879	Gomari	50	6.10
984	Neem	40	5.20	873	Guwal	80	4.60
983	Jiya	30	5.90	866	Krishnosura	130	7.40
982	Jiya	40	5.20	865	maj	50	6.10
981	Jiya	50	5.10	856	Krishnosura	100	5.80
980	Jiya	40	5.10	846	Bokul	70	7.30
979	Jiya	40	5.10	844	Karanja	220	5.30
978	Jiya	30	5.00	843	Shirish	80	6.80
977	Sationa	30	5.20	842	Shirish	130	7.20
976	Jiya	30	5.10	841	Karanja	130	6.30
975	Jiya	50	5.10	839	Krishnosura	90	6.80
974	Jiya	80	6.30	837	Satiana	90	6.50
973	Sationa	100	5.00	836	Satiana	100	6.20
972	Sirish	30	4.80	835	Satiana	130	6.20
971	Krishnasura	90	4.80	834	Satiana	110	8.00
970	Jiya	40	4.40	833	Moder	70	7.00
969	Jiya	40	4.30	832	Satiana	140	5.80
968	Koros	70	5.20	831	Satiana	160	5.10
967	Jiya	40	4.50	830	hemalo	110	8.00



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
966	Moj	40	4.80	827	Shirish	70	5.00
965	Jiya	30	4.40	825	Shirish	100	4.70
964	Jiya	50	4.80	824	Shirish	70	4.90
963	Jiya	30	4.50	823	Satiana	100	5.90
962	Jiya	30	4.50	822	Shirish	50	5.20
960	Jiya	40	5.20	821	Shirish	80	4.90
959	Jiya	30	4.90	820	Gomari	120	4.80
958	Bogore	80	7.80	819	Azhar	70	4.70
957	Bhatgela	30	7.50	818	Jamuk	80	4.90
956	Krishnasura	90	4.70	817	maj	70	5.10
955	Sationa	40	6.80	815	maj	60	6.40
954	Neem	40	5.60	813	maj	60	4.80
953	Azhar	80	7.80	811	maj	60	4.60
952	Azhar	50	7.70	810	Satiana	50	4.80
951	Katkora	40	7.60	806	Satiana	90	7.10
950	Bogore	100	5.70	803	Hunaru	60	7.30
949	Guwal	40	7.90	801	Maj	50	5.20
948	Katkora	110	7.40	800	Maj	50	5.40
947	Katkora	50	5.60	799	Krishnosura	150	5.50
946	Bogore	120	6.10	795	Maj	60	6.70
945	Azhar	90	7.20	793	Maj	60	6.00
944	Sum	90	6.80	790	Maj	120	5.40
943	Moj	40	6.50	789	Maj	60	5.20
942	Azhar	100	5.70	788	Maj	80	4.90
941	Sationa	180	7.10	786	Maj	60	5.00
940	Bhatgela	120	6.70	785	Maj	50	6.30
939	Krishnasura	120	6.70	784	Gomari	70	5.50
938	Bokul	90	5.30	783	Hunaru	60	5.70
937	Sirish	70	7.30	782	Karanja	100	5.50
935	Rabab tenga	60	6.20	780	Karanja	230	5.40
934	Nuni	30	7.80	779	Bogori	130	5.00
933	Madhuri	40	5.10	778	Krishnosura	50	5.80
932	Modor	60	4.80	777	Hunaru	80	5.10
931	Gomare	50	5.50	776	Karanja	100	4.80
930	Guwal	60	6.30	775	Bogori	80	5.30
929	Jiya	30	5.30	774	Shirish	60	5.60
928	Jiya	40	5.60	773	Shirish	50	6.90
927	Jiya	40	5.60	772	Guwal	90	7.00
926	Jiya	40	5.80	771	Azhar	100	7.50
925	Jiya	40	5.50	770	Gohora	70	6.90
924	Krishnasura	70	7.30	768	Shirish	60	6.10
923	Krishnasura	40	4.80	764	Karanja	70	5.50
922	Azhar	90	7.60	763	Karanja	80	6.30
920	Moj	150	5.80	762	Karanja	80	5.90
918	Sirish	90	4.20	759	Maj	60	6.90
917	Pisola	30	7.00	758	Karanja	50	4.50
916	Sirish	200	6.00	757	Hongalu	70	6.10
915	Hasi	30	7.70	756	Karanja	60	5.50
911	Jamuk	40	6.10	754	Peepal	300	5.30



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
910	Nuni	40	6.00	753	Chationa	50	5.60
907	Thekera	40	6.10	750	Karanja	50	6.30
905	Madhuri	90	7.30	748	Shirish	180	5.70
904	Arjun	80	8.00	747	Karanja	50	5.00
903	Sirish	60	6.50	746	Karanja	60	4.90
902	Sirish	50	6.80	745	Karanja	50	5.00
901	Sirish	80	4.80	744	Shirish	170	5.50
900	Sirish	130	6.60	742	Karanja	130	6.90
899	Sirish	90	5.50	741	Karanja	60	4.90
898	Sirish	30	5.90	740	Karanja	60	5.40
897	Sirish	70	4.90	739	Karanja	100	5.10
896	Sirish	30	6.10	738	Karanja	60	5.10
895	Sirish	30	6.00	737	Karanja	50	5.50
894	Guwal	90	7.30	736	Karanja	90	5.80
893	Moj	60	4.60	735	Shirish	190	5.30
892	Nuni	50	4.90	734	Karanja	50	6.80
891	Mango	50	5.40	731	Karanja	50	5.00
890	Guwal	90	5.40	729	Shirish	140	5.10
889	Bogore	70	4.50	728	Karanja	50	5.60
888	Modor	40	5.50	727	Karanja	50	5.50
887	Gomare	100	4.60	726	Karanja	60	5.00
886	Sirish	60	6.50	724	Karanja	50	5.30
885	Gomare	90	6.50	722	Karanja	160	5.50
884	Sationa	70	6.10	720	Bogori	60	4.40
883	Koros	70	5.90	719	Guwal	70	5.20
882	Koros	60	5.30	718	Hunaru	70	5.70
881	Sirish	140	5.40	713	Bokul	50	6.10
880	Koros	60	7.30	712	Maj	80	8.00
879	Sirish	40	7.60	711	Krishnosura	180	8.00
878	Koros	100	5.30	710	Shirish	200	4.80
877	Sationa	160	5.30	709	Shirish	180	4.10
876	Sirish	70	4.70	708	Shirish	200	4.90
874	Sirish	50	3.50	707	Krishnosura	100	5.90
873	Sirish	120	4.90	706	Shirish	130	5.00
872	Sirish	50	3.80	704	Hunaru	80	5.30
871	Sirish	50	4.00	702	Amora	120	5.20
869	Sationa	150	4.90	701	Amora	140	5.50
868	Sationa	70	4.50	700	Amora	100	6.20
867	Modor	30	4.10	699	Krishnosura	110	5.60
866	Sirish	90	5.60	698	Krishnosura	90	7.30
865	Silikha	70	4.60	697	Shirish	60	6.50
861	Mango	30	4.90	696	Krishnosura	200	6.50
859	Kothal	40	5.00	693	Sationa	100	4.80
858	Kothal	50	5.00	691	Karanja	80	6.00
857	Jiya	40	4.40	690	Karanja	80	6.70
856	Kothal	50	6.20	689	Krishnosura	70	6.50
855	Jiya	70	8.00	685	Bogori	80	3.80
854	Sationa	140	4.30	684	arjun	80	5.20
853	Sirish	70	4.90	683	Krishnosura	200	6.90



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
852	Sationa	130	6.40	680	Gomari	100	6.20
851	Bokul	60	5.20	678	Amora	70	5.60
850	Moj	110	6.00	677	Bogori	80	5.40
849	Sirish	90	6.00	676	Amora	80	5.50
848	Jiya	70	5.60	674	Neem	50	5.00
847	Jiya	60	5.60	673	Amora	70	5.30
846	Sationa	70	5.70	672	Bogori	110	7.90
845	Jiya	80	6.40	670	Shirish	70	4.50
844	Gomare	130	3.90	667	Shirish	50	5.00
843	Gomare	70	4.90	666	Shirish	80	4.30
842	Gomare	80	5.20	665	Shirish	50	4.70
841	Gomare	70	5.90	664	Shirish	60	5.80
840	Gomare	120	6.60	663	Shirish	100	4.20
839	Gomare	120	4.80	662	Shirish	60	7.40
838	Gomare	120	4.90	661	Shirish	60	7.30
837	Gomare	100	4.40	660	Shirish	70	7.30
836	Moj	30	7.40	659	Shirish	70	5.80
835	Koros	120	6.30	657	Shirish	70	7.50
834	Gomare	60	5.20	656	Molia	60	8.00
833	Bandordina	80	6.70	655	Shirish	60	6.70
832	Krishnasura	70	4.20	654	Shirish	70	6.70
831	Koros	130	6.30	653	Shirish	60	7.90
830	Gomare	30	6.30	648	Karanja	50	4.10
829	Sirish	170	4.60	647	Karanja	100	4.90
828	Sirish	70	5.10	645	Karanja	80	5.50
827	Moj	70	6.00	644	Karanja	100	6.20
826	Moj	90	5.70	643	Karanja	60	4.60
825	Sirish	110	6.10	639	Karanja	60	5.90
824	Sirish	60	6.70	638	Krishnosura	50	5.20
823	Moj	90	5.80	637	Karanja	90	5.30
822	Sirish	30	4.90	634	Karanja	80	6.20
821	Moj	30	7.00	633	Karanja	150	5.70
820	Sirish	50	7.70	632	Satiana	200	4.80
819	Sirish	70	5.10	631	Shirish	70	4.80
818	Sopa	30	5.90	626	Shirish	100	5.20
817	Sirish	50	4.30	625	Shirish	60	6.00
816	Sirish	120	7.50	624	Karanja	70	5.00
815	Sirish	60	4.50	622	Shirish	60	6.60
814	Sirish	60	7.80	621	Shirish	100	6.40
813	Madhuri	60	6.30	620	Karanja	120	7.20
812	Sirish	60	5.90	619	Karanja	50	5.40
811	Sirish	80	5.30	618	Karanja	170	6.70
810	Sirish	100	6.60	617	Karanja	90	6.30
809	Sirish	140	6.60	616	Satiana	60	5.90
808	Sirish	60	6.70	615	Karanja	140	6.60
807	Sirish	120	7.40	613	Karanja	60	5.80
806	Katkora	70	6.80	612	Karanja	100	7.10
805	Demoru	70	6.70	611	Karanja	110	6.80
804	Katkora	220	7.50	609	Satiana	70	6.50



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
803	Azhar	80	7.40	608	Satiana	60	6.30
802	Modor	100	7.20	607	Karanja	130	5.70
801	Moj	40	6.10	606	Karanja	120	6.20
800	Sationa	150	7.60	605	Karanja	90	7.10
799	Sirish	80	4.60	604	Karanja	110	6.70
798	Jiya	80	5.30	603	Karanja	50	6.70
797	Krishnasura	60	6.10	602	Karanja	70	7.20
796	Jiya	30	5.30	601	Bogori	110	5.70
795	Moj	30	6.40	599	Karanja	120	4.60
794	Krishnasura	90	6.00	597	Satiana	90	6.30
791	Jiya	80	5.20	596	Satiana	120	5.80
790	Koros	80	5.30	595	Satiana	120	6.60
789	Jiya	50	4.80	594	Shirish	70	4.90
788	Jiya	100	5.30	593	Satiana	120	5.20
787	Guwal	60	6.20	591	Satiana	100	5.50
786	Sirish	110	4.60	590	Guwal	50	5.20
785	Hunaru	30	6.00	589	Shirish	120	6.20
784	Bogore	90	4.20	588	Guwal	70	5.50
783	Moj	60	5.60	587	Satiana	90	5.70
782	Krishnasura	70	5.10	585	Shirish	90	5.30
781	Moj	60	7.50	584	Satiana	70	6.40
780	Sirish	70	4.90	583	Shirish	90	5.00
779	Sirish	60	6.20	582	Shirish	80	6.70
778	Sirish	60	4.60	581	Satiana	60	6.20
777	Sirish	40	4.40	580	Satiana	120	5.40
776	Sirish	90	4.50	579	Satiana	50	7.00
775	Sirish	40	5.00	578	Satiana	120	5.30
774	Sirish	50	5.20	577	Guwal	60	6.00
773	Sirish	60	4.90	576	Satiana	80	6.80
772	Sationa	190	5.60	575	Satiana	100	7.00
771	Bogore	70	6.20	571	Satiana	160	6.00
770	Sirish	60	5.10	569	Satiana	100	6.10
769	Sationa	80	4.40	568	Satiana	80	6.50
768	Moj	60	5.20	567	Shirish	60	5.00
767	Raghu	100	6.30	564	Shirish	60	5.20
766	Madhuri	40	7.10	563	Shirish	50	5.10
765	Moj	60	4.60	562	Satiana	80	6.60
764	Raghu	120	6.80	561	Satiana	80	6.20
763	Raghu	130	7.50	559	Satiana	70	6.60
762	Koros	100	5.60	558	Satiana	100	6.00
761	Koros	140	6.20	557	Satiana	110	5.20
760	Koros	50	4.60	556	Shirish	60	5.20
759	Krishnasura	40	5.70	555	Dimaru	60	7.60
758	Krishnasura	40	5.50	554	Karanja	90	5.80
757	Sirish	40	5.90	553	Karanja	160	6.00
756	Sirish	70	5.90	551	Shirish	60	5.90
755	Sationa	90	4.90	550	Krishnosura	50	5.90
754	Moj	30	5.90	549	Batghula	70	7.90
753	Moj	80	4.90	546	Shirish	50	5.50



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
752	Azhar	70	5.40	545	Shirish	60	5.30
751	Moj	60	5.10	542	Shirish	60	5.70
750	Moj	90	5.20	541	Maj	70	8.00
749	Krishnasura	40	5.70	537	Satiana	100	7.80
748	Moj	60	7.20	536	Karanja	90	8.00
747	Krishnasura	30	5.80	535	Gomari	220	5.20
746	Bogore	90	5.80	534	Shirish	50	8.00
745	Moj	70	6.00	533	Karanja	90	4.70
744	Moj	110	6.40	532	Satiana	90	7.80
743	Sirish	30	6.40	531	Dimaru	90	7.90
742	Koros	80	5.30	530	Satiana	100	5.50
741	Koros	50	5.30	529	Satiana	60	7.10
740	Sationa	80	6.30	528	Satiana	170	7.80
739	Koros	120	6.30	527	Sume	70	5.70
738	Guwal	60	4.70	526	Bokul	140	7.20
737	Koros	70	6.60	523	Maj	80	8.00
736	Koros	80	6.30	522	Poing	130	6.40
735	Koros	80	5.40	521	Flower	80	6.30
734	Koros	90	5.70	520	Atloch	50	5.50
733	Koros	70	4.80	519	Satiana	50	7.80
732	Koros	60	5.90	517	Shilong	60	7.30
731	Guwal	100	6.60	512	Karanja	120	4.80
730	Guwal	90	6.70	511	Atloch	60	6.30
729	Koros	120	5.80	510	Karanja	60	7.30
728	Guwal	60	5.30	505	Atloch	50	6.70
727	Guwal	40	6.10	503	Amora	100	5.20
726	Sirish	40	7.40	499	Shirish	120	5.80
725	Sirish	40	6.40	498	Satiana	100	5.80
724	Sirish	40	6.00	496	Satiana	50	5.30
723	Krishnasura	30	6.50	492	Amora	80	6.40
722	Koros	90	5.80	491	Shirish	120	7.60
721	Guwal	30	6.40	490	Karanja	70	4.20
720	Koros	90	6.00	489	Satiana	90	4.30
719	Koros	60	5.90	488	Shirish	90	6.00
718	Koros	60	7.30	486	Shirish	50	5.20
717	Kanchon	60	5.60	485	Hengalu	80	5.80
716	Guwal	30	6.00	481	Gomari	80	6.70
715	Hunaru	30	5.90	480	hilikha	80	7.00
714	Koros	50	5.50	476	Amora	70	6.00
713	Koros	40	5.30	472	Dimaru	50	6.30
712	Koros	40	5.80	470	Gomari	90	6.50
711	Krishnasura	40	6.00	468	Dimaru	50	6.50
710	Bogore	90	5.30	467	arjun	50	7.60
709	Bogore	100	7.00	465	Jamuk	90	7.40
708	Koros	90	7.60	464	Jolphoy	70	7.50
707	Demoru	40	8.00	462	Amora	100	6.30
706	Kothal	60	5.30	461	Azhar	150	6.70
705	Aamlokhi	50	4.30	460	Polokh	190	6.00
704	Guwal	30	5.30	452	Shirish	80	4.60



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
703	Koros	150	5.50	451	Satiana	80	4.60
702	Koros	100	5.00	444	Satiana	80	4.80
701	Koros	30	6.00	441	Dimaru	90	8.00
700	Guwal	30	6.50	440	Bhomlote	80	7.90
699	Koros	80	5.60	439	Lali	50	8.00
698	Koros	30	6.00	438	Shirish	140	7.00
697	Koros	40	5.90	437	Moder	80	8.00
696	Sirish	100	5.20	436	Moder	100	7.20
695	Koros	40	5.10	434	Lali	130	6.70
694	Koros	40	5.10	432	Bhomlote	110	5.80
693	Koros	90	3.50	430	Bhomlote	50	6.30
692	Koros	40	4.40	429	Satiana	70	5.80
691	Koros	40	4.00	428	Guwal	60	5.80
690	Krishnasura	40	4.60	426	Bhomlote	80	5.90
689	Sirish	120	5.00	424	Shirish	50	7.50
688	Sirish	130	4.60	423	Bhomlote	70	7.80
687	Koros	70	5.50	421	Satiana	70	7.20
686	Koros	110	4.70	420	arjun	110	7.10
685	Azhar	30	5.20	419	Gomari	150	6.40
684	Sirish	110	4.50	418	Gomari	140	6.10
683	Sirish	40	5.50	417	Gohora	70	6.40
682	Sirish	40	5.00	412	Amora	60	5.90
681	Koros	100	4.40	411	Amora	60	6.00
680	Sirish	80	7.40	408	Amora	50	5.80
679	Silikha	40	7.30	404	Guwal	50	7.90
678	Sirish	40	7.30	403	Guwal	50	6.20
677	Arjun	50	7.10	397	Amora	50	5.80
676	Aamlokhi	40	6.50	394	Amora	60	5.40
675	Arjun	60	6.40	391	Amora	100	7.80
674	Sirish	40	5.50	390	Guwal	90	7.00
673	Sirish	30	5.50	389	Guwal	110	7.90
672	Sirish	40	6.40	387	Guwal	50	6.10
671	Sirish	30	5.30	386	Dimaru	50	6.70
670	Krishnasura	50	6.70	385	Gomari	240	6.90
669	Sirish	60	4.50	384	Gomari	200	7.90
668	Kanchon	40	5.90	383	Gomari	150	7.90
667	Krishnasura	70	6.20	382	Holong	150	7.80
666	Sationa	80	6.80	381	Hengalu	250	7.40
665	Madhuri	30	6.80	380	Shirish	100	8.00
664	Gomare	80	5.60	379	Satiana	50	6.90
663	Krishnasura	80	5.20	378	Karanja	130	4.40
662	Sationa	80	5.10	376	Amora	90	5.20
661	Krishnasura	90	5.50	375	Karanja	70	5.80
660	Krishnasura	90	5.20	374	Amora	50	5.80
659	Pepale	250	6.80	372	Amora	60	5.00
658	Arjun	160	6.30	371	Malia	60	7.70
657	Arjun	70	4.80	364	Kuchum	50	4.80
656	Modor	90	7.70	363	Kuchum	90	4.80
655	Modor	50	7.40	362	Amora	50	4.80



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
654	Guwal	60	6.60	361	Keselu	60	5.10
653	Koros	80	5.20	360	Amora	50	4.80
652	Sirish	70	4.00	358	Guwal	80	7.00
651	Sirish	60	5.00	355	Shirish	70	6.20
650	Sationa	140	4.10	354	Amora	60	4.70
649	Sirish	80	4.20	353	Amora	60	4.70
648	Sirish	70	5.10	351	Shirish	90	5.00
647	Sirish	70	4.80	350	Amora	100	4.60
646	Sirish	80	5.10	349	Amora	70	5.20
645	Sirish	70	4.40	348	Amora	80	5.10
644	Mango	90	6.80	345	Shirish	130	4.70
643	Jiya	110	7.80	344	Shirish	70	4.70
642	Koros	30	3.90	341	Karanja	90	6.60
641	Gomare	40	5.80	340	Karanja	110	5.10
640	Koros	50	4.60	339	Karanja	120	5.80
639	Hiloi	40	7.20	338	Karanja	120	5.90
638	Koros	30	7.20	337	Karanja	50	6.80
637	Sationa	160	7.20	336	Gomari	100	6.10
636	Guwal	50	5.70	335	Azhar	80	7.20
635	Sationa	120	5.20	334	Satiana	100	6.30
634	Sationa	90	4.80	333	Satiana	60	7.40
633	Sationa	120	4.30	332	Karanja	50	6.40
632	Sationa	60	4.90	331	Karanja	50	7.20
631	Koros	70	4.30	330	Karanja	70	5.40
630	Sationa	70	5.50	329	Azhar	100	6.60
629	Modor	70	7.00	328	Karanja	50	6.70
628	Koros	140	5.20	327	Katkora	90	6.30
627	Koros	130	5.50	326	Karanja	70	7.30
626	Koros	90	5.70	325	Satiana	110	7.00
625	Koros	70	5.40	324	Karanja	100	7.00
624	Koros	90	5.40	323	Karanja	90	7.90
623	Sirish	80	6.20	322	Satiana	100	6.20
622	Sirish	30	6.20	321	Karanja	80	6.80
621	Guwal	60	6.10	320	Karanja	80	8.00
620	Koros	90	4.20	319	Karanja	170	7.10
619	Koros	90	6.00	318	Karanja	130	5.60
618	Sirish	30	7.20	317	Karanja	80	5.90
617	Sirish	30	7.20	316	Karanja	120	6.20
616	Sirish	30	6.00	315	Karanja	80	7.00
615	Sationa	70	6.00	314	Karanja	90	7.00
614	Koros	90	5.50	313	Karanja	70	7.20
613	Koros	80	5.80	312	Satiana	100	7.20
612	Sirish	30	5.80	311	Karanja	200	7.00
611	Sationa	60	6.00	310	Karanja	70	7.30
610	Sationa	150	5.50	309	Karanja	100	6.60
609	Koros	100	5.80	308	Karanja	180	6.20
608	Koros	90	5.90	306	Karanja	80	7.00
607	Sationa	80	6.00	305	Karanja	130	5.80
606	Guwal	40	6.00	304	Karanja	100	6.20



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
605	Guwal	70	5.30	303	Karanja	80	7.00
604	Sationa	90	5.50	302	Karanja	100	7.00
603	Sationa	50	5.60	300	Shirish	80	5.10
602	Koros	100	5.10	299	Satiana	170	7.10
601	Guwal	40	6.00	298	Dimaru	50	7.80
600	Sirish	50	5.00	296	Batghula	100	5.50
599	Azhar	40	6.80	295	Shirish	90	7.40
598	Jiya	30	6.70	294	Karanja	160	4.80
597	Sationa	70	5.70	293	Karanja	80	6.30
596	Sationa	70	5.30	292	Karanja	100	6.20
595	Sationa	50	5.80	291	Karanja	120	7.10
594	Sationa	160	6.20	290	Karanja	60	6.00
593	Sationa	80	5.00	289	Karanja	140	6.40
592	Guwal	30	5.60	288	Karanja	70	6.20
591	Sationa	70	5.90	287	Karanja	70	6.20
590	Guwal	40	5.70	286	Karanja	130	7.40
589	Sationa	50	5.70	285	Karanja	140	6.00
588	Sationa	40	5.90	284	Karanja	70	6.20
587	Sationa	210	4.40	283	Shirish	70	6.70
586	Guwal	50	5.30	282	Dimaru	100	7.70
585	Hengalu	30	6.80	281	Hengalu	160	7.50
584	Sationa	140	5.60	279	Molia	50	5.30
583	Koros	100	5.10	278	Molia	80	5.30
582	Pepale	530	4.80	277	Bonpitha	60	7.00
581	Sationa	130	7.70	276	Molia	70	5.30
580	Bogore	80	8.00	274	Hengalu	50	5.20
579	Azhar	80	7.60	270	Krishnosura	100	7.90
578	Moj	70	8.00	269	Gandeli poma	80	6.30
577	Gomare	120	3.60	267	Gandeli poma	50	6.20
576	Karabi	30	4.10	261	Dimaru	100	6.10
575	Demoru	50	5.50	260	Gandeli poma	60	6.00
574	Jolphi	100	5.40	259	Malia	60	5.80
573	Jiya	100	3.90	255	Hengalu	60	7.20
571	Guwal	30	4.10	254	Karanja	80	4.80
570	Rabab tenga	50	6.60	253	Dimaru	70	6.00
569	Thekera	60	5.40	251	Satiana	180	7.20
568	Moj	90	4.10	250	Moder	80	5.60
567	Sationa	130	5.80	249	Shirish	90	6.00
566	Guwal	130	5.80	248	Shirish	120	6.90
565	Jiya	30	3.40	246	Satiana	140	6.70
564	Modor	190	5.00	245	Karanja	80	8.00
563	Jiya	70	3.40	244	Karanja	60	6.60
562	Gomare	30	3.40	243	Karanja	100	6.60
561	Guwal	110	6.30	242	Shirish	140	5.80
560	Joba Flower	30	5.10	241	Hunaru	100	4.90
559	Jiya	120	4.30	240	Karanja	140	6.00
558	Karabi	50	6.60	239	Guwal	60	6.10
557	Guwal	40	6.60	237	Karanja	50	6.50
556	Guwal	50	7.80	236	Satiana	70	6.60



**IMP IMPROVEMENT AND UPGRADATION OF MORAN NAHARKATIA ROAD  
[DEESANG KINAR BANGALI TO KATHALGURI] UNDER ASOM MALA  
[FROM CH. 0+000 TO CH. 23+958]**

**EIA & ESMP**

LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
555	Moj	100	6.00	235	Satiana	170	5.70
554	Jiya	90	6.20	232	Gomari	140	6.10
553	Sajina	90	7.40	231	Karanja	170	5.90
552	Payeng	150	5.30	230	Karanja	70	6.00
551	Moj	60	5.70	228	Gohora	50	7.20
550	Sopa	30	4.90	227	Hunaru	100	5.80
549	Sirish	50	7.70	226	Hunaru	70	5.30
548	Sirish	30	7.70	225	Karanja	70	5.10
547	Sationa	210	5.40	224	Karanja	110	5.30
546	Gomare	210	5.00	223	Batghula	50	6.40
545	Sationa	220	5.90	222	Batghula	50	6.40
544	Sationa	30	7.80	221	Satiana	50	7.70
543	Sirish	40	6.80	219	Karanja	50	5.80
542	Koros	60	5.90	218	Hunaru	90	4.70
541	Azhar	50	5.90	214	Karanja	60	6.10
540	Sationa	110	7.60	213	Karanja	100	6.00
539	Krishnasura	240	6.50	212	Bogori	90	6.00
538	Sirish	70	7.80	211	Karanja	50	5.20
537	Sirish	60	7.90	210	Karanja	50	4.50
536	Jiya	40	5.70	209	Karanja	50	5.30
535	Sationa	160	5.50	204	Karanja	50	6.00
534	Krishnasura	250	5.50	203	Karanja	50	6.40
533	Aamlokhi	150	5.50	201	Karanja	50	6.00
532	Sopa	30	5.40	199	dhich	70	6.00
531	Jiya	30	5.40	198	Karanja	60	5.30
530	Poniyal	30	5.30	192	Gomari	80	5.60
529	Sopa	30	5.70	191	Azhar	260	4.80
528	Madhuri	30	5.40	190	Gomari	80	5.50
527	Sationa	200	7.00	188	Gomari	70	5.90
526	Sopa	40	5.80	187	dhich	70	6.00
525	Sopa	30	5.80	186	Azhar	180	5.40
524	Sationa	80	6.30	185	Gomari	80	5.50
523	Amora	190	7.00	184	Azhar	140	5.70
522	Aager	70	6.80	183	Azhar	150	5.80
521	Koros	90	7.40	182	satiana	150	5.80
520	Krishnasura	250	5.10	181	Azhar	170	7.50
519	Krishnasura	80	5.70	180	Azhar	110	7.50
518	Krishnasura	200	4.80	179	Azhar	110	7.50
517	Aamlokhi	40	7.90	178	Azhar	120	5.00
516	Jiya	100	7.90	177	Azhar	140	4.90
515	Sopa	40	5.30	176	Gomari	110	5.10
514	Thekera	120	7.40	175	Azhar	130	7.10
513	Gomare	40	7.90	174	Gomari	110	5.40
512	Guwal	50	7.00	171	Azhar	160	7.30
511	Hiloi	30	7.00	170	Azhar	130	6.90
510	Koros	30	7.50	169	Azhar	200	6.70
509	Deaisali	110	6.50	168	Azhar	150	5.20
508	Poniyal	60	7.30	167	Azhar	80	6.90
507	Poniyal	80	7.30	166	Azhar	160	4.50



LHS				RHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m	Tree No.	Tree Name	Girth in cm	Distance from C/L in m
506	Koros	280	4.90	165	Gomari	160	4.50
505	Madhuri	60	6.10	164	Azhar	90	4.50
504	Krishnasura	140	5.30	163	Azhar	170	5.10
503	Silikha	140	5.40	162	Shirish	80	6.40
502	Mango	70	6.80	161	bargad	300	4.70
501	Bogore	150	6.20	160	Shirish	90	5.40
500	Guwal	110	6.20	159	Shirish	90	5.90
499	Arjun	40	5.80	158	Shirish	55	5.60
498	Jamuk	210	5.50	156	Shirish	70	7.50
497	Payeng	120	5.10	155	Shirish	70	6.90
496	Pepale	320	5.20	154	sagun	170	6.50
495	Krishnasura	330	4.70	152	Azhar	70	7.90
494	Koros	310	5.20	151	Gomari	140	6.60
493	Koros	190	5.10	150	panderi	80	7.80
492	Hewali	30	6.90	149	panderi	55	8.00
491	Sirish	70	6.70	148	panderi	55	6.60
490	Sirish	90	7.00	146	panderi	90	6.00

LHS			
Tree No.	Tree Name	Girth in cm	Distance from C/L in m
489	Sirish	80	7.60
488	Koros	160	5.70
487	Koros	160	5.60
486	Sirish	100	7.10
485	Koros	80	6.60
484	Sirish	90	7.60
483	Jamuk	130	6.30
482	Tetali	80	7.30
481	Outenga	80	7.10
480	Amora	50	5.90
479	Gomare	100	5.90
478	Gomare	110	5.60
477	Bhamlati	70	6.20
476	Krishnasura	150	6.00
475	Neem	90	5.10
474	Bandordina	40	6.80
472	Jiya	60	5.90
471	Jiya	50	5.90
470	Jiya	50	5.90
469	Demoru	70	5.90
465	Guwal	90	5.90
462	Mango	90	7.60
461	Jiya	90	5.30
460	Jiya	60	5.30
459	Koros	180	5.50
458	Sopa	30	7.20
457	Silikha	30	6.90
456	Silikha	150	5.60
455	Bogore	70	4.90



Tree No.	Tree Name	LHS	
		Girth in cm	Distance from C/L in m
454	Arjun	150	5.10
453	Koros	290	5.60
452	Sopa	30	5.70
451	Silikha	30	5.60
450	Koros	280	5.30
449	Koros	140	5.20
448	Koros	230	5.00
447	Koros	230	5.50
446	Arjun	110	7.10
445	Pepale	140	7.10
444	Guwal	30	6.00
443	Krishnasura	50	6.60
442	Neem	60	6.50
441	Arjun	80	6.00
440	Jiya	60	5.90
439	Jiya	80	5.50
438	Jiya	40	6.10
437	Guwal	50	5.90
436	Guwal	30	6.10
435	Fudkola	140	7.60
434	Sationa	120	7.40
433	Madhuri	40	6.80
432	Krishnasura	140	5.50
431	Jiya	60	7.10
430	Krishnasura	160	7.60
429	Krishnasura	140	5.30
428	Moralia	40	5.60
427	Moralia	30	5.40
426	Guwal	80	6.00
425	Guwal	40	6.30
424	Sationa	100	5.80
423	Sationa	80	7.50
422	Sationa	80	7.90
421	Jiya	100	7.80
420	Guwal	90	5.40
419	Jiya	210	8.00
418	Jiya	40	8.00
417	Jiya	40	8.00
416	Jiya	40	8.00
415	Jiya	40	8.00
414	Guwal	50	6.70
413	Jiya	40	8.00
412	Jiya	80	8.00
411	Sationa	180	6.50
410	Sationa	80	6.50
409	Krishnasura	140	6.40
408	Krishnasura	100	4.70
407	Jamuk	80	7.90
406	Pepale	150	7.00
405	Koros	170	6.20
404	Koros	60	7.20



Tree No.	Tree Name	LHS	
		Girth in cm	Distance from C/L in m
403	Koros	140	5.40
402	Koros	120	5.40
401	Jiya	30	6.40
400	Sirish	30	7.30
399	Krishnasura	90	7.40
398	Jiya	30	6.10
397	Krishnasura	40	7.70
396	Krishnasura	120	6.30
395	Koros	90	6.20
394	Jiya	30	6.30
393	Jiya	70	6.00
392	Hunaru	60	6.80
391	Jiya	30	6.10
390	Mango	30	6.50
389	Jiya	40	5.60
388	Jiya	30	5.60
387	Madhuri	30	7.50
386	Mango	40	7.90
385	Jiya	30	5.60
384	Koros	140	5.60
383	Jiya	40	5.40
382	Payeng	110	5.50
381	Bompitha	120	6.60
380	Jiya	40	5.60
379	Pines	40	6.70
378	Jiya	40	5.60
377	Jiya	30	5.60
376	Krishnasura	140	7.10
375	Payeng	200	5.70
374	Koros	180	5.50
373	Jiya	30	6.00
372	Koros	100	6.40
371	Jiya	35	6.10
370	Sirish	55	4.10
369	Koros	90	6.90
368	Jiya	30	6.40
367	Jiya	45	6.20
366	Jiya	45	6.20
365	Hengalu	90	7.80
364	Guwal	40	7.80
363	Koros	50	5.90
362	Hunaru	120	5.50
361	Azhar	55	4.70
360	Hunaru	120	5.90
359	Hengalu	90	6.40
358	Hengalu	55	6.40
357	Azhar	30	5.90
356	Koros	130	5.90
355	Koros	100	5.20
354	Koros	190	5.20
353	Koros	100	5.70



Tree No.	Tree Name	LHS	
		Girth in cm	Distance from C/L in m
352	Moralia	70	5.40
351	Neem	70	5.40
350	Koros	170	5.20
349	Outenga	60	6.50
348	Sirish	180	6.30
347	Koros	200	6.10
346	Koros	140	5.00
345	Amora	130	5.80
344	Koros	110	5.50
343	Koros	90	5.30
342	Guwal	30	6.50
341	Sirish	60	6.90
340	Azhar	75	6.00
339	Azhar	50	7.10
338	Azhar	70	6.20
337	Sationa	140	6.00
336	Koros	80	8.00
335	Krishnasura	150	7.70
334	Sationa	140	5.40
333	Sirish	80	6.60
332	Sirish	130	7.00
331	Sirish	100	6.50
330	Sirish	130	7.00
329	Sirish	110	7.00
328	Demoru	90	7.20
327	Azhar	110	8.00
326	Sirish	75	8.00
325	Sirish	80	7.30
324	Sirish	130	6.10
322	Sirish	110	6.30
321	Sirish	120	7.00
320	Sirish	40	7.30
319	Sirish	65	5.50
318	Sirish	40	5.70
317	Sirish	110	5.60
316	Sirish	85	5.50
315	Sirish	130	5.80
314	Krishnasura	145	5.30
313	Sirish	150	5.80
312	Koros	65	7.40
311	Moj	60	7.10
310	Moj	80	6.80
309	Demoru	30	6.90
308	Moj	75	6.30
307	Koros	135	5.90
306	Sirish	130	5.50
305	Koros	45	7.60
304	Sirish	140	6.60
303	Krishnasura	45	5.80
302	Jiya	35	7.90
301	Sirish	140	5.10



Tree No.	Tree Name	LHS	
		Girth in cm	Distance from C/L in m
300	Sirish	150	6.70
299	Moj	190	7.70
298	Moj	230	6.20
297	Moj	75	7.00
296	Mango	30	6.00
295	Kothal	110	6.30
294	Bogore	70	6.00
293	Mango	70	6.30
292	Pines	145	6.80
291	Monkey Puzda	110	7.30
289	Jiya	30	6.40
287	Narasingha	30	6.60
286	Kothal	140	6.90
285	Jiya	30	6.20
284	Kothal	100	7.60
283	Kothal	120	7.00
282	Kothal	140	6.40
281	Neem	130	5.80
280	Sationa	35	5.20
279	Bogore	110	6.30
277	Bamun	60	5.30
274	Neem	45	5.40
273	Neem	60	5.60
272	Neem	60	5.60
269	Neem	45	5.60
268	Neem	70	5.70
267	Neem	60	5.50
266	Koros	40	6.10
265	Kasom	70	7.30
264	Koros	30	7.40
263	Amora	100	6.50
262	Amora	80	5.70
261	Azhar	80	6.10
260	Bhamlati	70	5.70
259	Guwal	70	5.60
258	Jolphi	30	6.30
257	Aamlokhi	45	7.80
256	Neem	35	5.80
255	Krishnasura	150	5.80
254	Bandordina	80	5.50
253	Madhuri	30	5.60
252	Azhar	40	5.80
251	Thekera	35	6.50
250	Sationa	70	7.20
249	Sationa	80	6.80
248	Krishnasura	90	5.10
247	Bandordina	80	6.50
246	Bandordina	40	6.10
245	Sationa	35	6.65
244	Sirish	55	5.50
243	Sirish	150	6.30



Tree No.	Tree Name	LHS	
		Girth in cm	Distance from C/L in m
242	Amora	130	7.50
241	Demoru	30	7.40
240	Sirish	75	7.00
238	Demoru	60	7.40
237	Gomare	70	6.70
236	Amora	65	6.10
234	Hunaru	110	4.90
233	Bhatgela	30	6.50
232	Gorakhiya	40	6.60
231	Krishnasura	320	4.60
230	Pepale	310	4.50
229	Azhar	140	7.00
228	Azhar	175	6.00
227	Guwal	75	7.00
226	Koros	80	6.90
225	Koros	115	6.30
224	Azhar	65	6.20
223	Krishnasura	145	7.90
222	Koros	30	6.60
221	Sirish	35	6.20
220	Koros	70	5.80
219	Guwal	30	5.60
218	Koros	50	6.20
217	Thekera	35	7.25
216	Sirish	45	7.00
215	Modor	110	7.00
214	Koros	140	6.60
213	Koros	80	7.30
212	Koros	45	7.60
211	Modor	110	8.00
210	Koros	40	7.80
209	Bogore	160	4.60
208	Guwal	120	5.60
207	Demoru	60	7.00
206	Sirish	180	6.10
205	Koros	40	5.80
204	Azhar	30	5.80
203	Koros	110	5.40
202	Sirish	45	4.20
201	Hunaru	110	5.80
200	Koros	90	5.60
199	Raghu	150	5.90
198	Sirish	120	5.90
197	Sirish	125	6.80
196	Sirish	215	5.80
195	Sirish	50	5.30
194	Azhar	110	7.60
193	Azhar	165	5.40
192	Azhar	175	7.50
191	Azhar	180	7.50
190	Azhar	190	7.50



<b>LHS</b>			
<b>Tree No.</b>	<b>Tree Name</b>	<b>Girth in cm</b>	<b>Distance from C/L in m</b>
189	Azhar	200	8.00
188	Azhar	190	8.00
187	Krishnasura	65	6.50
186	Kanchon	90	6.50
185	Jamuk	80	6.80
184	Sirish	137	7.30



## Annexure 12: For Workers Health & Safety in Common Operation and During Construction

### House Keeping Practices

- Maintain washrooms and canteens clean
- Keep all walkways clear and unobstructed at all times
- Ensure that spillages of oil and grease does not take place and cleaned immediately, if any spillage take place.
- Stack raw materials and finished products clear of walkways or inside roads
- Do not leave tools on the floor or in any location where they can be easily dislodged
- Keep windows and light fitting clean
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water ponding
- Use metal bins for oily and greasy rags and store all flammable materials in appropriate bins, racks or cabinets. Ensure that the metal bins for storing oily and grease rags should be covered with lids.
- Ensure that protruding nails in boards or walls are moved or bent over so that they do not constitute a hazard to people
- Make sure that hazardous/dangerous chemicals are kept in the goods stores with the appropriate labeling, display of the material-safety-data-sheet (MSDS) and other precautionary measures
- Display 'no smoking' signs in areas with high fire risks, e.g. paint stores, wood working area and others

### Safe Layout in the construction plant, camp and quarry areas

- Arrange border to perimeter fencing
- Ensure good visibility and safe access at site entrances
- Provide adequate warning signs at the entrance and exit where necessary
- Provide adequate space/area for loading and unloading, storage of materials, plant and machinery
- Display emergency procedure and statutory notices at conspicuous location
- Consider welfare facilities required
- Provide areas for dumping garbage and other waste materials, and also arrange for their regular clearance.
- Arrange storage, transport and use of fuel, other flammable materials and explosives in line with the license requirements to be obtained from appropriate authorities
- Plan emergency assembly points, fire escape routes and locate fire-fighting equipment
- Provide access roads and plant movement areas within the site.
- Ensure the availability of first aid facilities and display notices at the various works to show the location of these facilities
- Provide proper drainage and sewage & drainage facilities



### Tree Felling

- Use hard hats during tree felling
- Ensure tools such as the axes are in good condition
- Determine proper foot and body position when using the axe. Do not cut above your head
- Wear appropriate foot protection
- Carry a first aid kit to the site
- Determine possible hazards in the area, e.g. electrical or telephone or other utility lines
- Prior to felling, determine the safest direction for the fall
- Determine the proper hinge size before directing the tree fall.

### Noise Hazards and its control

- Note that indications of noise levels are:
  - You have to shout to be heard;
  - Your hearing is dulled just after work;
  - You get head noises or ringing in the ears after work;
  - You have difficulty hearing people while others are talking
- Use sound level meters to measure. If the sound level exceeds 85 dB(A), then preventive measures should be taken
- Make personnel aware of noisy areas by using suitable warning signs and insisting that ear protectors should necessarily be worn.
- Reduce noise at source by improved maintenance, replacing noisy machines, screening with noise absorbing material, making changes to the process/equipment, controlling machine speeds, ensuring that two noise-generating machines are not running at the same time, using cutting oils and hydraulic breakers.
- Appoint a competent person to carry out a detailed noise assessment of the site, designate ear protection zone, and give instructions on the necessary precautionary measures to be observed by site personnel, including the use of suitable type of ear protections.
- Wear and maintain ear muffs and ear plug as required
- In construction or repair work, noise should be kept to a low-level bearing in mind the disturbance to local residents.

### Road Works

- The use of signage is most important to caution the road users of possible unsafe conditions due to the road works.
- Use the appropriate signage devices as required by the site conditions/situation. The devices include regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights.
- In using signs, make sure that they are (i) simple, easy-to-understand and convey only one message, (ii) luminescent and with reflective properties, and (iii) broad, prominent and of appropriate size.
- In using barricades, make sure that you keep traffic away from work areas and you guide the drivers to keep along a safe, alternative path.



- Ensure that proper personal protective equipment (PPE) is provided to all the workers.
- Cover existing road signs and install new ones at appropriate locations taking into account the distances that would be required and reaction times.
- Plan layout and traffic management so that hazard are not created.
- Deploy flagmen, who control traffic at the work areas. The flag should be 600mm x 600mm fastened to a 1m length staff.
- Flagmen should wear reflective safety vests along with hard hats
- If required, use wireless devices for flagmen to co-ordinate from either ends of the road, where works are being carried out.

#### **Electrical hazards in construction areas**

- Treat all wires as live wires
- Never touch dangling wires, but report them to your manager
- Unless you are a qualified electrician, do not attempt electrical repairs
- Never use electrical equipment if you hands are wet or you are standing in water
- If electrical equipment is sparking or smoking, turn the power off and report the condition to your supervisor
- Never use electrical wires that have physical damage
- Never allow equipment or traffic to run over electrical wires.

#### **Use and Storage of Gas/LPG**

- Store filled gas/LPG cylinder in the open area, i.e. outside of the building
- Transport, store, use and secure cylinders in upright position
- Ensure proper ventilation at the ground level in locations where gas/LPG is in use
- Avoid physical damage to the cylinders
- Never weld or cut on or near the cylinders
- Store empty cylinders secured and upright
- Make sure that the cylinder is closed immediately after use
- Investigate immediately if there is the smell of LPG or gas
- Never use destenched gas/LPG on site.
- Make sure that there is no other unrelated fire in the vicinity of the cylinder

#### **Operation of Excavators**

- Ensure that excavators are operated by authorized persons who have been adequately trained.
- Prevent unauthorized movement or use of the excavators
- Check regularly and maintain the machine thoroughly
- Ensure that all relevant information, including those related to instruction, training, supervision and safe system of work are provided to the operators.
- Ensure that the operation and maintenance manuals, manufacturer's specifications, inspection and maintenance log books are provided for the use of the mechanics, service engineers or other safety personnel during periodic maintenance, inspection and examination.
- During tipping or running alongside the trenches, excavators must be provided with stop blocks.
- Excavators must be rested on firm ground during operation



- Avoid operating the machine too close to an overhang, deep ditch or hole and be alert to potential carving edges, falling rocks and slides, rough terrain and obstacles.
- Locate and identify underground services by checking with all utility companies before excavations.
- Ensure that all excavations are supervised by experienced and competent persons.
- When reversing or in case the operator's view is restricted, adequate supervision and signaling should be provided.
- Ensure that the type and capacity of the excavator are properly chosen for the intended purposes and site conditions. Never use a machine for any purposes other than it is designed for.
- Check and report for excessive wear and any breakage of the bucket, blade, edge, tooth and other working tools of the excavator.
- Check that all linkages/hinges are properly lubricated and ensure that the linkage pins are secured. Never use improper linkage pins.
- Never dismount or mount a moving machine
- Work only with adequate ventilation and lighting
- Ensure that the protective front screen of the driving cabin is fixed in position during excavations to avoid eye injury to the operator.
- Ensure switch-off of the unattended vehicle.

#### **Operation of trucks and dumpers**

- Ensure that only trained, authorized and licensed drivers operate the vehicles
- Enlist the help of another worker before reversing the vehicle
- Switch-off the engine of an unattended vehicle
- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall.
- Wear safety boots or shoes to avoid injuries during loading and unloading.
- Carry out periodic servicing to the manufacturer's requirements. All records of maintenance and repairs should be in writing or kept on site.
- Keep the vehicle tidy and the cabin free from tools and material, which might obstruct the controls.
- Keep to speed limits.
- No passenger should be carried on a dumper except the driver
- Never drive the vehicle across a slope
- Provide stop blocks when the vehicle is tipping into or running alongside excavations
- Do not overload the vehicle.
- Carry only well secured loads
- Park only on level ground, in neutral with the parking brake applied
- Never mount or dismount from a moving vehicle

#### **Gas Welding**

- Use the following personal protective equipment during welding
  - Face or hand shield fitted with filters
  - Goggles, particularly when chipping slag
  - Gloves long enough to protect wrists and forearms against heats, sparks, molten metal and radiation



- High-top boots to prevent sparks from entering footwear.
- Screen of the work area with sturdy opaque or translucent materials because glare can cause eye injury.
- Key for opening the acetylene cylinder valve must be on the valve stem while the cylinder is in use so that the cylinder valve may be immediately shut-off in an emergency.
- Ventilate the workplace using air blowers and exhaust fans to remove poisonous fumes and gases that are given off during welding
- Take precautions against flying sparks and hot slag where welding is being done near flammable materials and check the area before leaving.
- Do not weld material degreased with solvents until completely dry.
- Do not use gas cylinders for supporting work or as rollers
- Do not use oil grease on oxygen cylinder fittings
- Do not use cylinders with damaged valves.
- Do not use too much force if valves are stuck.
- Replace valve caps after use
- Search for leaks in equipment by using a solution of soapy water.
- Shut the cylinder valve if acetylene from a cylinder catches fire at the valve or regulator due to leakage at a connection.
- Treat all gas cylinders as “full” unless you are sure otherwise.
- Never attempt to transfer acetylene from one cylinder to another or attempt to refill an acetylene cylinder.
- Place portable fire extinguishers near the welding area
- Secure all cylinders against accidental displacement.
- Always lift gas cylinders. Do not slide them along the ground or drop them from trucks.
- Keep gas cylinders in vertical position both in storage and when in use
- Keep the work place dry, secure, free from combustible materials and obstruction.
- Store the acetylene and oxygen cylinders separately, and in a proper store.
- Keep the gas cylinders from source of heat, flammable materials, corrosive chemicals and fumes.

#### **Manual Handling and Lifting**

- Use mechanical equipment in place of manual handling as far as possible.
- Assess the manpower required to handle or lift the load safely and arrange the manpower accordingly.
- In handling hazardous materials, the workers shall be informed of the hazards and safety precautions.
- All relevant persons shall be trained in the proper methods of lifting and carrying.
- Where team work is required, select the persons whose ages and physical builds are compatible for teaming up. Coordinate the actions of the team members by giving necessary instructions.
- Always lighten or suitably shape the load for manual handling as far as possible. Keep a look out for splinters, sharp edges, loose banding and nails.
- Clear path or obstruction and tripping hazards.



- Stack and secure goods safety on trucks, otherwise they fall off and injure passers-by.
- Use personal protective equipment such as gloves, safety shoes, etc.
- Adopt the following procedure when you lift a load:
- Stand close to the object. Have a firm footing with feet spread on either side of the road.
- Bend the knees and keep your back as straight as you can
- Grasp object firmly. Be sure grip will not slip
- Breath in and throw the shoulder back wards.
- Straighten the legs, continuing to keep the back as straight as you can.
- Hold object firmly close to the body
- Always lift smoothly. Avoid jerky motions. Turn with feet instead of twisting the back.

#### **Handling chemicals and hazardous substances**

- Always substitute hazardous chemicals with harmless or less hazardous ones wherever possible.
- Enclose the process using chemicals or provide other engineering controls such as local exhaust ventilation, a fume cupboard or a safety cabinet.
- Exercise great care in the storage and use of chemicals because they may be explosive, poisonous, corrosive or combustible.
- Separate different chemicals physically
- Store chemicals classified as dangerous goods in a properly constructed and approved goods store. Keep proper records of all chemicals and hazardous substances delivered, stored and used on site.
- Consider unknown substances and liquids as dangerous until proven otherwise.
- All containers should be clearly labeled to indicate contents. Never use a wrongly labeled container for chemicals.
- Prohibit smoking in the vicinity of dangerous chemicals
- Ensure that you are wearing the correct personal protective equipment before you handle chemicals
- Maintain the Material Safety Data Sheet of all chemicals for reference on safety precautions to be taken and the use of suitable PPE.
- When opening containers, hold a rag over the cap or lid, as some volatile liquids tend to spurt up when released.
- Wash before you eat and do not eat at the work place.
- If the skin is splashed with a chemical, rinse it immediately with plenty of clean water. Eye should be flushed thoroughly with water followed by immediate medical attention.
- Eye fountain, emergency shower and breathing apparatus should be available in the vicinity of the workplace.
- Safety instructions for handling emergency situations should be displayed prominently at both the storage and use locations.

#### **First Aid**

- Provide first aid boxes at every site



- Ensure that training on the use of the first aid box is provided to a handful of staff working in the site.
- Display the list of persons who are trained on providing first aid.
- Ensure that every first aid box is marked plainly “First Aid” in English and local language.
- The responsible person or first aider should replenish the contents of the first aid box as necessary.

#### **Personal protective Equipment**

- Consider the provision of personal protective equipment only after all measures for removing or controlling safety hazards have been provided reasonably impractical.
- Ensure that sufficient personal protective equipment are provided and that they are readily available for every person who may need to use them.
- The management should ensure that all persons make full and proper use of the personal protective equipment provided.
- Provide instruction and training in the proper use and care of any specific protective equipment where necessary
- Do not willfully misuse, interfere with or ill-treat any protective clothing and equipment provided.
- Ensure that the personal protective equipment are in good condition. Report immediately any damage to the management for replacement. Always keep the personal protective equipment as clean as possible.

#### **Eye Protection**

- Issue eye protection equipment where there is a foreseeable risk of eye injury
- Ensure an adequate supply of goggles/shields is available.
- Keep the goggles clean and make sure they are good fit.
- Do not watch welding operations unless your eyes are protected from the damaging effect of flash.

#### **Head Protection**

- No person shall enter a construction site unless he is wearing a suitable safety helmet
- Wear a safety helmet:
  - When there is the risk of being hit by falling objects
  - While on or near a construction site
  - During adverse weather conditions
  - When in any area designated as a “hard hat” area.
- Provide identification labels to all helmets in some way to prevent random exchange among wearers, with one helmet exclusive to each person.
- Inspect helmets for cracks of sign of impact or rough treatment before each usage. Destroy, remove and replace all worn, defective or damaged helmets.

#### **Hearing Protection**

- Provide ear plugs or ear muffs as required. Use re-usable ear plugs when the reduction required (15-25 dBA) is not excessive. Use ear muffs where a large attenuation of upto 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it cannot provide any.



- Provide disposable ear plugs for infrequent visitors and ensure that they are never re-used.
- Provide re-usable ear plugs for those who need to work continuously for a long period in a high noise area.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs.
- Use soap and water or the recommended solvent for cleaning ear muffs.
- Provide ear muffs for those who may need to get in and out of a high noise area frequently.

#### **Respiratory Protective Equipment**

- Wear suitable respirable for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags.
- Ensure that the exhalators can provide adequate protection.
- Provide training to all persons using the respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use.
- Store respirators properly when not in use.

#### **Safety Footwear**

- Wear suitable footwear for work
- Use safety footwear on site or in other dangerous areas
- Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects, etc.
- All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.
- Keep shoe lace knots tight.

#### **Hand Protection**

- Wear suitable gloves for selected activities such as welding & cutting and manual handling of materials & equipment.
- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery
- Wash hands properly with disinfectant soap and clean water before drinking, eating or smoking. Wash hands immediately after each operation on site when the situation warrants.

#### **Fire Prevention, Fighting and Equipment**

##### **Before fire breaks out**

- Store flammable material in proper areas having adequate fire protection systems.
- Display sufficient warning signs.
- Train selected personnel to use these fire extinguishers
- Inspect fire extinguishers regularly and replace as necessary
- Fire escape route should be kept clear at all times and clearly indicated.



- Know the escape route and assembly point.
- Display escape route maps prominently on each floor
- Carryout fire drill regularly. Designate fire officers
- Install fire alarm wherever required and test regularly.
- Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.

**When fire breaks out.**

- Alert all persons
- Put off the fire with appropriate fire extinguishers only when you are sure that you are safe to do so.
- Escape if you are in danger through the fire escape route to assembly point
- Fire officers to carryout head count at the assembly point.

**Incident and accident investigations**

- Carryout the investigation as quickly as possible.
- Conduct interviews with as many witnesses as necessary
- Do not rely on any one sole source of evidence
- Use the following tools:
  - Checklists for obtaining basic and typical information for accidents
    - Notebook
    - Tape records
    - Camera
    - Measuring tape
    - Special equipment for the particular investigation
- Obtain answers to the following questions:
  - When did the accident occur?
  - Where did it occur?
  - Who was injured and what was damaged?
  - What caused the accident?
  - Why did it occur?
  - How could it have been prevented?
  - How can a recurrence be prevented?
- Prepare a short but sufficient investigation report that contains the following:
  - A summary of what had happened
  - A summary of events prior to the accident
  - Information gathered during the investigation
  - Details of witnesses
  - Information on injury or loss sustained
  - Conclusions and possible causes of the accident
  - Recommendations to prevent recurrence
  - Supporting materials (photos, diagrams, etc.)



## Annexure 13: Guidelines for Siting, Management and Redevelopment of Construction Camps

### Introduction

Construction camp accommodates a mix of activities, which are highly polluting in nature causing considerable environmental impact and its proper siting, management and redevelopment is crucial to avoid, minimize and mitigate those impacts. The ESMP clearly distinguishes between various impacts that may occur at various stages of the camp like (i) siting, (ii) setting up, (iii) operation and (iv) closure / redevelopment and provide respective mitigation measures to some extent. In addition to that, this guideline has been prepared to provide the Contractor with comprehensive and systematic information on various steps to be undertaken during these four stages, so that s/he can execute his/her role in an environmentally sound manner. Various mitigation measures have been synthesized into this guideline so that it serves as a single and standalone document for the Contractor.

### Criteria for Siting the Camp

To the extent, possible barren land or wastelands shall be preferred during site selection and fertile land and agricultural land shall be avoided. All such sites must be above the HFL with adequate drainage facility. In areas prone to floods, cyclones, cloudbursts or heavy rainfall, selection of the site should be made keeping in mind the safety of the camp and the workers. In addition, the Contractor should take care of the following criteria for locating the site:

- A minimum of 250 m away from any major settlement or village in downwind direction.
- A minimum of 200 m of any major surface water course or body
- Not within 500 m from ecologically sensitive areas like wild life sanctuary, mangroves etc.
- Sufficiently wide access roads (at least 5.5 m Wide) for heavy vehicle movements

After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the CSE without which any activity shouldn't be started on the site

### Finalization Of Selected Site

After identification of the site, the Contractor should fill up the prescribed reporting format provided in ESMP and submit the same for approval to the CSE. Environmental Officer of CSE shall approve the selected site/s, after considering the compliance with the ESMP clauses. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the CSE. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost. After obtaining a written approval from the CSE for the selected site, the Contractor has to enter into an agreement with the landowner to obtain his/her consent before commencing any operation / activities in the land. The agreement should also mention its type, duration, amount and mode of payment as well as the preferences of the owner regarding site maintenance and redevelopment.



### **Designing of Camp / Preparation of Layout Plan**

The Contractor should design a layout plan of the camp with adequate space for (i) site office along with store room, rest area and sanitary facilities, (ii) plants, machineries, (iii) workshops, (iv) vehicle washing area, (v) fuel handling area, (vi) room for raw material unloading and stocking, (vii) space for storage and handling of solid wastes (viii) security cabin etc. The laying out of these should be undertaken in such a manner that it facilitates smooth functioning of both man and machine. Fuel pumps, storage facility for inflammable and hazardous chemicals/ materials shall be provided inside the camp, but at a safe distance from office. Electric safety practices shall be integrated/ incorporated during the lay-out plan preparation. Prevailing wind direction shall be kept in mind while planning out the lay-out of internal facilities. Cutting of trees should be minimum and the existing ones need to be integrated into the lay-out plan with proper planning. The roads within the camp should be well planned with adequate space for movement of vehicles and their parking.

### **Setting Up Of Construction Camp**

#### **Site preparation:**

The stripping, stacking and preservation of top soil will be mandatory in case of farm lands and fertile areas and absolutely no material stacking or equipment installment or vehicle parking or any other activity should be allowed prior to the satisfactory completion of this activity as per guidelines in ESMP. Thereafter, the site should be graded and rendered free from depressions such that the water does not get stagnant anywhere. A compound wall of 2.0 m height should be constructed all around the camp to prevent the trespassing of humans and animals. Green belt should be provided along the boundary and as detailed in the ESMP, it should be integrated with storm water drain and sedimentation trenches as given in annexure in ESMP. No. of trees planted should not be less than three times the number of trees cut. The approved layout plan should be strictly adhered to while setting up the camp.

#### **Setting up of plants and machineries:**

Adequate arrangements should be made for avoiding fugitive emissions from plants and camp premises. This will include (i) control of air pollution through provision of in-built dust extraction systems like bag filter, damper and cyclone filter for bitumen hot mix plant, (ii) a chimney of appropriate height (as per SPCB guideline) from ground level attached with dust extraction system and scrubber for the hot mix plant, (iii) a chimney of appropriate height for the DG set (iv) water sprinkling facilities for the concrete batching plant, wet mix macadam plant as well as in the camp premises and (v) garden net to prevent fugitive emissions from storage place of cement and aggregates.. It has to be also ensured that effluent from the sludge tank of the scrubber is recycled and reused and the sludge is used for land filling with top soil spread on it.

To ensure that noise levels are within the limit, all plants and machineries should have their own silencers or any other noise control devices. All pollution control devices should be provided with back-up power. Following conditions should be complied regarding the sound level conditions:

- The sound level (Leq) measured at a distance of 1 m from the boundary of the site shall not exceed 55dB (A) during day time (6am - 6pm) and 45 dB(A) during night time (6 pm - 6am).



- The total sound power level of the DG set shall be less than  $96+10 \log_{10}(\text{KVA})$  dB(A) where KVA is the nominal power rating of DG set.
- The DG set shall be provided with acoustic enclosure/acoustic treatment with an insertion loss of minimum 25 dB(A).
- The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).
- A proper, routine and preventive maintenance procedure for the DG set shall be set and followed in consultation with the DG set manufacturer.
- Concrete flooring with slope drains and oil interceptors should be proposed for hot mix plant area and workshop, vehicle washing and fuel handling area as per ESMP, so that oil and lubricants that may spill on the floor does not contaminate any soil or water body. In case of any oil spills, it should be cleaned properly. There shall also be provisions for storage of used oil until it is disposed as per comprehensive waste management plan prepared by Contractor and approved by CSE.

#### **Sanitation Facilities:**

Adequate no. of toilets shall be provided separately for males and females (depending on their strength), screened from those of men and provided with markings in vernacular language. All such facilities must have adequate water supply with proper drainage and effluent treatment system like septic tank with soak pit. Soak pit should have a sealed bottom, honey comb wall and 75 cm. thick, 2 mm sand envelope around that. The sewage system for the camp must be properly sited, designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Portable toilets may be brought to use and the night soil from such units has to be disposed through designated septic tanks so as to prevent pollution of the surrounding areas. In the construction camp, no night soil or sewerage shall be disposed of at any place other than the septic tanks constructed at the site.

#### **Waste Disposal:**

While preparing the layout plan, the Contractor should allocate adequate space for storage and handling of various wastes generated until they are disposed off in pre-identified disposal sites. The Contractor should provide separate garbage bins for biodegradable, non-biodegradable and domestic hazardous wastes in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner. No incineration or burning of wastes shall be carried out by the Contractor. The disposal of any biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling. POL (petroleum, oil and lubricants) waste shall be disposed off by transfer only to recycler/ re-refiners possessing valid authorization from the State Pollution Control Board and valid registration from the Central Pollution Control Board. Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.

#### **First aid / safety facilities:**

At every camp site, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances should be provided. Workplaces which are remote and far away from regular hospitals should have indoor health units with one bed for every 250



workers. Details of nearest clinics as well as major hospitals like their location, distance from camp, phone nos. facilities offered by the hospital should be displayed in the camp office at clearly visible location in a legible manner. Suitable transport should be provided to facilitate taking injured and ill persons to the nearest hospital. Adequate personal protective equipments and firefighting equipments as detailed out in ESMP should be made available in the camp and provided to the staff / workers. Operation manuals and training should be provided to machine operators. Warning signs should be placed at accident prone areas as well as at the entrance of the site.

**Training to workers:**

Workers shall be trained in smooth operation of plants and machines, the irregular maintenance and various safety measures to be followed as well as about the need for adherence to these measures.

**Information dissemination:**

There should be a sign board of size 6' x 4' mentioning the project details and Contractor's details to disseminate the information to the public. There should be a second sign board displaying the latest air and noise monitoring data against the standards specified.

Warning signboards should be set up at the entrance gate for the public as well as at other required places for the workers to alert them about the nature of operation being undertaken at those respective places. Once the construction camp is set up, the date of commissioning of the camp should be intimated to the Head Office and concerned District Office of the SPCB.

**Operation of Construction Camp**

During the operation phase of the camp it is important to ensure that all vehicles and machineries are maintained regularly and their PUC certificates are renewed at regular intervals. All pollution control devices should be monitored and maintained properly at regular intervals. In case of process disturbance/ failure of pollution control equipment's, the respective units should be shut down and should not be restarted until the control measures are rectified to achieve the desired efficiency. All units should operate only between 6 am and 10 pm. or as specified by SPCB in the consent letter. Oil and grease waste generated from garages in construction camps should be drained out through oil interceptors and they should be maintained properly. Necessary arrangements should be made for regular sprinkling of water for dust suppression. Raw materials and products should be transported with proper cover to prevent spreading of dust.

Hygienic environment must be ensured by (i) provision of safe drinking water, (ii) proper maintenance of toilets including daily cleaning and disinfection using proper disinfectants, (iii) regular cleaning of drains by removing the silt and solid waste, (if any) and iv) appropriate waste management practices. While it is of utmost importance to ensure that firefighting equipment's like fire extinguishers are in working condition, it should also be monitored that construction workers use the personal protective equipment's provided to them and they are replaced when necessary. All these facilities should be inspected on a weekly basis to achieve the desired levels of safety and hygiene standards.

Environmental monitoring should be undertaken by the Contractor as stipulated in the ESMP. If any standard is set by SPCB for hot mix plant emissions, the Contractor should



collect samples of emission from all the chimneys and analyse for the parameters at least once in a month. The CTE certificate from SPCB should be renewed at regular intervals and the same should be intimated to CSE. A register should be maintained at the site office which provides (i) a one page format for each migrant labourer which will give their personal profile (including name, age, sex, educational qualification, address, blood group and any major illness), along with a copy of any ID proof and an original photograph, (ii) a copy of the ID card of local labourers. A copy of the details of the migrant labourers should be submitted to the local police station.

#### **Demobilization and Redevelopment of the Site**

The Contractor should clear all temporary structures; dispose all building debris, garbage, night soils and POL waste as per the approved debris management plan. All disposal pits or trenches should be filled in, disinfected and effectively sealed off. All the areas within the camp site should be levelled and spread over with stored top soil. Residual topsoil, if any will be distributed or spread evenly in plantation sites, on adjoining/near-by barren land or affected agricultural Jhum land adjacent to the RoW that has been impacted on account of any accidental spillage. Entire camp area should be left clean and tidy, in a manner keeping the adjacent lands neat and clear, at the Contractor's expense, to the entire satisfaction of landowner and CSE.

These activities should be completed by the Contractor prior to demobilization. Once the Contractor finishes his job, he needs to obtain a certificate from the owner, stating that the site has been redeveloped to his/her satisfaction and in tune with the agreement. Then following documents needs to be submitted to the CSE by the Contractor:

- Copy of approved site identification report
- Photographs of the concerned site 'before' and 'after' setting up the camp.
- Certificate from the owner stating his/her satisfaction about status of re-development of the site. CSE shall ensure, through site verification that all clean-up and restoration operations are completed satisfactorily and a written approval should be given to the Contractor mentioning the same before the works completion' certificate is issued/recommended. The EO shall ensure through site inspection that the Contractor and CSE have complied with all these provisions. The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be. Certification/documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor, Supervision Consultant and PD office.



## Annexure 14: Site Selection, Layout Plan and Basic Amenities at Labour Camp

Construction camps include, but may not be limited to, office space; laboratory; vehicle repair and maintenance workshop/s; fuel pumps and associated areas; parking spaces; accommodation or quarters for engineers, workers and labour; basic amenities such as mess, kitchen, potable water supply, first aid room, garbage collection and disposal facility, sanitation (toilets, bathrooms, washing areas and water supply for such needs), material stack yards or storage areas, circulation areas, hot-mix plants, batching plants, crushers and any other space/area associated with similar activities.

### Site Selection Criteria

- No construction camp, including batching plant, hot mix plant, material stock yards and storage facility will be proposed within 500 m from a) a settlement/habitation b) water source c) reserved or protected forest limits d) migratory corridor of the wildlife to avoid conflicts and stress on local infrastructures facilities and natural resources.
- To the extent possible prime agricultural land shall be avoided.
- The location should have proper drainage facilities.
- Location criteria should finally confirm with the stipulated conditions with the Contract Agreement.
- Location of plants at down wind direction of settlement or dense forest area shall be avoided.

The selected site/s shall be approved by Environmental Officer of SC and PWD/PIU after considering the compliance with the ESMP clauses including the activities proposed for such a site. Contractor shall enclose copy of the agreement with the land owner and permission of the local authorities as may be applicable.

### Layout

The lay-out of a construction camp site has to be carefully planned and prepared keeping in view the various activities proposed for a particular site. The lay-out plan will contain details pertaining to, but not limited to, the cardinal points, wind direction, dimensions, surrounding features and proposed activities. This shall be submitted with complete details provided in the prescribed reporting format to the SC for written approval before any physical work (includes storage of materials, equipment etc.) is undertaken on a particular site.

The SC will carefully examine the proposals in light of the various ESMP and regulatory provisions and provide suggestions, as necessary. Both the Resident Engineer and the Environmental Officer shall be responsible for satisfactory and timely completion of this ESMP requirement.

Some of the principles governing a lay-out plan have been listed below:



- The prevailing wind direction shall be kept in mind while planning out the lay-out of internal facilities.
- Tree felling shall be avoided and it should be tried to integrate the existing ones into the lay-out plan with proper planning.
- The stripping, stacking and preservation of top soil will be mandatory in case of farm lands and fertile areas and absolutely no material stacking or equipment installment or vehicle parking or any other activity shall be allowed prior to the satisfactory completion of this activity.
- The proposed top soil stacking areas along with the quantity shall be clearly depicted on the lay-out plan.
- Proper circulation paths and parking spaces need to be provided.
- Fuel pumps, storage facility for inflammable and hazardous chemicals/ materials shall be screened at safe distance from office, mess and residential areas inside the camp.
- Proper fire safety precautions including safe exits, warning signs need to be provided at all locations including vulnerable areas like plant sites, kitchen, workshops, fuel pumps, stores etc.
- Electric safety practices shall be integrated/incorporated during the lay-out plan preparation.
- All sites must be graded and rendered free from depressions such that water does not get stagnant
- Appropriate drainage shall be provided. Typical layout plan is given in Figure-1.
- Camp site shall be fenced at direction with a security at the entry gate
- Contractor is encouraged to take up plantation along the boundaries of the camp with indigenous species.
- Contractor shall obtain permission from the concerned authority to fell tree(s) which is unavoidable.

## **BASIC AMENITIES/FACILITIES**

### **Accommodation for Labours**

The height of the workers and labour accommodation shall not be less than 3 m from floor level to lowest part of the roof. Sheds shall be kept clean, with proper cross ventilation, and the space provided shall be on the basis of 3.5 sq.m per head or as per the relevant regulation, whichever is higher. Fire and electrical safety pre-cautions shall be adhered to. Cooking, sanitation and washing areas shall be provided separately as per the ESMP clauses.

### **Drinking Water**

- Effective arrangements shall be made to provide and maintain at suitable points conveniently situated for all workers employed therein a sufficient supply of wholesome drinking water.
- All such points shall be legibly marked "drinking water" in a language understood by majority of the workers
- and no such point shall be situated within six meters of any washing place, urinal, latrine, spittoon, open drain carrying sludge or effluent or any other source of contamination.



- An adequate and convenient water supply, approved by the appropriate health authority, must be provided in each camp for drinking, cooking, bathing and laundry purposes.
- The drinking water system must be monitored in accordance with IS:10500 or the water quality parameters as prescribed by State Pollution Control Board. The water supply system used for cooking purposes that is drained seasonally must be cleaned, flushed, and disinfected prior to use. Furthermore, a water sample of satisfactory bacteriologic quality

#### **First Aid**

- Contractor shall provide and maintain First Aid facility so as to be readily accessible during all working hours. First-Aid boxes or cupboards equipped with the prescribed contents, and the number of such boxes or cupboards to be provided and maintained shall not be less than one for every one hundred and fifty workers ordinarily employed
- Nothing except the prescribed contents shall be kept in a first-aid box or cupboard
- Each first-aid box or cupboard shall be kept in the charge of a separate responsible person who holds a certificate in first-aid treatment recognised by the Government of Assam /Govt of India and who shall always be readily available during the working hours

#### **Canteen Facilities**

A cooked food canteen on a moderate scale shall be provided by the Contractor for the benefit of workers wherever it is considered necessary.

#### **Sanitation Facilities**

- There shall be adequate supply of water, close to latrines and urinals.
- Within the precincts of every workplace, latrines and urinals shall be provided in an accessible place, and the accommodation, separately for each of these, as per standards set by the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. Except in workplaces provided with water - flushed latrines connected with a water borne sewage system, all latrines shall be provided with dry - earth system (receptacles) which shall be cleaned at least two times daily kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year
- Toilet facilities adequate for the capacity of the camp must be provided. Each toilet room must be located so as to be accessible, without any individual passing through any sleeping room
- Where the toilet rooms are shared, such as in multifamily shelters and in barracks type facilities, separated toilet rooms must be provided for each sex. These rooms must be distinctly marked "for men" and "for women" by signs printed in English and in the native language of the persons occupying the camp, or marked with easily understood pictures or symbols. If the facilities for each sex are in the same building, they must be separated by solid walls or partitions extending from the floor to the roof or ceiling



- The floor from the wall and for a distance not less than 15 inches measured from the outward edge of the urinals must be constructed of materials impervious to moisture where
- water under pressure is available, urinals must be provided with an adequate water flush
- Urinals troughs in privies must drain freely into the pit or vault, and the construction of this drain must be such as to exclude flies and rodents from the pit

### **Scale of Accommodation in latrines and Urinals<sup>3</sup>**

There shall be provided within the precincts of every work place, latrines and urinals in an accessible place, and the accommodation, separately each for this, shall not be less than at the following scale:

No. Of seats

- 2 – where number of persons does not exceed 50
- 3 – where number of persons exceed 50 but does not exceed 100
- 3 – additional each 100 persons or part thereof

In particular cases, the Engineer shall have the power to increase the requirement, wherever necessary.

### **Anti-malarial Precautions**

Contractor shall, at his own expense, conform to all anti-malarial instructions given to him by the Engineer, including filling up any pits which may have been dug by him. Contractor shall supply mosquito repellent to his labours, drivers, operators and labours through contract agency.

### **Child Labour Provision**

The Contractor shall not employ Child Labour for any works or in any manner under the execution of the construction of the project road at any time.

### **Awareness and Education of HiV/AIDS and Malaria**

The Contractor shall provide/carry out HIV/AIDS and Malaria awareness through fixing appropriate poster in local language with sketch and training programme to its labour and management, at least twice per year during the construction period.

### **Waste Disposal**

The sewage system for the camp must be designed, built and operated to the satisfaction of the concerned State Govt. Department so that no health hazard occurs and no pollution to the air, ground or adjacent watercourse takes place. Compliance with the relevant legislation must be strictly adhered to.

<sup>3</sup> Source: Civil Works Contract for Widening & Strengthening of existing carriageway to 2-lane road from Jagatpur to Duhuria (km 0/0 to km 49/0 of MDR), OWD, Government of Odisha.



- Garbage bins must be provided in the camps and regularly emptied and the garbage disposed off in a hygienic manner to the satisfaction of relevant norms.
- Septic system shall be constructed for collection and treatment of sanitary sewage. It should be installed in areas of stable soils that nearly level, well drained and permeable, with enough separation between the drained field and the ground water table or other receiving areas. Discharge of septic tank, if any, shall conform to standard4.
- Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta by incineration at the workplace shall be made by means of a suitable incinerator approved by the local medical health or municipal authorities. Alternatively, excreta may be disposed off by putting a layer of night soils at the bottom of permanent tank prepared for the purpose and covering it with 15 cm layer of waste or refuse and then covering it with a layer of earth for a fortnight (by then it will turn into manure).
- On completion of the works, all such temporary structures shall be cleared away, all rubbish burnt, excreta tank and other disposal pits or trenches filled in and effectively sealed off and the outline site left clean and tidy, at the Contractor's expense, to the the Engineer.



## Annexure 15: Generic Guidelines for Environment Friendly Construction Methodology

The contractor shall be deemed to have acquainted himself with the requirements of all the current statutes, ordinances, by-laws, rules and regulations or their instruments having the force of law including without limitation those relating to protection of the environment, health and safety, importation of labour, demolition of houses, protection of environment and procurement, transportation, storage and use of explosives, etc.

### Protection of Environment

- The contractor will take all necessary measures and precautions and ensure that the execution of the works and all associated operations on site or offsite are carried out in conformity with statutory and regulatory environmental requirements including those prescribed in ESMP.
- The contractor will take all measures and precautions to avoid any nuisance or disturbance to inhabitants arising from the execution of works.
- All liquid waste products arising on the sites will be collected and disposed of at a location on or off the sites and in a manner that will not cause either nuisance or pollution.
- The contractor will at all times ensure that all existing water courses and drains within and adjacent to the site are kept safe and free from any contamination.
- The contractor will submit details of his temporary drainage work system (including all surface channels, sediment traps, washing basins and discharge pits) to the Project Implementation Unit / Supervising Engineer for approval prior to commencing work on its construction.
- The contractor will arrange all the equipment in good condition to minimize dust, gaseous or other air-borne emissions and carry out the works in such a manner as to minimize adverse impact on air.
- Any vehicle with an open load-carrying area used for transporting potentially dust-producing material will have properly fitted side and tailboards. Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a clean tarpaulin in good condition.
- The contractor will take all necessary measures to ensure that the operation of all mechanical equipment and condition processes on and off the site will not cause any unnecessary or excessive noise, taking into account applicable environmental requirements.
- The contractor will take necessary measures to maintain all plant and equipment in good condition.
- Where the execution of the works requires temporary closure of road to traffic, the contractor will provide and maintain temporary traffic diversions subject to the approval of the CSE.
- Where the execution of the works requires single-lane operation on public road the contractor will provide and maintain all necessary barriers, warning signs and traffic control signals to the satisfaction of the CSE.



- Wherever traffic diversions, warning signs, traffic control signals, barriers and the like are required, the contractor will install them to the satisfaction of CSE prior to commencing the work, in that area.
- Contractor will install asphalt plants and other machineries away from the populated areas as per laid down regulations.
- Permit for felling of trees will be obtained from the forest department before the execution of any work.
- Trees and plants going to be uprooted by Contractor's own requirement will be duly compensated and maintained up to 3 years.
- Mist sprays should be provided at appropriate places for preventing dust pollution during handling and stockpiling of stones and loose earth.
- Over Burden (OB) waste dumps shall be sprayed with water, as they are the major source of air borne particulate matter.
- OB waste dumps shall be reclaimed / afforested to bind the loose soil and to prevent soil erosion. The frequency of sprinkling should be fixed as per the seasonal requirement and in consultation with engineer.
- Regular water spraying on haulage roads during transportation of construction material by water sprinklers. The frequency of sprinkling should be fixed as per the seasonal requirements in consultation with engineer.
- Transfer point for transporting construction material shall be provided with appropriate hoods/ chutes to prevent dust emissions.
- Dumping of construction material should be from an optimum height (preferably not too high), so as to reduce the dust blow.
- Innovative approaches of using improvised machinery designs, with in-built mechanism to reduce sound emission.
- Procurement of drill loaders, dumpers and other equipment with noise proof system in operator's cabin.
- Confining the equipment with heavy noise emissions in soundproof cabins, so that noise is not transmitted to other areas.
- Regular and proper maintenance of noise generating machinery including the transport vehicles to maintain noise levels.
- Provisions should be made for noise absorbing pads at foundations of vibrating equipments to reduce noise emissions.

### **Quarry Operations**

The Contractor shall obtain materials from quarries only after the consent of the Forest Department or other concerned authorities and in consultation with the supervision Engineer. The quarry operations shall be undertaken within the purview of the rules and regulations in force.

### **Prevention of Water Courses from Soil Erosion and Sedimentation / Siltation**

The Contractor shall apply following mitigation measures to prevent sedimentation and pollution of watercourses.

- To prevent increased siltation, if need be existing bridges maybe widened downstream side of the water body;



- Cement and coal ash should be stacked together, fenced by bricks or earth wall, and kept away from water, to prevent leachate formation and contamination of surface and ground water;
- If need be, slope of the embankments leading to water bodies should be modified and rechannelised to prevent entry of contaminants into the water body;
- During construction silt fencing (consists of geo-textile with extremely small size supported by wire-mesh mounted on a panel made up of angle frame) could be used along the road at all canals and rivers to prevent sediments from the construction site to enter into the watercourses.

#### **Pollution from Hot-Mix Plants and Batching Plants**

Bituminous hot-mix plants and concrete batching plants shall be located sufficiently away from habitation, agricultural operations. The Contractor shall take every precaution to reduce the levels of noise, vibration, dust and emissions from his plants and shall be fully responsible for any claims for damages caused to the owners of property, fields and residents in the vicinity.

#### **Arrangement for Traffic During Construction**

The Contractor shall at all times carry out work on the road in a manner creating least interference to the flow of traffic with the satisfactory execution. For all works involving improvements to the existing state highway, the Contractor shall, in accordance with the directives of the SE, provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the state highway. The Contractor shall take prior approval of the SE regarding traffic arrangements during construction.

#### **Traffic Safety and Control**

- Where subject to the approval of the Engineer the execution of the works requires temporary closure of road to traffic use, the Contractor shall provide and maintain temporary traffic diversions. The diversion shall generally consist of 200 mm thickness of gravel 4.5 meters wide laid directly upon natural ground and where any additional earthworks are required for this purpose that will be provided under the appropriate payment items.
- Where the execution of the works requires single-lane operation on public road, the Contractor shall provide and maintain all necessary barriers, warning signs and traffic control signals to the approval of the Engineer.
- With the exception of temporary traffic arrangements or diversions required within the first 4 weeks of the Contract, the Contractor shall submit details of his proposals to the Engineer for approval not less than 4 weeks prior to the temporary arrangement or diversion being required. Details of temporary arrangements or diversions for approval as soon as possible after the date of the Letter of Acceptance.
- The color, configuration, size and location of all traffic signs shall be in accordance with the code of practice for road sign. In the absence of any detail or for any missing details, the signs shall be provided as directed by the CSE.



- The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the road under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic or closer of traffic on the road shall be drawn up in consultation with the CSE.
- At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the carriageway) the lane width path for traffic shall be clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the SE. At night, the passage shall be delineated with lanterns or other suitable light source.
- One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns / lights.
- On both sides, suitable regulatory / warnings signs as approved by the SE shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs shall be of design and of reflectory type, if so directed by the SE.
- Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor shall remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started, as directed by the Engineer.

### **Health and Safety**

The contractor shall take all measures and precautions necessary to ensure the health, safety and welfare of all persons entitled to be on the site. Such precautions shall include those that, in the opinion of the Engineer, are reasonable to prevent unauthorized entry upon the site and to protect members of the public from any activities under the control of the contractor. The contractor's responsibilities shall include but not be limited to:

- The provision and maintenance of the Contractor's Equipment in a safe working condition and the adoption of methods of work that are safe and without risks to the health of any person entitled to be on the site.
- The execution of suitable arrangements for ensuring safety and absence of risks to health in connection with the use, handling, storage, transport and disposal of articles and substances,
- The provision of lighting, including standby facilities in the event of failure, that, in the opinion of the Engineer, is adequate to ensure the safe execution of any works that are to be carried out at right.
- The provision of protective clothing and safety equipment, with such personnel and equipment and such information, instruction, training and supervision as are necessary to ensure the health and safety at work of all persons employed on or



entering on the site in connection with the works, including the Engineer's supervisory staff, all in accordance with the laws.

- Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced provided with proper caution signs and marked with lights at night to avoid accidents. Contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.
- The contractor shall not use or generate any materials in the works, which are hazardous to the health of persons, animals or vegetation. Where it is necessary to use some substances, which can cause injury to the health of workers, the Contractor shall provide protective clothing or appliances to his workers.
- The contractor will take all measures necessary to safeguard the health; safety and welfare of all persons entitled to be on site and will ensure that works are carried out in a safe and efficient manner.
- The contractor will provide, and ensure the utilization of appropriate safety equipment for all workmen and staff employed directly or indirectly by the contractor. Such safety equipment will include but not be limited to the safety helmets, goggles and other eye protectors, hearing protectors, safety harnesses, safety equipment for working over water, rescue equipment, fire extinguishers and first-aid equipment. The personnel working at vulnerable locations at site will wear safety helmets and strong footwear.
- The contractor will provide an adequate number of latrines and other sanitary arrangements at areas of the site where work is in progress and ensure that they are regularly cleaned and maintained in a hygienic condition.
- Provision should be made to provide OHS orientation training<sup>5</sup> to all new employees to ensure they are apprised of basic site rules or work at / on site and of personal protection and preventing injury to fellow employees.
- OHS training should consist of basic hard awareness, site specific hazards, safe work practices and emergency procedures for fire, evacuation and natural disaster as appropriate.

#### First Aid

- The provision and maintenance of suitably equipped and staffed first aid stations throughout the extent of the works to the satisfaction of the Engineer. The contractor shall allow in his prices and the responsible for the costs of all such site welfare arrangements and requirements.
- Injuries might occur during the construction period. It is therefore pertinent to provide first aid facilities for all the construction workers. At construction camps and at all workplaces first aid equipment and nursing staff must be provided. Since many of the workplaces may be far away from regular hospitals, an indoor health unit having one bed facility every 250 workers needs to be provided.
- Adequate transport facilities for moving the injured persons to the nearest hospital must also be provided in ready to move condition.
- The first-aid units apart from an adequate supply of sterilized dressing material should contain other necessary appliances as per the factory rules.

<sup>5</sup> IFC's EHS Guidelines 2007



### **Maintenance**

- All buildings, rooms and equipment and the grounds surrounding them shall be maintained in a clean and operable condition and be protected from rubbish accumulation.
- Each structure made available for occupancy shall be of sound construction, shall assure adequate protection against weather, and shall include essential facilities to permit maintenance in a clean and operable condition. Comfort and safety of occupants shall be provided for by adequate heating, lighting, ventilation or insulation when necessary to reduce excessive heat.
- Each structure made available for occupancy shall comply with the requirements of the Uniform Building Code. This shall not apply to tent camps.

### **Maintenance of Diversions and Traffic Control Devices**

Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversion shall be maintained in a satisfactory condition till such time they are required as directed by the SE. The temporary traveled way shall be kept free of dust by frequent applications of water, if necessary.

### **Community Health and Safety**

Hazards posed to the public while accessing project facilities may include:

- Physical trauma associated with failure of building structures
- Burns and smoke inhalation from fires
- Injuries suffered as a consequence of falls or contact with heavy equipment
- Respiratory distress from dust, fumes, or noxious odors
- Exposure to hazardous materials

Reduction of potential hazards should be accomplished by:

- Inclusion of buffer strips or other methods of physical separation around project sites to protect the public from major hazards associated with hazardous materials incidents or process failure, as well as nuisance issues related to noise, odors, or other emissions
- Incorporation of siting and safety engineering criteria to prevent failures due to natural risks posed by earthquakes, tsunamis, wind, flooding, landslides and fire. To this end, all project structures should be designed in accordance with engineering and design criteria mandated by site-specific risks, including but not limited to seismic activity, slope stability, wind loading, and other dynamic loads

### **Arrangement for transportation of hazardous material**

The procedures for transportation of hazardous materials (Hazmats) should include:

- Proper labelling of containers, including the identify and quantity of the contents, hazards, and shipper contact information
- Providing a shipping document (e.g. shipping manifest) that describes the contents of the load and its associated hazards in addition to the labeling of the containers.



The shipping document should establish a chain-of-custody using multiple signed copies to show that the waste was properly shipped, transported and received by the recycling or treatment/disposal facility

- Training employees involved in the transportation of hazardous materials regarding proper shipping procedures and emergency procedures

### **Community Notification**

If a local community may be at risk from a potential emergency arising at the facility, the company should implement communication measures to alert the community, such as:

- Audible alarms, such as fire bells or sirens
- Fan out telephone call lists
- Vehicle mounted speakers
- Communicating details of the nature of the emergency
- Communicating protection options (evacuation, quarantine)
- Providing advice on selecting an appropriate protection option



## Annexure 16: Guidelines for Stripping, Stocking, Preservation of Top Soil<sup>6</sup>

When so directed by the Engineer, the topsoil from all areas of cutting and from all areas to be covered by embankment foundation shall be stripped to specified depths not exceeding 150 mm and stored in stockpiles of height not exceeding 2 m for covering embankment slopes, cut slopes and other disturbed areas where re-vegetation is desired. Topsoil shall not be unnecessarily subjected to traffic either before stripping or when in a stockpile. At least 10% of the temporary acquired area shall be earmarked for storing top soil. The stockpile shall be designated such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the stockpile is restricted to 2 m. Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum.

Prior to stripping the topsoil, all trees, shrubs etc. shall be removed along with their roots, with approval of the Engineer. Where directed, the topsoil removed and conserved shall be spread over cut slopes, shoulders and other disturbed areas. Slopes may be roughened and moistened slightly, prior to the application of topsoil, in order to provide satisfactory bond. The depth of topsoil shall be sufficient to sustain plant growth, the usual thickness being from 75 mm to 100 mm.

Topsoil generated during excavation of the borrow area shall be stockpiled at a certain location within the borrow area and the same shall be used for rehabilitation/reinstatement of the borrow area, when operation of the borrow area is over.

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<sup>6</sup> Clauses 301.3.2 and 305.3.3 of MoRTH Specifications for Roads and Bridges Works (Fifth Edition) 2013



## Annexure 17: Baseline Monitoring Results

### Air Quality Monitoring Results

**NOIDA TESTING LABORATORIES**

(An ISO : 9001 : 2008, 14001 : 2004 & OHSAS : 18001 : 2007 Certified & NABL Accredited Laboratory)

MoEF & CC (Ministry of Environment, Forest & Climate Change) Recognized Laboratory.

+91-9313611642, 8510081921, 7503031145, 8527870572, 7503031146, 9999794369

**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
Ambient Air Quality Analysis	AAQ-240120-01	29/01/2020

**ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAL**

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam

Sample Drawn On : 18/01/2020

Sample Drawn By : Mr. Tejas Dwivedi

Sample description : Ambient Air

Sampling Location : Padumoni Gaon

Sampling Plan & Procedure : SOP-AAQ/08

Analysis Duration : 24/01/2020 TO 29/01/2020

Ambient Temperature (°C) : 22

Average Flow Rate of SPM (m<sup>3</sup>/min.) : 1.10

Average Flow Rate of Gases (lpm) : 1.0

Sampling Instrument Used : Repairable Dust Sampler, Fine Particulate(PM 2.5) Sampler

Weather Condition : Clear

**TEST RESULT**

S.No.	Parameter	Test Method	Results	Units	Limits as per Environment (Protection) Act.
1.	Particulate Matter (PM <sub>10</sub> )	IS:5182 Part-XXIII	48.3	µg /m <sup>3</sup>	100.0
2.	Particulate Matter (PM <sub>2.5</sub> )	CPCB Volume – 1 / Grav	18.2	µg /m <sup>3</sup>	60.0
3.	Sulphur Dioxide	IS:5182 Part-II	6.4	µg /m <sup>3</sup>	80.0
4.	Nitrogen Oxide	IS:5182 Part-VI	12.4	µg /m <sup>3</sup>	80.0
5.	Carbon Monoxide	IS:5182 Part-X	0.430	mg/m <sup>3</sup>	4.0

**Notes:**

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. Responsibility of the Laboratory is limited to the invoiced amount only.
3. This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
4. This test report will not be used for any publicity/legal purpose.
5. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.

**CHECKED BY**

**AUTHORIZED SIGNATORY**

**Laboratory :** GT-20, Sector-117, Noida, Gautam Budh Nagar - 201301  
**E. :** noida.laboratory@gmail.com, info@noidalabs.com **W.:** www.noidalabs.com



**NOIDA TESTING LABORATORIES**  
(An ISO : 9001 : 2008, 14001 : 2004 & OHSAS : 18001 : 2007 Certified & NABL Accredited Laboratory)  
MoEF & CC (Ministry of Environment, Forest & Climate Change) Recognized Laboratory.  
+91-9313611642, 8510081921, 7503031145, 8527870572, 7503031146, 9999794369

**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
Ambient Air Quality Analysis	AAQ-240120-05	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sample Drawn On : 19/01/2020  
Sample Drawn By : Mr. Kashmir Singh Pal  
Sample description : Ambient Air  
Sampling Location : Nahorkatia  
Sampling Plan & Procedure : SOP-AAQ/08  
Analysis Duration : 24/01/2020 TO 29/01/2020  
Ambient Temperature (°C) : 22  
Average Flow Rate of SPM (m<sup>3</sup>/min.) : 1.10  
Average Flow Rate of Gases (lpm) : 1.0  
Sampling Instrument Used : Repairable Dust Sampler, Fine Particulate(PM 2.5) Sampler  
Weather Condition : Clear

**TEST RESULT**

S.No.	Parameter	Test Method	Results	Units	Limits as per Environment (Protection) Act.
1.	Particulate Matter (PM <sub>10</sub> )	IS:5182 Part-XXIII	47.4	µg /m <sup>3</sup>	100.0
2.	Particulate Matter (PM <sub>2.5</sub> )	CPCB Volume – 1 / Grav	17.5	µg /m <sup>3</sup>	60.0
3.	Sulphur Dioxide	IS:5182 Part-II	6.3	µg /m <sup>3</sup>	80.0
4.	Nitrogen Oxide	IS:5182 Part-VI	12.6	µg /m <sup>3</sup>	80.0
5.	Carbon Monoxide	IS:5182 Part-X	0.430	mg/m <sup>3</sup>	4.0

**Notes:**

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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
Ambient Air Quality Analysis	AAQ-240120-06	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sample Drawn On : 19/01/2020  
Sample Drawn By : Mr. Tejas Dwivedi  
Sample description : Ambient Air  
Sampling Location : Chalakataki No.1  
Sampling Plan & Procedure : SOP-AAQ/08  
Analysis Duration : 24/01/2020 TO 29/01/2020  
Ambient Temperature (°C) : 23  
Average Flow Rate of SPM (m<sup>3</sup>/min.) : 1.10  
Average Flow Rate of Gases (lpm) : 1.0  
Sampling Instrument Used : Repairable Dust Sampler, Fine Particulate(PM 2.5) Sampler  
Weather Condition : Clear

**TEST RESULT**

S.No.	Parameter	Test Method	Results	Units	Limits as per Environment (Protection) Act.
1.	Particulate Matter (PM <sub>10</sub> )	IS:5182 Part-XXIII	47.9	µg /m <sup>3</sup>	100.0
2.	Particulate Matter (PM <sub>2.5</sub> )	CPCB Volume – 1 / Grav	18.1	µg /m <sup>3</sup>	60.0
3.	Sulphur Dioxide	IS:5182 Part-II	6.7	µg /m <sup>3</sup>	80.0
4.	Nitrogen Oxide	IS:5182 Part-VI	12.2	µg /m <sup>3</sup>	80.0
5.	Carbon Monoxide	IS:5182 Part-X	0.460	mg/m <sup>3</sup>	4.0

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### Noise Level Monitoring Results

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**TEST CERTIFICATE**

<b>Test Report of</b>	<b>Report Code</b>	<b>Date of Issue</b>
Ambient Noise	N-240120-01	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
 Sample Drawn On : 18/01/2020  
 Sample Drawn By : Mr. Mayur Dhadwad  
 Sample Received On : 24/01/2020  
 Sample description : Ambient Noise  
 Sampling Location : Padumoni gaon  
 Sampling Time : 24 hrs  
 Analysis Duration : 24/01/2020 TO 29/01/2020

TEST RESULT						
S. No	Test Parameters	* Results	Units	Requirement (as per CPCB Guidelines Limits in dB (A) Leq		
				Category of Area/ Zone	Day Time	Night Time
1.	EQUIVALENT NOISE LEVEL (6.0 AM TO 10.0 PM)	45.1	dB(A)	Industrial Area	75	70
				Commercial Area	65	55
2.	EQUIVALENT NOISE LEVEL (10.0 PM TO 6.0 AM)	33.4	dB(A)	*Residential Area	55	45
				Silence Zone	50	40

**Notes:**

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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
Ambient Noise	N-240120-05	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sample Drawn On : 19/01/2020  
Sample Drawn By : Mr. Bhuban Chetry  
Sample Received On : 24/01/2020  
Sample description : Ambient Noise  
Sampling Location : Nahorkatia  
Sampling Time : 24 hrs  
Analysis Duration : 24/01/2020 TO 29/01/2020

TEST RESULT						
S. No	Test Parameters	* Results	Units	Requirement (as per CPCB Guidelines Limits in dB (A) Leq		
				Category of Area/ Zone	Day Time	Night Time
1.	EQUIVALENT NOISE LEVEL (6.0 AM TO 10.0 PM)	43.8	dB(A)	Industrial Area	75	70
				Commercial Area	65	55
2.	EQUIVALENT NOISE LEVEL (10.0 PM TO 6.0 AM)	32.7	dB(A)	*Residential Area	55	45
				Silence Zone	50	40

**Notes:**

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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
Ambient Noise	N-240120-06	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sample Drawn On : 19/01/2020  
Sample Drawn By : Mr. Tajas Dwivedi  
Sample Received On : 24/01/2020  
Sample description : Ambient Noise  
Sampling Location : Chalakataki  
Sampling Time : 24 hrs  
Analysis Duration : 24/01/2020 TO 29/01/2020

**TEST RESULT**

S. No	Test Parameters	* Results	Units	Requirement (as per CPCB Guidelines Limits in dB (A) Leq		
				Category of Area/ Zone	Day Time	Night Time
1.	EQUIVALENT NOISE LEVEL (6.0 AM TO 10.0 PM)	45.3	dB(A)	Industrial Area	75	70
				Commercial Area	65	55
2.	EQUIVALENT NOISE LEVEL (10.0 PM TO 6.0 AM)	32.4	dB(A)	*Residential Area	55	45
				Silence Zone	50	40

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Groundwater Quality Testing Results

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TEST CERTIFICATE

Test Report of GROUND WATER	Report Code W-240120-01	Date of Issue 29/01/2020
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ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

SAMPLING & ANALYSIS DATA

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sample received on : 24/01/2020  
Sample Drawn By : Mr. Bhuban Chetry  
Sample Quantity : 2.0 Lt.  
Analysis Duration : 24/01/2020 TO 29/01/2020  
Sample Description : Ground Water (Hand Pump)  
Sample Location : Duijan No.2

BACTERIOLOGICAL PARAMETERS				
S. No.	Parameter	Test Method	Results	Required as per IS-10500:2012
1.	Total Faecal Coliform Bacteria	IS-1622	Absent	Absent/100ml

ORGANOLEPTIC & PHYSICAL PARAMETERS						
S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	pH	-	6.5-8.5	No Relaxation	7.5	IS:3025(Pt-11) 1983, Reaff. 2002
2.	Colour	Hazen	5	25	<5.0	IS:3025(Pt-4) 1983, Reaff. 2002
3.	Odour	-	Agreeable	Agreeable	Agreeable	IS:3025(Pt-5) 1983, Reaff. 2002
4.	Turbidity	NTU	1	5	<1.0	IS-3025(P-10), 1984
5.	Total Hardness (as CaCO <sub>3</sub> )	mg/l	200	600	103.12	IS:3025(Pt-21) 1983, Reaff. 2002
6.	Chloride (as Cl)	mg/l	250	1000	25.28	IS:3025(Pt-32) 1988, Reaff. 2002
7.	Fluoride (as F)	mg/l	1	1.5	0.27	APHA 22 <sup>nd</sup> Ed., 4500F(D)
8.	Phenol Content	mg/l	<0.001	-	<0.001	IS: 3025 (P-43)
9.	Calcium (as CaCO <sub>3</sub> )	mg/l	75	200	32.72	IS:3025(Pt-40) 1983, Reaff. 2002
10.	Magnesium (as CaCO <sub>3</sub> )	mg/l	30	100	5.2	APHA 22 <sup>nd</sup> Ed., 3500-Mg(B)

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11.	Sulphate (as SO <sub>4</sub> )	mg/l	200	400	25.3	IS:3025(Pt-24) 1986, Reaff. 2003
12.	Nitrate (as NO <sub>3</sub> )	mg/l	45	No Relaxation	0.15	IS:3025(Pt-34) 1988, Reaff. 2003
13.	Selenium (as Se)	mg/l	0.01	No Relaxation	<0.01	IS: 3025 (P- 56)
14.	Alkalinity as (CaCO <sub>3</sub> )	mg/l	200	600	126	IS:3025(Pt-23) 1986, Reaff. 2003
15.	TDS	mg/l	500	2000	194.72	IS-3025(P-16), 1984
16.	TSS	Mg/l	-	-	<1.0	APHA
17.	Dissolved Oxygen	% By Mass	-	-	4.5	3025(P-38), 1989
18.	BOD (at 27°C 3-Days)	mg/l	-	-	<2.0	IS-3025(P-44), 1993
19.	Phosphates	mg/l	-	-	<0.05	IS-3025(P-31)
20.	Ammonia	mg/l	0.5	No Relaxation	<0.1	IS: 3025 (P- 34)
21.	Electrical Conductivity	Micromhos/cm	-	-	299.57	IS-3025(P-14), 1984
22.	Sodium (as Na)	mg/l	-	-	18.75	IS-3.25(P-45)
23.	Potassium (as K)	mg/l	-	-	11.72	IS-3.25(P-45)
24.	Iron (as Fe)	mg/l	0.3	No Relaxation	0.07	IS:3025 Part 53 2003, RA-2003
25.	TKN	mg/l	-	-	<0.1	IS: 3025 (P- 34)

**PARAMETERS CONCERNING TOXIC SUBSTANCES**

S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001	IS-3025(P-41)
2.	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.01	IS-3025(P-27)
3.	Lead ( as Pb)	mg/l	0.01	No Relaxation	<0.01	IS-3025(P-47)
4.	Arsenic (as As)	mg/l	0.01	0.05	<0.01	IS-3025(P-37)
5.	Total Chromium (Cr)	mg/l	0.05	No Relaxation	<0.05	IS-3025 (P-52)
6.	Mercury (as Hg)	mg/l	0.001	-	<0.0001	IS-3025 (P-48)

**Notes:**

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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
GROUND WATER	W-240120-05	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sample received on : 24/01/2020  
Sample Drawn By : Mr. Kashmir Singh Pal  
Sample Quantity : 2.0 Lt.  
Analysis Duration : 24/01/2020 TO 29/01/2020  
Sample Description : Ground Water (Hand Pump)  
Sample Location : Bailungheti

BACTERIOLOGICAL PARAMETERS				
S. No.	Parameter	Test Method	Results	Required as per IS-10500:2012
1.	Total Faecal Coliform Bacteria	IS-1622	Absent	Absent/100ml

ORGANOLEPTIC & PHYSICAL PARAMETERS						
S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	pH	-	6.5-8.5	No Relaxation	6.6	IS:3025(Pt-11) 1983, Reaff. 2002
2.	Colour	Hazen	5	25	<5.0	IS:3025(Pt-4) 1983, Reaff. 2002
3.	Odour	-	Agreeable	Agreeable	Agreeable	IS:3025(Pt-5) 1983, Reaff. 2002
4.	Turbidity	NTU	1	5	<1.0	IS-3025(P-10), 1984
5.	Total Hardness (as CaCO <sub>3</sub> )	mg/l	200	600	83.07	IS:3025(Pt-21) 1983, Reaff. 2002
6.	Chloride (as Cl)	mg/l	250	1000	12.35	IS:3025(Pt-32) 1988, Reaff. 2002
7.	Fluoride (as F)	mg/l	1	1.5	0.16	APHA 22 <sup>nd</sup> Ed., 4500F(D)
8.	Phenol Content	mg/l	<0.001	-	<0.001	IS: 3025 (P-43)
9.	Calcium (as CaCO <sub>3</sub> )	mg/l	75	200	22.24	IS.3025(Pt-40) 1983, Reaff. 2002
10.	Magnesium (as CaCO <sub>3</sub> )	mg/l	30	100	6.7	APHA 22 <sup>nd</sup> Ed., 3500-Mg(B)
11.	Sulphate (as SO <sub>4</sub> )	mg/l	200	400	24.28	IS:3025(Pt-24) 1986, Reaff.

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						2003
12.	Nitrate (as NO <sub>3</sub> )	mg/l	45	No Relaxation	0.29	IS:3025(Pt-34) 1988, Reaff. 2003
13.	Selenium (as Se)	mg/l	0.01	No Relaxation	<0.01	IS: 3025 (P- 56)
14.	Alkalinity as (CaCO <sub>3</sub> )	mg/l	200	600	142.20	IS:3025(Pt-23) 1986, Reaff. 2003
15.	TDS	mg/l	500	2000	188.71	IS-3025(P-16), 1984
16.	TSS	Mg/l	-	-	<1.0	APHA
17.	Dissolved Oxygen	% By Mass	-	-	4.1	3025(P-38), 1989
18.	BOD (at 27°C 3-Days)	mg/l	-	-	<2.0	IS-3025(P-44), 1993
19.	Phosphates	mg/l	-	-	<0.05	IS-3025(P-31)
20.	Ammonia	mg/l	0.5	No Relaxation	<0.1	IS: 3025 (P- 34)
21.	Electrical Conductivity	Microm/hos/cm	-	-	290.32	IS-3025(P-14), 1984
22.	Sodium (as Na)	mg/l	-	-	24.28	IS-3.25(P-45)
23.	Potassium (as K)	mg/l	-	-	13.25	IS-3.25(P-45)
24.	Iron (as Fe)	mg/l	0.3	No Relaxation	0.05	IS:3025 Part 53 2003, RA-2003
25.	TKN	mg/l	-	-	<0.1	IS: 3025 (P- 34)

**PARAMETERS CONCERNING TOXIC SUBSTANCES**

S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001	IS-3025(P-41)
2.	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.01	IS-3025(P-27)
3.	Lead ( as Pb)	mg/l	0.01	No Relaxation	<0.01	IS-3025(P-47)
4.	Arsenic (as As)	mg/l	0.01	0.05	<0.01	IS-3025(P-37)
5.	Total Chromium (Cr)	mg/l	0.05	No Relaxation	<0.05	IS-3025 (P-52)
6.	Mercury (as Hg)	mg/l	0.001	-	<0.0001	IS-3025 (P-48)

**Notes:**

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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
GROUND WATER	W-240120-06	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sample received on : 24/01/2020  
Sample Drawn By : Mr. Bhuban Chetry  
Sample Quantity : 2.0 Lt.  
Analysis Duration : 24/01/2020 TO 29/01/2020  
Sample Description : Ground Water (Hand Pump)  
Sample Location : Nahorkatia

BACTERIOLOGICAL PARAMETERS				
S. No.	Parameter	Test Method	Results	Required as per IS-10500:2012
1.	Total Faecal Coliform Bacteria	IS-1622	Absent	Absent/100ml

ORGANOLEPTIC & PHYSICAL PARAMETERS						
S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	pH	-	6.5-8.5	No Relaxation	6.3	IS:3025(Pt-11) 1983, Reaff. 2002
2.	Colour	Hazen	5	25	<5.0	IS:3025(Pt-4) 1983, Reaff. 2002
3.	Odour	-	Agreeable	Agreeable	Agreeable	IS:3025(Pt-5) 1983, Reaff. 2002
4.	Turbidity	NTU	1	5	<1.0	IS:3025(P-10), 1984
5.	Total Hardness (as CaCO <sub>3</sub> )	mg/l	200	600	78.24	IS:3025(Pt-21) 1983, Reaff. 2002
6.	Chloride (as Cl)	mg/l	250	1000	14.27	IS:3025(Pt-32) 1988, Reaff. 2002
7.	Fluoride (as F)	mg/l	1	1.5	0.19	APHA 22 <sup>nd</sup> Ed., 4500F(D)
8.	Phenol Content	mg/l	<0.001	-	<0.001	IS: 3025 (P-43)
9.	Calcium (as CaCO <sub>3</sub> )	mg/l	75	200	21.29	IS:3025(Pt-40) 1983, Reaff. 2002
10.	Magnesium (as CaCO <sub>3</sub> )	mg/l	30	100	6.1	APHA 22 <sup>nd</sup> Ed., 3500-Mg(B)
11.	Sulphate (as SO <sub>4</sub> )	mg/l	200	400	22.47	IS:3025(Pt-24) 1986, Reaff. 2003
12.	Nitrate (as NO <sub>3</sub> )	mg/l	45	No Relaxation	0.22	IS:3025(Pt-34) 1988, Reaff. 2003
13.	Selenium (as Se)	mg/l	0.01	No	<0.01	IS: 3025 (P- 56)

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				Relaxation		
14.	Alkalinity as (CaCO <sub>3</sub> )	mg/l	200	600	138.12	IS:3025(PI-23) 1986, Reaff. 2003
15.	TDS	mg/l	500	2000	186.09	IS-3025(P-16), 1984
16.	TSS	Mg/l	-	-	<1.0	APHA
17.	Dissolved Oxygen	% By Mass	-	-	4.7	3025(P-38), 1989
18.	BOD (at 27 <sup>o</sup> C 3-Days)	mg/l	-	-	<2.0	IS-3025(P-44), 1993
19.	Phosphates	mg/l	-	-	<0.05	IS-3025(P-31)
20.	Ammonia	mg/l	0.5	No Relaxation	<0.1	IS: 3025 (P- 34)
21.	Electrical Conductivity	Microm/hos/cm	-	-	286.30	IS-3025(P-14), 1984
22.	Sodium (as Na)	mg/l	-	-	26.52	IS-3.25(P-45)
23.	Potassium (as K)	mg/l	-	-	12.35	IS-3.25(P-45)
24.	Iron (as Fe)	mg/l	0.3	No Relaxation	0.04	IS:3025 Part 53 2003, RA-2003
25.	TKN	mg/l	-	-	<0.1	IS: 3025 (P- 34)

**PARAMETERS CONCERNING TOXIC SUBSTANCES**

S. No.	Parameters	Unit	Limit (as per IS:10500-2012)		Result	Test Method
			Desirable Limit	Permissible Limit		
1.	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001	IS-3025(P-41)
2.	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.01	IS-3025(P-27)
3.	Lead ( as Pb)	mg/l	0.01	No Relaxation	<0.01	IS-3025(P-47)
4.	Arsenic (as As)	mg/l	0.01	0.05	<0.01	IS-3025(P-37)
5.	Total Chromium (Cr)	mg/l	0.05	No Relaxation	<0.05	IS-3025 (P-52)
6.	Mercury (as Hg)	mg/l	0.001	-	<0.0001	IS-3025 (P-48)

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### Surface Water Quality Testing Results



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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
SURFACE WATER	W-240120-07	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
 Sample received on : 24/01/2020  
 Sample Drawn By : Mr. Tejas Dwivedi  
 Sample Quantity : 2.0 Lt.  
 Analysis Duration : 24/01/2020 TO 29/01/2020  
 Sample Description : Surface Water (River)  
 Sample Location : Boragadhai

**MICROBIOLOGICAL REQUIREMENT RESULTS**

S.No.	Parameter	Test Method	Results
1.	Total Faecal Coliform Bacteria(MPN/100ML)	IS-1622	474

**ORGANOLEPTIC & PHYSICAL PARAMETERS**

S.NO.	Parameter	Test method	Result	Unit
2.	Colour	IS-3025(P-04)	<5.0	Hazen Unit
3.	Odour	IS-3025(P-05)	Agreeable	-
4.	Turbidity	IS-3025(P-10)	2.6	NTU
5.	pH value	IS-3025(P-11)	7.10	-
6.	Total dissolve solid ( TDS)	IS-3025(P-16)	151.31	mg/l
7.	Electrical Conductivity	IS-3025(P-14)	232.78	µs/cm
8.	Total Suspended Solid	IS-3025(P-17)	1.7	mg/l
9.	Total Dissolve Oxygen	IS-3025(P-38)	4.9	mg/l
10.	Biological Oxygen Demand	IS-3025(P-44)	3.6	mg/l
11.	Phosphate Content	IS-3025(P-31)	0.044	mg/l

**GENERAL PARAMETERS CONCERNING SUBSTANCES UNDESIRABLE IN EXCESSIVE AMOUNTS**

S.NO.	Parameter	Test method	Result	Unit
12.	Total Ammonia	IS: 3025 (P- 34)	<0.1	mg/l
13.	TKN	IS: 3025 (P- 34)	0.45	mg/l
14.	Boron (as B)	IS: 3025 (P- 57)	BDL	mg/l
15.	Calcium (as Ca)	IS: 3025 (P- 40)	14.26	mg/l
16.	Chloride (as Cl)	IS: 3025 (P- 32)	24.14	mg/l
17.	Copper (as Cu)	IS : 3025 (P-42)	<0.05	mg/l
18.	Fluoride (as F)	IS: 3025 (P-60)	0.28	mg/l

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19.	Phenol Content	IS: 3025 (P-43)	<0.001	mg/l
20.	Iron (as Fe)	IS: 3025(P-53)	0.024	mg/l
21.	Magnesium (as mg)	IS: 3025 (P-46)	12.7	mg/l
22.	Nitrate (as NO <sub>3</sub> )	IS: 3025 (P- 34)	4.34	mg/l
23.	Selenium (as Se)	IS: 3025 (P- 56)	<0.01	mg/l
24.	Sulphate (as SO <sub>4</sub> )	IS: 3025 (P- 24)	22.45	mg/l
25.	Alkalinity ( as Ca CO <sub>3</sub> )	IS: 3025 (P- 23)	91.25	mg/l
26.	Total hardness (as CaCO <sub>3</sub> )	IS: 3025 (P- 21)	88.05	mg/l
27.	Zinc (as Zn)	IS: 3025 (P- 49)	0.27	mg/l
28.	Sodium (as Na)	IS-3.25(P-45)	14.12	mg/l
29.	Potassium (as K)	IS-3.25(P-45)	4.47	mg/l

**Parameters Concerning Toxic Substances:**

S.NO.	Parameter	Test method	Result	Unit
30.	Cadmium (as Cd)	IS-3025(P-41)	<0.001	mg/l
31.	Cyanide (as CN)	IS-3025(P-27)	<0.01	mg/l
32.	Lead ( as Pb)	IS-3025(P-47)	<0.01	mg/l
33.	Arsenic (as As)	IS-3025(P-37)	<0.01	mg/l
34.	Total Chromium (Cr)	IS-3025 (P-52)	<0.05	mg/l
35.	Mercury (as Hg)	IS-3025 (P-48)	<0.0001	mg/l

**Notes:**

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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
SURFACE WATER	W-240120-10	29/01/2020

**ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.**

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam

Sample received on : 24/01/2020

Sample Drawn By : Mr. Kashmir Singh Pal

Sample Quantity : 2.0 Lt.

Analysis Duration : 24/01/2020 TO 29/01/2020

Sample Description : Surface Water (Pond)

Sample Location : Nagaon Dhadunia

**MICROBIOLOGICAL REQUIREMENT**

RESULTS			
S.No.	Parameter	Test Method	Results
1.	Total Faecal Coliform Bacteria(MPN/100ML)	IS-1622	469

**ORGANOLEPTIC & PHYSICAL PARAMETERS**

S.NO.	Parameter	Test method	Result	Unit
2.	Colour	IS-3025(P-04)	<5.0	Hazen Unit
3.	Odour	IS-3025(P-05)	Agreeable	-
4.	Turbidity	IS-3025(P-10)	2.5	NTU
5.	pH value	IS-3025(P-11)	7.12	-
6.	Total dissolve solid ( TDS)	IS-3025(P-16)	132.65	mg/l
7.	Electrical Conductivity	IS-3025(P-14)	204.08	µs/cm
8.	Total Suspended Solid	IS-3025(P-17)	1.2	mg/l
9.	Total Dissolve Oxygen	IS-3025(P-38)	4.6	mg/l
10.	Biological Oxygen Demand	IS-3025(P-44)	3.5	mg/l
11.	Phosphate Content	IS-3025(P-31)	0.061	mg/l

**GENERAL PARAMETERS CONCERNING SUBSTANCES UNDESIRABLE IN EXCESSIVE AMOUNTS**

S.NO.	Parameter	Test method	Result	Unit
12.	Total Ammonia	IS: 3025 (P- 34)	<0.1	mg/l
13.	TKN	IS: 3025 (P- 34)	0.52	mg/l
14.	Boron (as B)	IS: 3025 (P- 57)	BDL	mg/l
15.	Calcium (as Ca)	IS: 3025 (P- 40)	16.25	mg/l
16.	Chloride (as Cl)	IS: 3025 (P- 32)	25.35	mg/l
17.	Copper (as Cu)	IS : 3025 (P-42)	<0.05	mg/l
18.	Fluoride (as F)	IS: 3025 (P-60)	0.21	mg/l
19.	Phenol Content	IS: 3025 (P-43)	<0.001	mg/l
20.	Iron (as Fe)	IS: 3025(P-53)	0.027	mg/l
21.	Magnesium (as mg)	IS: 3025 (P-46)	8.2	mg/l

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22.	Nitrate (as NO <sub>3</sub> )	IS: 3025 (P- 34)	5.4	mg/l
23.	Selenium (as Se)	IS: 3025 (P- 56)	<0.01	mg/l
24.	Sulphate (as SO <sub>4</sub> )	IS: 3025 (P- 24)	23.27	mg/l
25.	Alkalinity ( as Ca CO <sub>3</sub> )	IS: 3025 (P- 23)	62.24	mg/l
26.	Total hardness (as CaCO <sub>3</sub> )	IS: 3025 (P- 21)	74.25	mg/l
27.	Zinc (as Zn)	IS: 3025 (P- 49)	0.24	mg/l
28.	Sodium (as Na)	IS-3.25(P-45)	12.14	mg/l
29.	Potassium (as K)	IS-3.25(P-45)	4.27	mg/l

**Parameters Concerning Toxic Substances:**

S.NO.	Parameter	Test method	Result	Unit
30.	Cadmium (as Cd)	IS-3025(P-41)	<0.001	mg/l
31.	Cyanide (as CN)	IS-3025(P-27)	<0.01	mg/l
32.	Lead ( as Pb)	IS-3025(P-47)	<0.01	mg/l
33.	Arsenic (as As)	IS-3025(P-37)	<0.01	mg/l
34.	Total Chromium (Cr)	IS-3025 (P-52)	<0.05	mg/l
35.	Mercury (as Hg)	IS-3025 (P-48)	<0.0001	mg/l

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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
SURFACE WATER	W-240120-11	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sample received on : 24/01/2020  
Sample Drawn By : Mr. Bhuban Chetry  
Sample Quantity : 2.0 Lt.  
Analysis Duration : 24/01/2020 TO 29/01/2020  
Sample Description : Surface Water (River)  
Sample Location : Nahorkatia

**MICROBIOLOGICAL REQUIREMENT**

RESULTS			
S.No.	Parameter	Test Method	Results
1.	Total Faecal Coliform Bacteria(MPN/100ML)	IS-1622	487

**ORGANOLEPTIC & PHYSICAL PARAMETERS**

S.NO.	Parameter	Test method	Result	Unit
2.	Colour	IS-3025(P-04)	<5.0	Hazen Unit
3.	Odour	IS-3025(P-05)	Agreeable	-
4.	Turbidity	IS-3025(P-10)	2.4	NTU
5.	pH value	IS-3025(P-11)	7.19	-
6.	Total dissolve solid ( TDS)	IS-3025(P-16)	129.83	mg/l
7.	Electrical Conductivity	IS-3025(P-14)	199.74	µs/cm
8.	Total Suspended Solid	IS-3025(P-17)	1.7	mg/l
9.	Total Dissolve Oxygen	IS-3025(P-38)	4.2	mg/l
10.	Biological Oxygen Demand	IS-3025(P-44)	3.7	mg/l
11.	Phosphate Content	IS-3025(P-31)	0.052	mg/l

**GENERAL PARAMETERS CONCERNING SUBSTANCES UNDESIRABLE IN EXCESSIVE AMOUNTS**

S.NO.	Parameter	Test method	Result	Unit
12.	Total Ammonia	IS: 3025 (P- 34)	<0.1	mg/l
13.	TKN	IS: 3025 (P- 34)	0.58	mg/l
14.	Boron (as B)	IS: 3025 (P- 57)	BDL	mg/l
15.	Calcium (as Ca)	IS: 3025 (P- 40)	14.28	mg/l
16.	Chloride (as Cl)	IS: 3025 (P- 32)	20.14	mg/l
17.	Copper (as Cu)	IS : 3025 (P-42)	<0.05	mg/l
18.	Fluoride (as F)	IS: 3025 (P-60)	0.29	mg/l
19.	Phenol Content	IS: 3025 (P-43)	<0.001	mg/l
20.	Iron (as Fe)	IS: 3025(P-53)	0.028	mg/l
21.	Magnesium (as mg)	IS: 3025 (P-46)	8.4	mg/l

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22.	Nitrate (as NO <sub>3</sub> )	IS: 3025 (P- 34)	5.6	mg/l
23.	Selenium (as Se)	IS: 3025 (P- 56)	<0.01	mg/l
24.	Sulphate (as SO <sub>4</sub> )	IS: 3025 (P- 24)	25.32	mg/l
25.	Alkalinity ( as Ca CO <sub>3</sub> )	IS: 3025 (P- 23)	62.35	mg/l
26.	Total hardness (as CaCO <sub>3</sub> )	IS: 3025 (P- 21)	70.14	mg/l
27.	Zinc (as Zn)	IS: 3025 (P- 49)	0.28	mg/l
28.	Sodium (as Na)	IS-3.25(P-45)	13.47	mg/l
29.	Potassium (as K)	IS-3.25(P-45)	5.21	mg/l

#### Parameters Concerning Toxic Substances:

S.NO.	Parameter	Test method	Result	Unit
30.	Cadmium (as Cd)	IS-3025(P-41)	<0.001	mg/l
31.	Cyanide (as CN)	IS-3025(P-27)	<0.01	mg/l
32.	Lead ( as Pb)	IS-3025(P-47)	<0.01	mg/l
33.	Arsenic (as As)	IS-3025(P-37)	<0.01	mg/l
34.	Total Chromium (Cr)	IS-3025 (P-52)	<0.05	mg/l
35.	Mercury (as Hg)	IS-3025 (P-48)	<0.0001	mg/l

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Soil Quality Testing Results

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**TEST CERTIFICATE**

Test Report of	Report Code	Date of Issue
Soil Quality Analysis	S-240120-01	29/01/2020

**ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAL**

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam

Sampling Location : Padumoni Gaon

Sample Received On : 24/01/2020

Sample Drawn by : Mr. Tejas Dwivedi

Sample Description : Soil

Sample Drawn On : 18/01/2020

Sample Quantity : 1.0 Kg

Weather Conditions : Normal

Analysis Duration : 24/01/2020 TO 29/01/2020

S.No.	PARAMETERIS	TEST METHOD	Results	UNIT
1.	pH(1:5 suspension)	IS:2720(Part-26)	6.56	-
2.	Electrical Conductivity at 25 <sup>0</sup> C (1:5suspension.)	IS:2720(Part-21)	54	µmhos/cm
3.	Porosity	STP/SOIL	24.25	% by mass
4.	Texture	STP/SOIL	Sandy Clay Loam	-
5.	Sand	STP/SOIL	52.31	% by mass
6.	Clay	STP/SOIL	41.14	% by mass
7.	Silt	STP/SOIL	6.55	% by mass
8.	Nitrogen	STP/SOIL	1860	mg/1000g
9.	Potassium (as K)	STP/SOIL	85.21	mg/1000g
10.	Phosphorus	STP/SOIL	<5.0	mg/1000g
11.	Organic Matter	IS:2720 (Part-22)	0.87	% by mass
12.	Moisture Retention capacity	STP/SOIL	35.69	% by mass
13.	Infiltration Rate	STP/SOIL	256	mm/hr
14.	Sulphates	STP/SOIL	25.67	mg/100gm
15.	Sodium Sulphates	STP/SOIL	13.25	mg/1000g
16.	Calcium Sulphates	STP/SOIL	8.64	mg/1000g
17.	Bulk Density	STP/SOIL	1.24	gm/cm <sup>3</sup>

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**TEST CERTIFICATE**

<b>Test Report of</b>	<b>Report Code</b>	<b>Date of Issue</b>
Soil Quality Analysis	S-240120-05	29/01/2020

ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAL

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sampling Location : Nahorkatia  
Sample Received On : 24/01/2020  
Sample Drawn by : Mr. Tejas Dwivedi  
Sample Description : Soil  
Sample Drawn On : 19/01/2020  
Sample Quantity : 1.0 Kg  
Weather Conditions : Normal  
Analysis Duration : 24/01/2020 TO 29/01/2020

S.No.	PARAMETERTS	TEST METHOD	Results	UNIT
1.	pH(1:5 suspension)	IS:2720(Part-26)	6.85	-
2.	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	62	µmhos/cm
3.	Porosity	STP/SOIL	26.3	% by mass
4.	Texture	STP/SOIL	Sandy Clay Loam	-
5.	Sand	STP/SOIL	50.25	% by mass
6.	Clay	STP/SOIL	42.64	% by mass
7.	Silt	STP/SOIL	7.11	% by mass
8.	Nitrogen	STP/SOIL	1790	mg/1000g
9.	Potassium (as K)	STP/SOIL	89.18	mg/1000g
10.	Phosphorus	STP/SOIL	<5.0	mg/1000g
11.	Organic Matter	IS:2720 (Part-22)	0.82	% by mass
12.	Moisture Retention capacity	STP/SOIL	36.32	% by mass
13.	Infiltration Rate	STP/SOIL	247	mm/hr
14.	Sulphates	STP/SOIL	24.86	mg/100gm
15.	Sodium Sulphates	STP/SOIL	14.21	mg/1000g
16.	Calcium Sulphates	STP/SOIL	8.66	mg/1000g
17.	Bulk Density	STP/SOIL	1.23	gm/cm <sup>3</sup>

CHECKED BY



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**TEST CERTIFICATE**

Test Report of Soil Quality Analysis	Report Code S-240120-06	Date of Issue 29/01/2020
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ISSUED TO: FORTRESS INFRACON LIMITED, MUMBAI.

**SAMPLING & ANALYSIS DATA**

Project Name : Improvement of SH and MDRs under Axom Mala for Moran to Nagajan Road in District Dibrugarh in the State of Assam  
Sampling Location : Duliajon No. 2  
Sample Received On : 24/01/2020  
Sample Drawn by : Mr. Mayur Dhadwad  
Sample Description : Soil  
Sample Drawn On : 19/01/2020  
Sample Quantity : 1.0 Kg  
Weather Conditions : Normal  
Analysis Duration : 24/01/2020 TO 29/01/2020

S.No.	PARAMETERS	TEST METHOD	Results	UNIT
1.	pH(1:5 suspension)	IS:2720(Part-26)	6.69	-
2.	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	51	µmhos/cm
3.	Porosity	STP/SOIL	25.89	% by mass
4.	Texture	STP/SOIL	Sandy Clay Loam	-
5.	Sand	STP/SOIL	51.45	% by mass
6.	Clay	STP/SOIL	41.87	% by mass
7.	Silt	STP/SOIL	6.68	% by mass
8.	Nitrogen	STP/SOIL	1840	mg/1000g
9.	Potassium (as K)	STP/SOIL	85.28	mg/1000g
10.	Phosphorus	STP/SOIL	<5.0	mg/1000g
11.	Organic Matter	IS:2720 (Part-22)	0.84	% by mass
12.	Moisture Retention capacity	STP/SOIL	37.7	% by mass
13.	Infiltration Rate	STP/SOIL	275	mm/hr
14.	Sulphates	STP/SOIL	22.24	mg/100gm
15.	Sodium Sulphates	STP/SOIL	12.34	mg/1000g
16.	Calcium Sulphates	STP/SOIL	9.2	mg/1000g
17.	Bulk Density	STP/SOIL	1.24	gm/cm

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AUTHORIZED SIGNATORY

Laboratory : GT-20, Sector-117, Noida, Gautam Budh Nagar - 201301  
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## Annexure 18: Prediction of Air Quality along the Project Road

The impacts in the operation stage for air would be less severe as compared to that in construction phase. After completion of road improvement works, smoothed new pavement and widened roads reduce fugitive dust emissions. This reduced vehicular emission is due to uniform speed and less frequent acceleration and deceleration of vehicles. With reduction in the levels of CO<sub>2</sub>, NO<sub>x</sub>, CO and HC emissions from the operating vehicles, there will be extensive saving on fuel consumption. Air pollution can be an important concern due to increase in number of vehicles on the improved roads and poor maintenance of vehicles. To assess the likely concentrations at the critical location along the project road corridors, the prediction of the pollutant concentrations has been carried out for project using CALINE-4, a dispersion model based on Gaussian Equation. The current and projected traffic volume of **A30\_2 Moran to Deesang Kinar Bengali** road has been used for the prediction. CALINE-4 is a dispersion model developed by the California Department of Transportation for the prediction of concentrations of critical atmospheric pollutants (CO, NO<sub>x</sub> and PM<sub>2.5</sub>) along the highways. This model employs a mixing zone concept to characterize pollutant dispersion over the highway and can be used to predict the pollutant concentrations for receptors up to 500 m of the corridor. The model uses the baseline data on existing concentration of pollutants and estimates the incremental emissions due to the project.

### Modeling using Caline 4

The **Job Parameters** for Modelling are as follows:

**Molecular weight:** Molecular weight input to the model based on the chosen pollutant ("n/a" for Particulates).

**Settling Velocity:** The rate at which a particle falls with respect to its immediate surroundings. This parameter is an optional parameter for Particulates only ("n/a" for Carbon Monoxide and Nitrogen Dioxide). Only a value greater than or equal to zero can be used in the model.

**Deposition Velocity:** The rate at which a pollutant can be adsorbed or assimilated by a surface. This parameter may be specified for all pollutants but it is optional and only a value greater than or equal to zero can be used in the model.

**Aerodynamic Roughness Coefficient:** Also known as the Davenport-Wieringa roughness-length. These choices determine the amount of local air turbulence that affects plume spreading.

- Rural: Roughness Coefficient = 10 cm
- Suburban: Roughness Coefficient = 100 cm
- Central Business District: Roughness Coefficient = 400 cm
- Other: Use Table A below as guidance to select an appropriate value:



**Table A: Aerodynamic Roughness Coefficient defined for various types of landscapes.**

Roughness Coefficient (cm)	Landscape Type
0.002	Sea, paved areas, snow-covered flat plain, tide flat, smooth desert
0.5	Beaches, pack ice, morass, snow-covered fields
3	Grass prairie or farm fields, tundra, airports, heather
10	Cultivated areas with low crops and occasional obstacles (such as bushes)
25	High crops, crops with varied height, scattered obstacles (such as trees or hedgerows), vineyards
50	Mixed far fields and forest clumps, orchards, scattered buildings
100	Regular coverage with large obstacles, open spaces roughly equal to obstacle heights, suburban houses, villages, mature forests
≥200	Centers of large towns or cities, irregular forests with scattered clearings

**Run Type:** Different choices are associated with different hourly average wind angle(s) and averaging times (for CO concentrations only). (Wind angle is the angle between the roadway link and the wind direction. CALINE4 calculates the angles based on data in the Link Geometry and Run Conditions tabs.)

- Standard - Calculates 1-hr average CO, NO<sub>2</sub>, or PM concentrations at the receptors. The user must input a wind direction on the Run Conditions tab.
- Worst-Case Wind Angle - Calculates 1-hr average CO or PM concentrations at the receptors. The model selects wind angles that produce the highest concentrations at each of the receptors. This is the most appropriate choice for most users.
- Multi-Run - Calculates 8-hr average CO concentrations at the receptors. The user must input wind angles for each hour.
- Multi-Run/Worst-Case Hybrid - Calculates 8-hr average CO concentrations at the receptors. The model selects wind angles that produce the highest CO concentrations at each of the receptors.

**Altitude above sea level:** The altitude above mean sea level used in the mass concentration-to volumetric (ppm) conversion. This value must be between zero and 10,000 meters (32,808 feet).



Figure A: Job Parameters Tab

The **Run Conditions** for Modelling are as follows:

**Wind Speed:** Expressed in meters per second (m/s). It is recommended that users input worst-case wind speeds based on observations, or that represent the minimum choice available for CALINE4 (0.5 m/s). Alternatively, EPA (1992) recommends a value of 1 m/s as the worst-case wind speed.

**Wind Direction:** The direction from which the wind is blowing, measured clockwise in degrees from the north (0 = north, 90 = east, 180 = south, 270 = west). Most users should opt for the "Worst-Case Wind Direction" choice on the Job Parameters tab. If "Worst-Case" is selected, CALINE4 does not use this input.

**Wind Direction Standard Deviation:** The statistical standard deviation of the Wind Direction, sometimes termed "sigma theta." **Table B** below provides guidance for specifying this option. CALINE4 requires this value range to be between 5 and 60 degrees.



**Table B: Worst-case meteorological inputs for the estimation of 1-hr CO concentrations (Nokes and Benson, 1985).**

Time Period	Geographic Location	Wind Speed (m/s)	Standard Deviation (degrees)	Stability Class	Temperature Adjustment
Morning (6-10 a.m.)	Coastal	0.5	10	G (7)	+5°F
	Coastal Valley	0.5	20	G (7)	+5°F
	Central Valley	0.5	5	G (7)	+5°F
	Mountain	0.5	30	G (7)	+5°F
Midday (10 a.m.- 5 p.m.)	Coastal	1.0	25	D (4)	+10°F
	Coastal Valley	9.6	30	D (4)	+10°F
	Central Valley	0.5	20	D (4)	+10°F
	Mountain	0.9	30	D (4)	+10°F
Evening (5-9 p.m.)	Coastal	0.5	10	G (7)	+5°F
	Coastal Valley	0.5	10	G (7)	+5°F
	Central Valley	0.5	5	G (7)	+5°F
	Mountain	0.5	30	G (7)	+5°F
Nighttime (9 p.m.-6 a.m.)	Coastal	0.5	5	G (7)	+0°F
	Coastal Valley	0.5	15	G (7)	+0°F
	Central Valley	0.5	10	G (7)	+0°F
	Mountain	0.5	20	G (7)	+0°F

**Atmospheric Stability Class:** A measure of the turbulence of the atmosphere. Values 1 through 7 correspond to the standard definitions for stability class A through E. **Table B** above guides this choice. Stability class E (or 7) represents the most stable conditions. The stability class entered will affect permissible wind speed. A table of valid wind speeds is presented on the Run Conditions tab for reference.

**Mixing Height:** The altitude at which thermal turbulence occurs due to solar heating of the ground. This concept is discussed further in elementary meteorological textbooks. Reasonable values for the worst-case mixing height rarely have a significant impact on CALINE4 model results. If an extreme condition could be anticipated at the project location, the local air district should be consulted for guidance. A mixing height of greater than or equal to 5 meters must be entered.

**Ambient Temperature:** The ambient air temperature is needed to convert mass to volumetric concentration. A temperature that reflects wintertime conditions should be selected, expressed in degrees Celsius.

**Ambient CO Concentration (Pollutant Type = Carbon Monoxide):** This measure reflects the pre-existing background level of carbon monoxide, expressed in parts per million (ppm). CALINE4 adds the pre-existing and modeled CO concentrations together to determine the total impact at each receptor.

When NO<sub>2</sub> is selected under the pollutant type option, several additional parameters are required in the Run Conditions tab, including ambient concentrations of ozone (O<sub>3</sub>), nitrogen



monoxide (NO), and nitrogen dioxide (NO<sub>2</sub>), NO<sub>2</sub> photolysis rate constant, and tailpipe NO<sub>2</sub> to nitrogen oxide (NO<sub>x</sub>) emissions ratio.

**Ambient O<sub>3</sub> Concentration (Pollutant Type = Nitrogen Dioxide):** This measure reflects the pre-existing background level of O<sub>3</sub>, expressed in parts per million.

**Ambient NO Concentration (Pollutant Type = Nitrogen Dioxide):** This measure reflects the pre-existing background level of NO, expressed in parts per million.

**Ambient NO<sub>2</sub> Concentration (Pollutant Type = Nitrogen Dioxide):** This measure reflects the pre-existing background level of NO<sub>2</sub>, expressed in parts per million.

**NO<sub>2</sub> Photolysis Rate Constant (Pollutant Type = Nitrogen Dioxide):** The rate constant for the photo dissociation of NO<sub>2</sub>, in units of 1/second. The modeled NO<sub>2</sub> concentrations decrease when the photolysis rate constant values increase; therefore, CALINE4 provides the most conservative estimates for NO<sub>2</sub> concentrations when the photolysis rate constant is set to zero through CL4.

**NO<sub>2</sub>/NO<sub>x</sub> Ratio (Pollutant Type = Nitrogen Dioxide):** The ratio of tailpipe NO<sub>2</sub> emissions versus NO<sub>x</sub> emissions. Note that CL4 and CALINE4 require input of g/mi NO<sub>x</sub> emissions factors (on the Link Activity tab) when modeling NO<sub>2</sub> concentrations. This ratio is used to convert NO<sub>x</sub> emissions to NO<sub>2</sub> emissions from on-road vehicles.

**Ambient PM Concentration (Pollutant Type = Particulates):** This measure reflects the pre-existing background level of particulates, expressed in micrograms per cubic meter. Note that PM<sub>2.5</sub> and PM<sub>10</sub> are not directly differentiated in the CL4 user interface or the CALINE4 model functions, but the input parameters, such as ambient concentrations and emission factors, would be different when modeling PM<sub>2.5</sub> and PM<sub>10</sub> respectively using CL4 and CALINE4. CALINE4 adds the pre-existing and modeled PM<sub>2.5</sub> or PM<sub>10</sub> concentrations together to determine the total impact of PM<sub>2.5</sub> or PM<sub>10</sub> at each receptor.

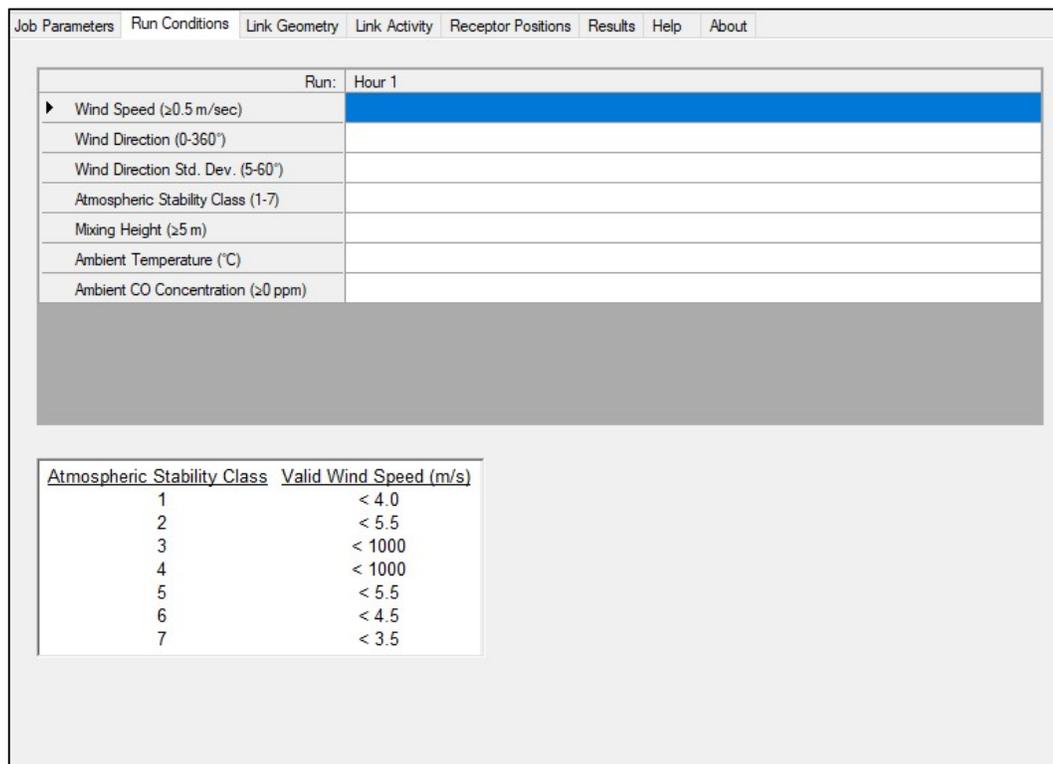


Figure B: Run Conditions Tab

The **Link Geometry** for Modelling are as follows:

The Link Geometry tab contains a matrix to define the roadway network to be modeled. Each row in the matrix defines a single link. Links are defined as straight-line segments. The distance between the centerline of the curved roadway and the straight-line link should be no greater than 3 meters.

**Link Description:** The user may define a 12-character description for the link. If more than 12 characters are entered, only the first 12 characters will be used.

**Link Type:** The user must select one of the following five choices to define the type of roadway that each link represents.

- **At-Grade:** For at-grade links, CALINE4 does not permit the plume to mix below ground level, which is assumed to be at a height of zero. The height of the link above ground level, defined in the Link Height cell, must be zero.
- **Fill:** For fill links, CALINE4 assumes that air flow follows the surface terrain, undisturbed. Link Height for fill sections must be between zero and 10 meters (32.81 feet).
- **Depressed:** For depressed links, CALINE4 increases the residence time of an air parcel in the mixing zone. The residence time increases in relation to the depth of the roadway depression. (Mixing zone = width of traffic lane(s) plus 3 meters on each side.) In such a case, estimated concentrations adjacent to the mixing zone are higher than those for an equivalent at-grade or fill section. The modeled



concentrations drop more rapidly downwind of a depressed link because vertical mixing increases with residence time. Link Height for depressed links must be between zero and -10 meters (-32.81 feet).

- **Bridge:** For bridge sections, CALINE4 allows air to flow above and below the link. The plume is permitted to mix downward from the link, until it reaches the distance defined in the Link Height cell. Link Height must be between zero and 10 meters (32.81 feet).
- **Parking Lot:** Parking lot links should coincide with the parking lot access ways. The CALINE4 algorithms adjust to account for the reduced mechanical and thermal turbulence anticipated from slow-moving, cold-start vehicles. Link Height must be zero for parking lot links.

**Endpoint Coordinates:** Links are defined as straight-line segments. The entire length of each link should deviate no further than 3 meters from the centerline of the actual roadway. The endpoint coordinates, (X1, Y1) and (X2, Y2), define the positions of link endpoints.

- The units (meters or feet) are user-specified on the Job Parameters tab.
- The length of each link must be greater than the mixing zone width (see below).
- The user must define the link geometry and receptor positions with a consistent Cartesian coordinate system. The position of the coordinate system origin is arbitrary and at the user's discretion. The y-axis should be oriented north-south, with values increasing in the northward direction. The x-axis should be oriented east-west, with values increasing in the eastward direction. The choice of magnetic north, true north, or some other approximation is at the user's discretion. However, the wind direction must be defined on the Run Conditions tab according to the same definition of north.
- A map of the link geometry is shown on the Receptor Positions tab.

**Link Height:** For all link types except bridges, Link Height represents the height of the link above the surrounding terrain. Ground level is defined at zero meters or feet. The units of measure (meters or feet) are user-specified on the Job Parameters tab.

For at-grade links, the link height may be defined as zero. For fill links, the link height must be greater than zero. However, CALINE4 always treats the link as though its height is zero; the input does not affect CALINE4 model calculations. Therefore, the positive link height value should be used for documentation purposes. For depressed links, the depth of the depression should be indicated as a negative value. For parking lots, the link height should be defined as zero. For bridges, Link Height defines the height of the bridge above the surface beneath it (a positive value).

**Mixing Zone Width:** Mixing Zone is defined as the width of the roadway, plus 3 meters on either side. The minimum allowable value is 10 meters, or 32.81 feet. It must also be greater than or equal to the link length.

**Canyon/Bluff Mix:** The Canyon/Bluff Mix feature has not been validated with field measurements. Only very rare circumstances warrant its use; use extreme caution with this feature. Users of this feature should be thoroughly familiar with dispersion modeling, the key reference (D. B. Turner, Workbook of Atmospheric Dispersion Estimates, Environmental



Protection Agency, 1970), and the CALINE4 source code. All other users should leave the Canyon/Bluff input values set to zero, which disables the feature. If it is entered, Canyon/Bluff Mixing Width must be greater than one-half of the Mixing Zone Width.

	Link Description	Link Type	X1	Y1	X2	Y2	Link Height	Mixing Zone Width	Canyon/Bluff Mix Left	Canyon/Bluff Mix Right
▶										

Figure C: Link Geometry Tab

The **Link Activity** for Modelling are as follows:

The Link Activity tab defines the level of traffic and auto emission rate observed at each link.

**Traffic Volume:** Hourly traffic volume anticipated to travel on each link, in units of vehicles per hour. If a multi-run scenario is selected for modeling CO concentrations, traffic volume must be defined for each of the eight hours.

**Emission Factor:** The weighted average emission rate of the local vehicle fleet, expressed in terms of grams per mile, per vehicle, for the pollutant selected. When modeling NO2 concentrations, NOx emission factors should be specified for each link. Emission rates vary by time of day. Therefore, if a multi-run scenario is selected (for modeling CO concentrations), emission factors must be defined for each of the eight hours.

Link Desc. \ Run:	Traffic Volume (vph) Hour 1	CO Emiss. Factor (g/mi) Hour 1
▶		

Figure D: Link Activity Tab

The **Receptor Position** for Modelling are as follows:

The Receptor Positions tab contains data inputs for all receptor positions and displays a diagram of the link geometry and receptor positions. Receptors should be defined with the same Cartesian coordinate system and units of measure as the link geometry. For each



receptor, space is provided for an 8-character description, the X-coordinate, the Y-coordinate, and the height (Z). The maximum number of receptors is 20.

The links and receptors will appear on the map in their relative positions but the X and Y scales are not necessarily equal. The user may enlarge the map window by dragging the program edges or by clicking the program maximize button. Zooming in to view map details may be performed by using the mouse to drag a box around the area of interest while holding the left button. To un-zoom, click the left mouse button once

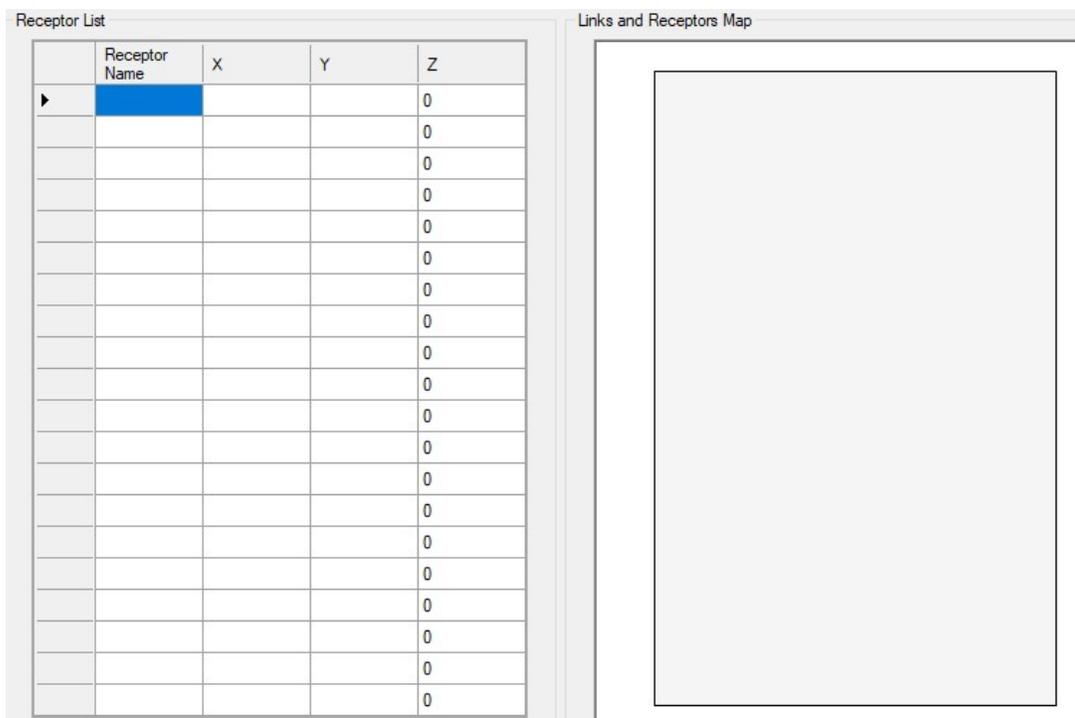


Figure E: Receptor Position Tab

**Input Parameters:**

- **Traffic Data:** The fleet wise traffic volumes for the present study have been taken from the detailed project report of the project. The annual average daily traffic (AADT) data is available for the proposed road through traffic survey. CALINE 4 model needs hour average traffic volume. The total traffic hour volume is further categorized into two-wheeler, four-wheeler, light commercial vehicles (LCV), bus, high commercial vehicles (HCVs) based on traffic survey at existing road.

**Table C: Predicted Traffic Volume Per Hour**

Year	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck	PCU
2020	115	1	69	3	2	4	274
2025	154	1	93	4	3	7	366
2030	205	1	124	6	4	9	490
2035	275	2	166	8	5	11	656
2040	368	2	223	10	7	14	878



- **Meteorological data:** The study was conducted to predict pollutant concentration for worst-case meteorological conditions. The meteorological parameters such as wind speed, wind direction, wind direction standard deviation, temperature, mixing height and stability condition are used in model.

**Table D: Meteorological Data for CALINE 4**

Sr. No.	Baseline Condition Input Data	Values
1	Altitude above Sea Level	128.7 m
2	Wind speed	2.22 m/s
3	Wind direction	North-East (45 <sup>0</sup> )
4	Ambient Temperature	25°C

- **Road Geometry:** In the CALINE-4 model the entire length of the selected road section is divided into various road links. The division of sections into links has been done in such a way, so that the link can be fairly considered straight stretch of road having homogenous geometry with uniform road width, height and alignment. The coordinates of end points of links specify the location of the links in the model. The maximum number of links in each road section can be 20. The mixing zone width calculated for selected highway corridor is 7m+ 3m + 3m = 13 m as per guideline provided in CALINE4 model.
- **Emission Factors:** Emission factor is one of the important input parameters in CALINE-4 model. In the present study, the emission factors specified by the Automotive Research Association of India (ARAI) have been used for calculation of weighted emission factors. These emission factors have been expressed in terms of type of vehicles and type of fuel used (for petrol and diesel driven passenger cars). Since, there is only one input requirement for total no. of vehicles in the CALINE 4 model, whereas there are different categories of vehicles (viz. two wheelers, cars, bus and trucks) with different year of manufacture and fuel used, it is essential that a single value representing the equivalent or weighted emission factors for all the vehicles is input into the model. The emission factor used to estimate WEF are given below. The traffic data are not available for fuel types, therefore average emission factor is used in this study.

**Table E: Emission factors for different types of Vehicle (ARAI, 2007)**

Pollutants	Unit	Two-wheeler	Three-wheeler	Car	LCV	Bus	Truck
CO	g/km	1.036	1.25	1.281	1.56	8.03	6
NOx	g/km	0.312	0.219	0.04	0.288	0.548	1.24
PM2.5	g/km	0.021	0.01	0.031	0.061	0.133	0.133

These projected vehicles would generate various air pollutants among which CO, NO<sub>2</sub> and Particulate matter (PM<sub>2.5</sub>) would be modelled to predict their quantities for the year 2020, 2025, 2030, 2035 and 2040. PM<sub>10</sub> and SO<sub>2</sub> concentration need not be modeled as sulfur content in the fuel used in vehicles is quite less to cause a significant SO<sub>2</sub> emission. SO<sub>2</sub> emission factor for vehicles is not included in the report on “Emission Factor development for Indian Vehicles” by The Automotive Research Association of India (ARAI). Similarly,



Particulate Matter in the emission factor considers only PM<sub>2.5</sub> as coarse fraction PM<sub>2.5</sub> to PM<sub>10</sub> is negligible in vehicle exhaust.

The predicted results of CALINE4 have been tabulated below. Considering the predicted future traffic according to normal growth rate for the years 2020, 2025, 2030, 2035 and 2040, CO, NO<sub>2</sub>, and PM<sub>2.5</sub> levels are predicted. These levels were within the limiting standards as specified in National Ambient Air Quality Standards.

**CO Modeling:**

**Input:**

**Table F: Input Parameter for CO Modelling**

Sr. No.	Input Parameter	Value
1	Molecular weight	28
2	Aerodynamic Roughness Coefficient	Rural
3	Run Type	Worst-case Wind Direction
4	Altitude Above Sea Level	128.7 m
5	Wind Speed	2.22 m/sec
6	Wind Direction	45°
7	Wind Direction Standard Deviation	20
8	Atmospheric Stability Class	4
9	Mixing Height	5
10	Ambient Temperature	25°C
11	Ambient CO Concentration	0.40 ppm

**Output:**

**Table G: Predicted Concentrations of CO in the study location (ppm)**

Year	Distance from Road Edge (m)				
	10	20	50	100	200
<b>2020</b>	0.5	0.5	0.5	0.5	0.4
<b>2025</b>	0.5	0.5	0.5	0.5	0.5
<b>2030</b>	0.6	0.5	0.5	0.5	0.5
<b>2035</b>	0.6	0.6	0.6	0.5	0.5
<b>2040</b>	0.7	0.6	0.6	0.6	0.5
<b>Limit</b>	3.495	3.495	3.495	3.495	3.495

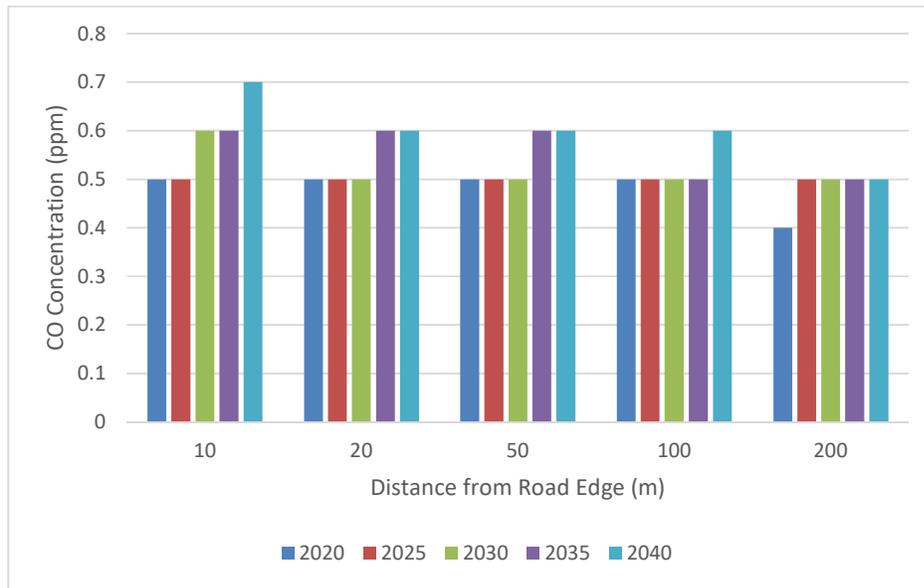


Figure F: Graph representing Predicted Concentrations of CO in the study location (ppm)



For Year 2020:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 1

JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 0.4 PPM  
 SIGH= 20. DEGREES              TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	274	2.1	0.0	13.0
B. 2	0	8000	0	16000	AG	274	2.1	0.0	13.0
C. 3	0	16000	0	23958	AG	274	2.1	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 2

JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	358.	0.5	0.0	0.1	0.0
2. 2	357.	0.5	0.0	0.1	0.0
3. 3	356.	0.5	0.0	0.1	0.0
4. 4	186.	0.5	0.0	0.0	0.0
5. 5	189.	0.4	0.0	0.0	0.0
6. 6	2.	0.5	0.0	0.1	0.0
7. 7	3.	0.5	0.0	0.1	0.0
8. 8	4.	0.5	0.0	0.1	0.0
9. 9	174.	0.5	0.0	0.0	0.0
10. 10	171.	0.4	0.0	0.0	0.0



For Year 2025:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 0.4 PPM  
 SIGTH= 20. DEGREES            TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	366	2.1	0.0	13.0
B. 2	0	8000	0	16000	AG	366	2.1	0.0	13.0
C. 3	0	16000	0	23958	AG	366	2.1	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	358.	0.5	0.0	0.1	0.0
2. 2	357.	0.5	0.0	0.1	0.0
3. 3	356.	0.5	0.0	0.1	0.0
4. 4	186.	0.5	0.0	0.0	0.0
5. 5	189.	0.5	0.0	0.0	0.0
6. 6	2.	0.5	0.0	0.1	0.0
7. 7	3.	0.5	0.0	0.1	0.0
8. 8	4.	0.5	0.0	0.1	0.0
9. 9	174.	0.5	0.0	0.0	0.0
10. 10	171.	0.5	0.0	0.0	0.0



For Year 2030:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 0.4 PPM  
 SIGTH= 20. DEGREES            TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	490	2.1	0.0	13.0
B. 2	0	8000	0	16000	AG	490	2.1	0.0	13.0
C. 3	0	16000	0	23958	AG	490	2.1	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	358.	0.6	0.0	0.1	0.0
2. 2	357.	0.5	0.0	0.1	0.0
3. 3	356.	0.5	0.0	0.1	0.0
4. 4	186.	0.5	0.0	0.1	0.0
5. 5	189.	0.5	0.0	0.0	0.0
6. 6	2.	0.6	0.0	0.1	0.0
7. 7	3.	0.5	0.0	0.1	0.0
8. 8	4.	0.5	0.0	0.1	0.0
9. 9	174.	0.5	0.0	0.1	0.0
10. 10	171.	0.5	0.0	0.0	0.0



For Year 2035:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 0.4 PPM  
 SIGTH= 20. DEGREES              TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	656	2.1	0.0	13.0
B. 2	0	8000	0	16000	AG	656	2.1	0.0	13.0
C. 3	0	16000	0	23958	AG	656	2.1	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	358.	0.6	0.0	0.2	0.0
2. 2	357.	0.6	0.0	0.2	0.0
3. 3	356.	0.6	0.0	0.1	0.0
4. 4	186.	0.5	0.1	0.1	0.0
5. 5	189.	0.5	0.1	0.1	0.0
6. 6	2.	0.6	0.0	0.2	0.0
7. 7	3.	0.6	0.0	0.2	0.0
8. 8	4.	0.6	0.0	0.1	0.0
9. 9	174.	0.5	0.1	0.1	0.0
10. 10	171.	0.5	0.1	0.1	0.0



For year 2040:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 0.4 PPM  
 SIGTH= 20. DEGREES            TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	878	2.1	0.0	13.0
B. 2	0	8000	0	16000	AG	878	2.1	0.0	13.0
C. 3	0	16000	0	23958	AG	878	2.1	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	358.	0.7	0.0	0.3	0.0
2. 2	357.	0.6	0.0	0.2	0.0
3. 3	356.	0.6	0.0	0.2	0.0
4. 4	186.	0.6	0.1	0.1	0.0
5. 5	189.	0.5	0.1	0.1	0.0
6. 6	2.	0.7	0.0	0.3	0.0
7. 7	3.	0.6	0.0	0.2	0.0
8. 8	4.	0.6	0.0	0.2	0.0
9. 9	174.	0.6	0.1	0.1	0.0
10. 10	171.	0.5	0.1	0.1	0.0



**PM<sub>2.5</sub> Modelling:**

**Input:**

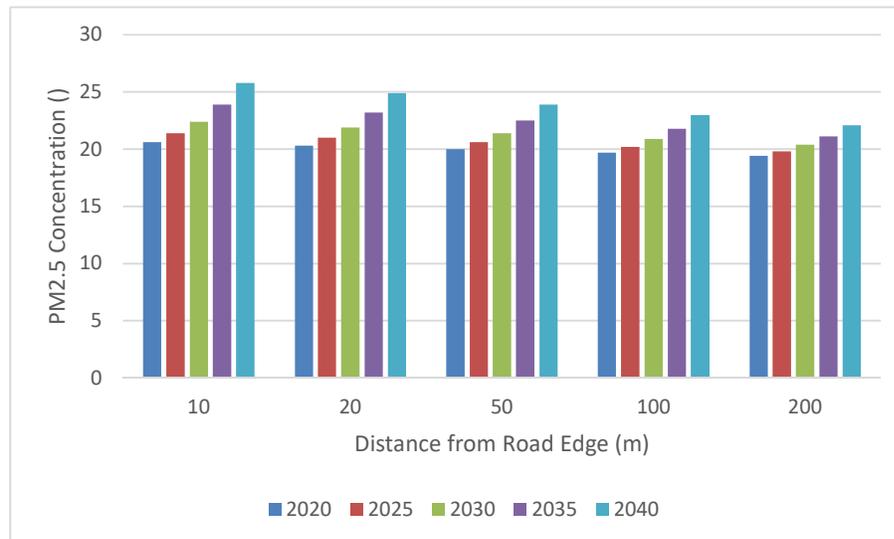
**Table H : Input Parameter for CO Modelling**

Sr. No.	Input Parameter	Value
1	Aerodynamic Roughness Coefficient	Rural
2	Run Type	Worst-case Wind Direction
3	Altitude Above Sea Level	120.874 m
4	Wind Speed	2.22 m/sec
5	Wind Direction	45°
6	Wind Direction Standard Deviation	20
7	Atmospheric Stability Class	4
8	Mixing Height	5
9	Ambient Temperature	25°C
10	Ambient PM Concentration	18.2

**Output:**

**Table I: Predicted Concentrations of CO in the study location (ppm)**

Year	Distance from Road Edge (m)				
	10	20	50	100	200
2020	20.6	20.3	20	19.7	19.4
2025	21.4	21	20.6	20.2	19.8
2030	22.4	21.9	21.4	20.9	20.4
2035	23.9	23.2	22.5	21.8	21.1
2040	25.8	24.9	23.9	23	22.1
Limit	60	60	60	60	60



**Figure G: Graph representing Predicted Concentrations of PM<sub>2.5</sub> in the study location (ppm)**



For year 2020:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 18.2 PPM  
 SIGTH= 20. DEGREES            TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	274	0.0	0.0	13.0
B. 2	0	8000	0	16000	AG	274	0.0	0.0	13.0
C. 3	0	16000	0	23958	AG	274	0.0	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	358.	20.6	0.0	2.2	0.2
2. 2	357.	20.3	0.0	1.9	0.2
3. 3	356.	20.0	0.0	1.6	0.2
4. 4	186.	19.7	0.6	0.9	0.0
5. 5	189.	19.4	0.6	0.7	0.0
6. 6	2.	20.6	0.0	2.2	0.2
7. 7	3.	20.3	0.0	1.9	0.2
8. 8	4.	20.0	0.0	1.6	0.2
9. 9	174.	19.7	0.6	0.9	0.0
10. 10	171.	19.4	0.6	0.7	0.0



For Year 2025:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 18.2 PPM  
 SIGTH= 20. DEGREES            TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	366	0.0	0.0	13.0
B. 2	0	8000	0	16000	AG	366	0.0	0.0	13.0
C. 3	0	16000	0	23958	AG	366	0.0	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	358.	21.4	0.0	2.9	0.3
2. 2	357.	21.0	0.0	2.5	0.3
3. 3	356.	20.6	0.0	2.1	0.3
4. 4	186.	20.2	0.8	1.2	0.0
5. 5	189.	19.8	0.8	0.9	0.0
6. 6	2.	21.4	0.0	2.9	0.3
7. 7	3.	21.0	0.0	2.5	0.3
8. 8	4.	20.6	0.0	2.1	0.3
9. 9	174.	20.2	0.8	1.2	0.0
10. 10	171.	19.8	0.8	0.9	0.0



For Year 2030:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 18.2 PPM  
 SIGTH= 20. DEGREES            TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	490	0.0	0.0	13.0
B. 2	0	8000	0	16000	AG	490	0.0	0.0	13.0
C. 3	0	16000	0	23958	AG	490	0.0	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)	A	B	C
1. 1	358.	22.4	0.0	3.9	0.3	
2. 2	357.	21.9	0.0	3.4	0.3	
3. 3	356.	21.4	0.0	2.8	0.3	
4. 4	186.	20.9	1.1	1.6	0.0	
5. 5	189.	20.4	1.0	1.2	0.0	
6. 6	2.	22.4	0.0	3.9	0.3	
7. 7	3.	21.9	0.0	3.4	0.3	
8. 8	4.	21.4	0.0	2.8	0.3	
9. 9	174.	20.9	1.1	1.6	0.0	
10. 10	171.	20.4	1.0	1.2	0.0	



For Year 2035:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 18.2 PPM  
 SIGTH= 20. DEGREES            TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	656	0.0	0.0	13.0
B. 2	0	8000	0	16000	AG	656	0.0	0.0	13.0
C. 3	0	16000	0	23958	AG	656	0.0	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	358.	23.9	0.0	5.2	0.5
2. 2	357.	23.2	0.0	4.6	0.5
3. 3	356.	22.5	0.0	3.8	0.5
4. 4	186.	21.8	1.4	2.2	0.0
5. 5	189.	21.1	1.4	1.6	0.0
6. 6	2.	23.9	0.0	5.2	0.5
7. 7	3.	23.2	0.0	4.6	0.5
8. 8	4.	22.5	0.0	3.8	0.5
9. 9	174.	21.8	1.4	2.2	0.0
10. 10	171.	21.1	1.4	1.6	0.0



For Year 2040:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
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JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= WORST CASE              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      AMB= 18.2 PPM  
 SIGH= 20. DEGREES              TEMP= 25.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	* AG	878	0.0	0.0	13.0
B. 2	0	8000	0	16000	* AG	878	0.0	0.0	13.0
C. 3	0	16000	0	23958	* AG	878	0.0	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 2

JOB: A30\_2 9-10-2020  
 RUN: Hour 1 (WORST CASE ANGLE)  
 POLLUTANT: Particulates  
 (NOTE: OUTPUT IN MICRO-GRAMS/METER\*\*3. IGNORE PPM LABEL)

IV. MODEL RESULTS (WORST CASE WIND ANGLE )

RECEPTOR	* BRG (DEG)	* PRED CONC (PPM)	* CONC/LINK (PPM)		
			A	B	C
1. 1	* 358.	* 25.8	* 0.0	7.0	0.6
2. 2	* 357.	* 24.9	* 0.0	6.1	0.6
3. 3	* 356.	* 23.9	* 0.0	5.1	0.6
4. 4	* 186.	* 23.0	* 1.9	2.9	0.0
5. 5	* 189.	* 22.1	* 1.8	2.1	0.0
6. 6	* 2.	* 25.8	* 0.0	7.0	0.6
7. 7	* 3.	* 24.9	* 0.0	6.1	0.6
8. 8	* 4.	* 23.9	* 0.0	5.1	0.6
9. 9	* 174.	* 23.0	* 1.9	2.9	0.0
10. 10	* 171.	* 22.1	* 1.8	2.1	0.0



**NO<sub>x</sub> Modelling:**

**Input:**

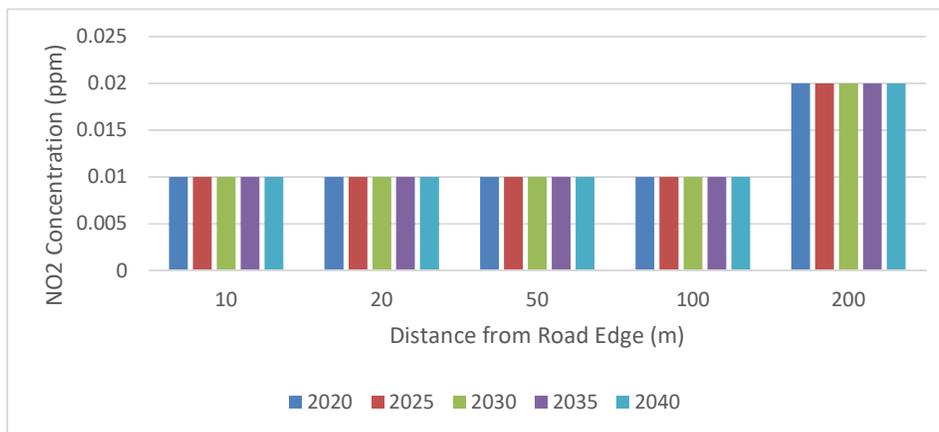
**Table J: Input Parameter for CO Modelling**

Sr. No.	Input Parameter	Value
1	Molecular weight	46
2	Aerodynamic Roughness Coefficient	Rural
3	Run Type	Standard
4	Altitude Above Sea Level	120.874 m
5	Wind Speed	2.22 m/sec
6	Wind Direction	45°
7	Wind Direction Standard Deviation	20
8	Atmospheric Stability Class	4
9	Mixing Height	5
10	Ambient Temperature	25°C
11	Ambient O <sub>3</sub> Concentration	0.03
12	Ambient NO Concentration	0.02
13	Ambient NO <sub>2</sub> Concentration	0.007
14	NO <sub>2</sub> Photolysis Rate Constant	0.004
15	NO <sub>2</sub> /NO <sub>x</sub> Ratio	0.35

**Output:**

**Table K: Predicted Concentrations of CO in the study location (ppm)**

Year	Distance from Road Edge (m)				
	10	20	50	100	200
2020	0.01	0.01	0.01	0.01	0.02
2025	0.01	0.01	0.01	0.01	0.02
2030	0.01	0.01	0.01	0.01	0.02
2035	0.01	0.01	0.01	0.01	0.02
2040	0.01	0.01	0.01	0.01	0.02
Limit	0.04	0.04	0.04	0.04	0.04



**Figure H: Graph representing Predicted Concentrations of NO<sub>x</sub> in the study location (ppm)**



For Year 2020:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 1

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= 45.0 DEGREES              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      TEMP= 25.0 DEGREE (C)  
 SIGTH= 20. DEGREES

NOX VARIABLES

NO2= 0.01 PPM      NO= 0.02 PPM      O3= 0.02 PPM      KR= 0.004 1/SEC

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	274	0.30	0.0	13.0
B. 2	0	8000	0	16000	AG	274	0.30	0.0	13.0
C. 3	0	16000	0	23958	AG	274	0.30	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 2

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

IV. MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

RECEPTOR	* PRED CONC (PPM)	* A	* B	* C
1. 1	0.01	0.00	0.00	0.00
2. 2	0.01	0.00	0.00	0.00
3. 3	0.01	0.00	0.00	0.00
4. 4	0.01	0.00	0.00	0.00
5. 5	0.01	0.00	0.00	0.00
6. 6	0.01	0.00	0.00	0.00
7. 7	0.01	0.00	0.00	0.00
8. 8	0.01	0.00	0.00	0.00
9. 9	0.01	0.00	0.01	0.00
10. 10	0.02	0.00	0.01	0.00



For Year 2025:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 1

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= 45.0 DEGREES              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      TEMP= 25.0 DEGREE (C)  
 SIGH= 20. DEGREES

NOX VARIABLES

NO2= 0.01 PPM              NO= 0.02 PPM              O3= 0.02 PPM              KR= 0.004 1/SEC

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	* AG	366	0.30	0.0	13.0
B. 2	0	8000	0	16000	* AG	366	0.30	0.0	13.0
C. 3	0	16000	0	23958	* AG	366	0.30	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 2

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

IV. MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

RECEPTOR	* PRED CONC (PPM)	* CONC/LINK (PPM)	A	B	C
1. 1	* 0.01	* 0.00	0.00	0.00	0.00
2. 2	* 0.01	* 0.00	0.00	0.00	0.00
3. 3	* 0.01	* 0.00	0.00	0.00	0.00
4. 4	* 0.01	* 0.00	0.00	0.00	0.00
5. 5	* 0.01	* 0.00	0.00	0.00	0.00
6. 6	* 0.01	* 0.00	0.00	0.00	0.00
7. 7	* 0.01	* 0.00	0.00	0.00	0.00
8. 8	* 0.01	* 0.00	0.00	0.00	0.00
9. 9	* 0.01	* 0.00	0.01	0.00	0.00
10. 10	* 0.02	* 0.00	0.01	0.00	0.00



For Year 2030:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 1

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= 45.0 DEGREES              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      TEMP= 25.0 DEGREE (C)  
 SIGTH= 20. DEGREES

NOX VARIABLES

NO2= 0.01 PPM      NO= 0.02 PPM      O3= 0.02 PPM      KR= 0.004 1/SEC

II. LINK VARIABLES

LINK DESCRIPTION	* X1	* Y1	* X2	* Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	* AG	490	0.30	0.0	13.0
B. 2	0	8000	0	16000	* AG	490	0.30	0.0	13.0
C. 3	0	16000	0	23958	* AG	490	0.30	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	* Y	* Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 2

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

IV. MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

RECEPTOR	* PRED CONC (PPM)	* CONC/LINK (PPM)	A	B	C
1. 1	0.01	0.00	0.00	0.00	0.00
2. 2	0.01	0.00	0.00	0.00	0.00
3. 3	0.01	0.00	0.00	0.00	0.00
4. 4	0.01	0.00	0.00	0.00	0.00
5. 5	0.01	0.00	0.00	0.00	0.00
6. 6	0.01	0.00	0.00	0.00	0.00
7. 7	0.01	0.00	0.00	0.00	0.00
8. 8	0.01	0.00	0.01	0.00	0.00
9. 9	0.01	0.00	0.01	0.00	0.00
10. 10	0.02	0.00	0.01	0.00	0.00



For Year 2035:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 1

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= 45.0 DEGREES              VD= 0.0 CM/S  
 CLAS= 4 (D)                      VS= 0.0 CM/S  
 MIXH= 5. M                      TEMP= 25.0 DEGREE (C)  
 SIGTH= 20. DEGREES

NOX VARIABLES

NO2= 0.01 PPM      NO= 0.02 PPM      O3= 0.02 PPM      KR= 0.004 1/SEC

II. LINK VARIABLES

LINK DESCRIPTION	* X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	* AG	656	0.30	0.0	13.0
B. 2	0	8000	0	16000	* AG	656	0.30	0.0	13.0
C. 3	0	16000	0	23958	* AG	656	0.30	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	* X	Y	Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 2

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

IV. MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

RECEPTOR	* PRED CONC (PPM)	* CONC/LINK (PPM)		
		A	B	C
1. 1	* 0.01	* 0.00	0.00	0.00
2. 2	* 0.01	* 0.00	0.00	0.00
3. 3	* 0.01	* 0.00	0.00	0.00
4. 4	* 0.01	* 0.00	0.00	0.00
5. 5	* 0.01	* 0.00	0.00	0.00
6. 6	* 0.01	* 0.00	0.00	0.00
7. 7	* 0.01	* 0.00	0.00	0.00
8. 8	* 0.01	* 0.00	0.01	0.00
9. 9	* 0.01	* 0.00	0.01	0.00
10. 10	* 0.02	* 0.00	0.01	0.00



For Year 2040:

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 1

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

I. SITE VARIABLES

U= 2.2 M/S                      Z0= 10. CM                      ALT= 129. (M)  
 BRG= 45.0 DEGREES            VD= 0.0 CM/S  
 CLAS= 4 (D)                    VS= 0.0 CM/S  
 MIXH= 5. M                      TEMP= 25.0 DEGREE (C)  
 SIGTH= 20. DEGREES

NOX VARIABLES

NO2= 0.01 PPM      NO= 0.02 PPM      O3= 0.02 PPM      KR= 0.004 1/SEC

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1	0	0	0	8000	AG	878	0.30	0.0	13.0
B. 2	0	8000	0	16000	AG	878	0.30	0.0	13.0
C. 3	0	16000	0	23958	AG	878	0.30	0.0	13.0

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. 1	10	10000	0.0
2. 2	20	10000	0.0
3. 3	50	10000	0.0
4. 4	100	10000	0.0
5. 5	200	10000	0.0
6. 6	-10	10000	0.0
7. 7	-20	10000	0.0
8. 8	-50	10000	0.0
9. 9	-100	10000	0.0
10. 10	-200	10000	0.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL  
 JUNE 1989 VERSION  
 PAGE 2

JOB: A30\_2 9-10-2020  
 RUN: Hour 1  
 POLLUTANT: Nitrogen Dioxide

IV. MODEL RESULTS (PRED. CONC. INCLUDES AMB.)

RECEPTOR	PRED CONC (PPM)	CONC/LINK (PPM)	A	B	C
1. 1	0.01	0.00	0.00	0.00	0.00
2. 2	0.01	0.00	0.00	0.00	0.00
3. 3	0.01	0.00	0.00	0.00	0.00
4. 4	0.01	0.00	0.00	0.00	0.00
5. 5	0.01	0.00	0.00	0.00	0.00
6. 6	0.01	0.00	0.00	0.00	0.00
7. 7	0.01	0.00	0.00	0.00	0.00
8. 8	0.01	0.00	0.01	0.00	0.00
9. 9	0.01	0.00	0.01	0.00	0.00
10. 10	0.02	0.00	0.01	0.00	0.00



## Annexure 19: Prediction of Noise Levels along the Project Road

During operation noise generating sources will be traffic noise and road-side commercial activities at some places. Noise generated due to traffic on this road will have impact on the nearby villages. Cumulative noise levels of these traffic sources were computed using Federal Highway Administration (FHWA's) Traffic Noise Model (TNM). TNM computes incremental highway traffic noise at nearby receivers. As sources of noise, it includes noise emission levels for the following vehicle types:

- Automobiles: all vehicles with two axles and four tyres primarily designed to carry nine or fewer people (passenger camp, vans) or cargo (vans, light trucks), generally with gross vehicle weight less than 4500 kg.
- Medium trucks: all cargo vehicles with two axles and six tires – generally with gross vehicle weight between 4500 kg and 12000 kg.
- Heavy trucks: All cargo vehicles with three or more axles, generally with gross vehicle weight more than 12000 kg.
- Buses: all vehicles designed to carry more than nine passengers
- Motorcycles: all vehicles with two or three tires and an open-air driver/passenger compartment.

The procedure for prediction of noise levels involved the following steps:

- Identification of various receivers,
- Determination of land uses and activities which may be affected by the noise generated
- Assemble input parameters
- Application of the model

### Input Parameters

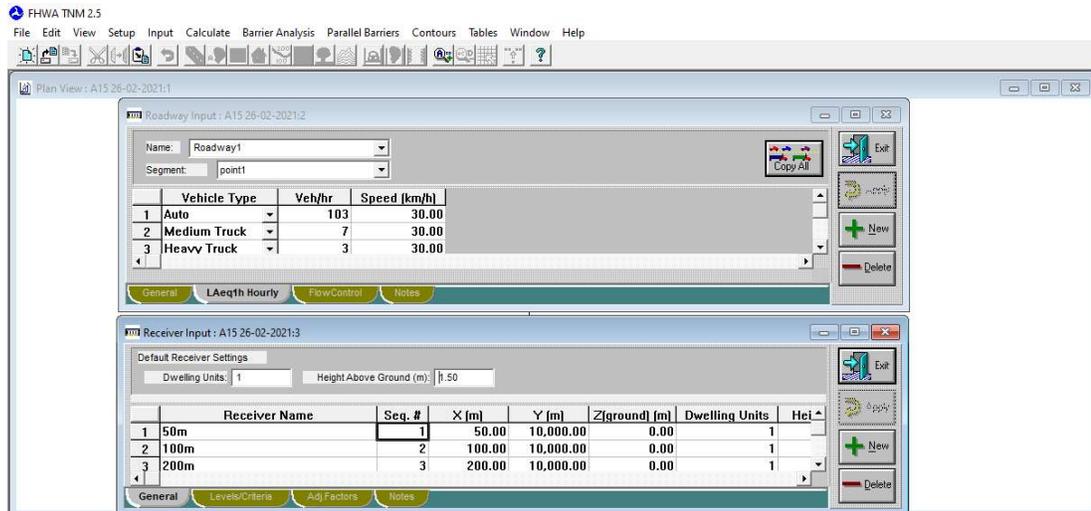
Traffic volume for the projected period is obtained from the traffic projections. The total number of vehicles passing per hour by type- light, medium and heavy along with their average speed is used for predictions. The average speeds for vehicles in our project road around build-up area are considered as 30 kmph for this model.

**Table A: Predicted Traffic Volume per hour during Day time**

Year	Two-wheeler	Car	LCV	Bus	Truck	PCU
2020	114	78	2	3	2	<b>174</b>
2025	153	104	3	3	2	<b>232</b>
2030	204	139	4	4	5	<b>311</b>
2035	273	186	5	6	6	<b>416</b>
2040	366	249	7	8	7	<b>556</b>

**Table B: Predicted Traffic Volume per hour during Night time**

Year	Two-wheeler	Car	LCV	Bus	Truck	PCU
2020	115	69	3	2	4	<b>274</b>
2025	154	93	4	3	7	<b>366</b>
2030	205	124	6	4	9	<b>490</b>
2035	275	166	8	5	11	<b>656</b>
2040	368	223	10	7	14	<b>878</b>



**Figure A: Layout of FHWA’s Traffic Noise Model**

**Noise Levels**

As per the Baseline survey conducted on **18<sup>th</sup> January 2020**, the maximum day time noise level is **45.3 dB** and the maximum night time noise level is **33.4 dB**.

**Average Noise Level**

All vehicles produce some noise, which is taken as the base and the cumulative noise at the receiver distance due to the whole traffic is estimated. The average noise levels vary depending on the type of vehicle. In order to assess the impact of noise due to the change in traffic density and speed, a small road section of each project road has been selected to develop noise projections for future years 2020, 2025, 2030, 2035, and 2040. In order to assess the impact of traffic on sensitive receptors along the road, receptor locations were set at 50 m, 100 m, 200 m, 300 m, 400 m, 500 m, 600 m, 700 m and 800 m from the center line of the road.

The outputs of the assessment are presented in table below. The table shows the noise levels that will be generated by traffic at the respective distance from the centerline of the road. The predicted noise levels are those predicted around built-up area considering vehicle speed as 30 kmph. The permissible noise levels in residential area according to Ambient Noise Standards are 55 dB in daytime and 45 dB at nighttime. It can be seen that even without mitigation measures, noise levels in built up area are within the permissible levels except, 50m and 100m from road during night time. The sensitive receptors located within



50m and 100m distance of the road are not operational at night time, hence increased noise will not cause any adverse impact. During day mitigation measure will be taken to prevent adverse impacts of noise pollution.

**Table C: Predicted Noise Level**

Sr. No.	Distance from Centerline (m)	2020		2025		2030		2035		2040	
		Day time	Night time								
1	50	46.6	47.5	47.6	49.2	49.5	50.4	50.6	51.5	51.7	52.7
2	100	41.6	42.6	42.5	44.4	44.5	45.6	45.6	46.7	46.7	47.8
3	200	36.8	37.9	37.7	39.7	39.8	40.9	40.9	42	42	43.1
4	300	34.2	35.2	35.2	36.9	37.1	38.1	38.2	39.2	39.4	40.4
5	400	32.5	33.4	33.4	35.1	35.4	36.4	36.5	37.4	37.6	38.6
6	500	31.3	32.1	32.2	33.9	34.1	35.1	35.3	36.2	36.4	37.4
7	600	30.3	31.2	31.3	32.9	33.2	34.1	34.3	35.2	35.4	36.4
8	700	29.6	30.4	30.5	32.2	32.4	33.4	33.5	34.5	34.7	35.6
9	800	28.8	29.7	29.8	31.5	31.7	32.7	32.8	33.8	34	34.9

**Output of Day time Noise Prediction:**

**For Year 2020:**

Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				LAeq1h		Sub'l Inc		
				Calculated	Crit'n	Calculated	Crit'n	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.3	46.6	66	1.3	10	—
100m	2	1	45.3	41.6	66	-3.7	10	—
200m	3	1	45.3	36.8	66	-8.5	10	—
300m	4	1	45.3	34.2	66	-11.1	10	—
400m	5	1	45.3	32.5	66	-12.8	10	—
500m	6	1	45.3	31.3	66	-14.0	10	—
600m	7	1	45.3	30.3	66	-15.0	10	—
700m	8	1	45.3	29.6	66	-15.7	10	—
800m	9	1	45.3	28.8	66	-16.5	10	—

**For Year 2025:**

Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				LAeq1h		Sub'l Inc		
				Calculated	Crit'n	Calculated	Crit'n	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.3	47.6	66	2.3	10	—
100m	2	1	45.3	42.5	66	-2.8	10	—
200m	3	1	45.3	37.7	66	-7.6	10	—
300m	4	1	45.3	35.2	66	-10.1	10	—
400m	5	1	45.3	33.4	66	-11.9	10	—
500m	6	1	45.3	32.2	66	-13.1	10	—
600m	7	1	45.3	31.3	66	-14.0	10	—
700m	8	1	45.3	30.5	66	-14.8	10	—
800m	9	1	45.3	29.8	66	-15.5	10	—



**For Year 2030:**

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n	
				Sub'l Inc	Sub'l Inc	Sub'l Inc	Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.3	49.5	66	4.2	10	—
100m	2	1	45.3	44.5	66	-0.8	10	—
200m	3	1	45.3	39.8	66	-5.5	10	—
300m	4	1	45.3	37.1	66	-8.2	10	—
400m	5	1	45.3	35.4	66	-9.9	10	—
500m	6	1	45.3	34.1	66	-11.2	10	—
600m	7	1	45.3	33.2	66	-12.1	10	—
700m	8	1	45.3	32.4	66	-12.9	10	—
800m	9	1	45.3	31.7	66	-13.6	10	—

**For Year 2035:**

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n	
				Sub'l Inc	Sub'l Inc	Sub'l Inc	Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.3	50.6	66	5.3	10	—
100m	2	1	45.3	45.6	66	0.3	10	—
200m	3	1	45.3	40.9	66	-4.4	10	—
300m	4	1	45.3	38.2	66	-7.1	10	—
400m	5	1	45.3	36.5	66	-8.8	10	—
500m	6	1	45.3	35.3	66	-10.0	10	—
600m	7	1	45.3	34.3	66	-11.0	10	—
700m	8	1	45.3	33.5	66	-11.8	10	—
800m	9	1	45.3	32.8	66	-12.5	10	—

**For Year 2040:**

Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n	
				Sub'l Inc	Sub'l Inc	Sub'l Inc	Sub'l Inc	
			dBA	dBA	dBA	dB	dB	
50m	1	1	45.3	51.7	66	6.4	10	—
100m	2	1	45.3	46.7	66	1.4	10	—
200m	3	1	45.3	42.0	66	-3.3	10	—
300m	4	1	45.3	39.4	66	-5.9	10	—
400m	5	1	45.3	37.6	66	-7.7	10	—
500m	6	1	45.3	36.4	66	-8.9	10	—
600m	7	1	45.3	35.4	66	-9.9	10	—
700m	8	1	45.3	34.7	66	-10.6	10	—
800m	9	1	45.3	34.0	66	-11.3	10	—



**Output of Night time Noise Prediction:**

**For Year 2020:**

Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				LAeq1h		Calculated	Crit'n Sub'l Inc	
				Calculated	Crit'n			
			dBA	dBA	dBA	dB	dB	
50m	1	1	33.4	47.5	66	14.1	10	Sub'l Inc
100m	2	1	33.4	42.6	66	9.2	10	—
200m	3	1	33.4	37.9	66	4.5	10	—
300m	4	1	33.4	35.2	66	1.8	10	—
400m	5	1	33.4	33.4	66	0.0	10	—
500m	6	1	33.4	32.1	66	-1.3	10	—
600m	7	1	33.4	31.2	66	-2.2	10	—
700m	8	1	33.4	30.4	66	-3.0	10	—
800m	9	1	33.4	29.7	66	-3.7	10	—

**For Year 2025:**

Receiver								
Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				LAeq1h		Calculated	Crit'n Sub'l Inc	
				Calculated	Crit'n			
			dBA	dBA	dBA	dB	dB	
50m	1	1	33.4	49.2	66	15.8	10	Sub'l Inc
100m	2	1	33.4	44.4	66	11.0	10	Sub'l Inc
200m	3	1	33.4	39.7	66	6.3	10	—
300m	4	1	33.4	36.9	66	3.5	10	—
400m	5	1	33.4	35.1	66	1.7	10	—
500m	6	1	33.4	33.9	66	0.5	10	—
600m	7	1	33.4	32.9	66	-0.5	10	—
700m	8	1	33.4	32.2	66	-1.2	10	—
800m	9	1	33.4	31.5	66	-1.9	10	—

**For Year 2030:**

Receiver								
Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				LAeq1h		Calculated	Crit'n Sub'l Inc	
				Calculated	Crit'n			
			dBA	dBA	dBA	dB	dB	
50m	1	1	33.4	50.4	66	17.0	10	Sub'l Inc
100m	2	1	33.4	45.6	66	12.2	10	Sub'l Inc
200m	3	1	33.4	40.9	66	7.5	10	—
300m	4	1	33.4	38.1	66	4.7	10	—
400m	5	1	33.4	36.4	66	3.0	10	—
500m	6	1	33.4	35.1	66	1.7	10	—
600m	7	1	33.4	34.1	66	0.7	10	—
700m	8	1	33.4	33.4	66	0.0	10	—
800m	9	1	33.4	32.7	66	-0.7	10	—



**For Year 2035:**

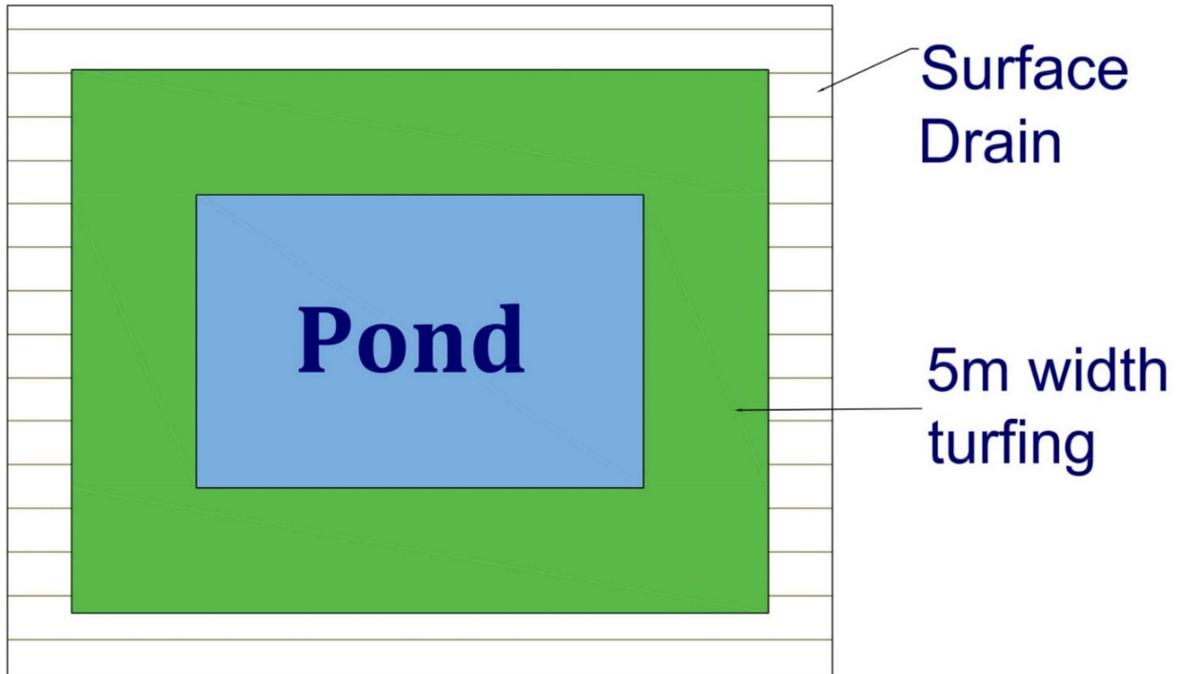
Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n	
				dB	dB	dB	dB	
50m	1	1	33.4	51.5	66	18.1	10	Sub'l Inc
100m	2	1	33.4	46.7	66	13.3	10	Sub'l Inc
200m	3	1	33.4	42.0	66	8.6	10	—
300m	4	1	33.4	39.2	66	5.8	10	—
400m	5	1	33.4	37.4	66	4.0	10	—
500m	6	1	33.4	36.2	66	2.8	10	—
600m	7	1	33.4	35.2	66	1.8	10	—
700m	8	1	33.4	34.5	66	1.1	10	—
800m	9	1	33.4	33.8	66	0.4	10	—

**For Year 2040:**

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier		Increase over existing		Type Impact
				Calculated	Crit'n	Calculated	Crit'n	
				dB	dB	dB	dB	
50m	1	1	33.4	52.7	66	19.3	10	Sub'l Inc
100m	2	1	33.4	47.8	66	14.4	10	Sub'l Inc
200m	3	1	33.4	43.1	66	9.7	10	—
300m	4	1	33.4	40.4	66	7.0	10	—
400m	5	1	33.4	38.6	66	5.2	10	—
500m	6	1	33.4	37.4	66	4.0	10	—
600m	7	1	33.4	36.4	66	3.0	10	—
700m	8	1	33.4	35.6	66	2.2	10	—
800m	9	1	33.4	34.9	66	1.5	10	—

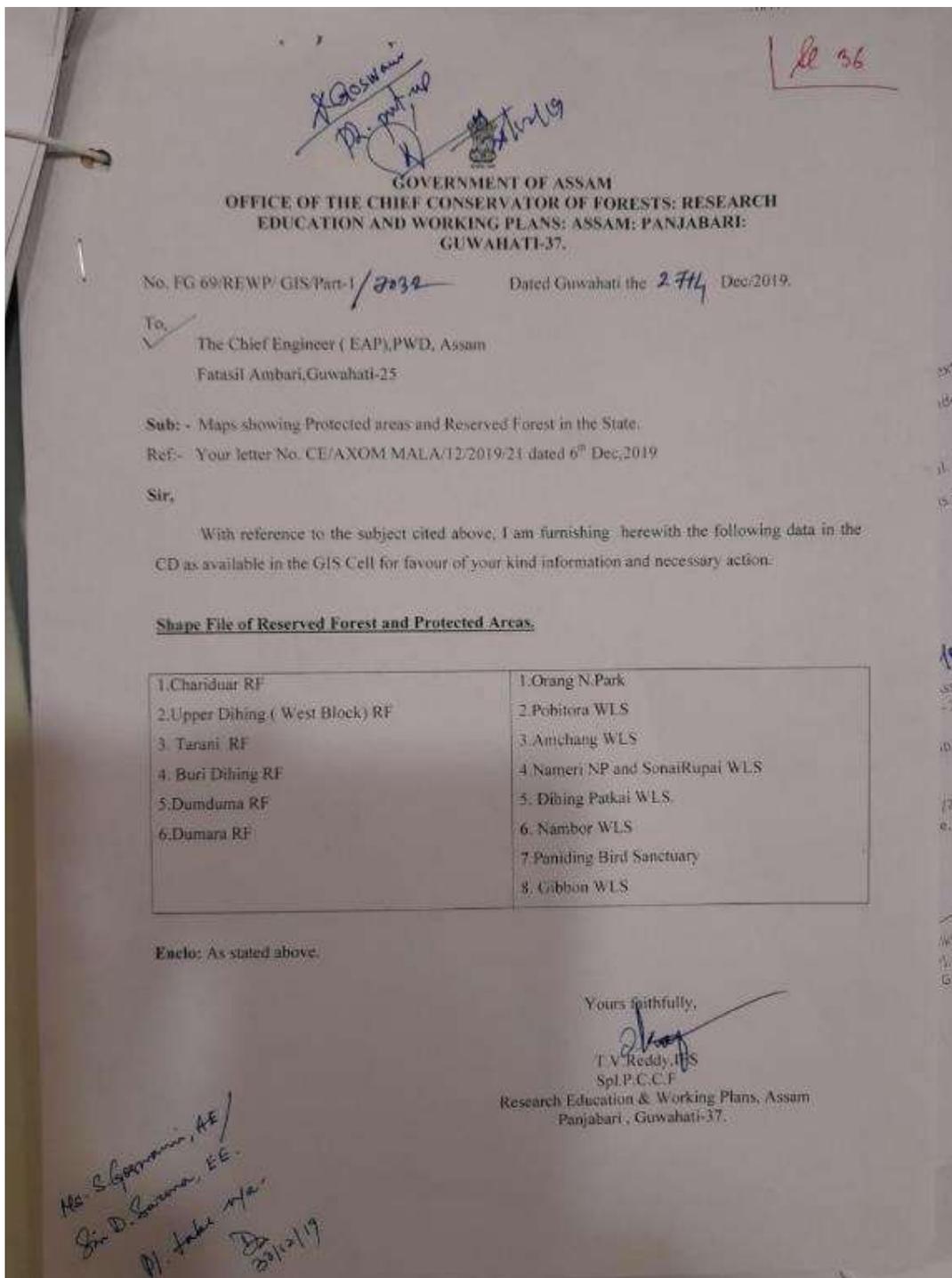


## Annexure 20: Pond Enhancement Plan





## Annexure 21: Letter from PCCF, Assam providing GIS Maps of Protected Areas and Reserve Forests





111

  
 GOVERNMENT OF ASSAM  
 OFFICE OF THE CHIEF CONSERVATOR OF FORESTS: RESEARCH  
 EDUCATION AND WORKING PLANS: ASSAM: PANJABARI:  
 GUWAHATI-37.

No. FG 69/REWP/ GIS/Part-1 Dated Guwahati the 15<sup>th</sup> February, 2020

To  
 ✓ The Chief Engineer ( EAP),PWD, Assam  
 Fatasil Ambari,Guwahati-25

*D. Goswami  
 ABE  
 Pl take necessary  
 action.  
 18/02/20*

**Sub:** - Maps showing Protected areas and Reserved Forest in the State.  
**Ref:-** Your letter No. CE/AXOM MALA/12/2019/40 dated 29<sup>th</sup> february,2020

**Sir,**

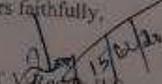
With reference to the subject cited above, I am furnishing herewith the following data in the CD as available in the GIS Cell for favour of your kind information and necessary action. The shape files are, however , subject to future corrections if any. The digitalized map of Drang RF,Namsai RF,Tirap RF,Tinkapani RF,Namphuk RF,Koria Pani RF,Diyan Auchal RF, Plyong RF,Kumchat RF Namsang RF are not available in the GIS Cell.

*email*

**Shape File of Reserved Forest and Protected Areas.**

1. Orang Reserved Forest	15.Lakapathar RF
2. Singri hill RF	16.Phillobari RF
3. Rowta RF	17.Nalini RF
4. Balipara RF	18.Tirap RF
5. Gohpur RF	19.Tinkapani RF
6. Borajan Bhetjan Podumoti WLS	20.Dighoi RF
7. Dihing RF	21.Dirak RF
8.Upper Dihing ( east Block) RF	22.Kakotjan RF
9.Pabha RF	23.Tacaauri RF
10.Sapekhati RF	24.Namdang RF
11.Diroi RF	25.Kotha RF
12.Sola RF	26.Namphai RF
13.Abhayapuri RF	
14.Duarmara RF	

**Encl:** As stated above.

Yours faithfully,  
  
 T.V.Reddy, I/S  
 Spl.P.C.C.F  
 Research Education & Working Plans, Assam  
 Panjabari, Guwahati-37.

*Ms. S. Goswami, AE  
 Pl take up as discussed.  
 29/2/2020*



## Annexure 22: Tree Cutting Evaluation from Forest Department

  
Government of Assam  
Office of the Divisional Forest Officer  
Digboi Division: Digboi

PA No 02751264433  
Letter No B/Axom Mala/2021/1351  
Email ID: dfodigboi@gmail.com  
Dated: 08-06-2021

To  
The Chief Engineer (EAP), PWRD,  
Assam, Fataal Ambari,  
Guwahati-25.

Sub: - Improvement and upgradation of A30 2 Disang Kinar Bangali to Kathalguri Road under Asom Mala  
Ref- Your letter No. 1. CE/AXOM MALA/12/2019/9 dtd.05/11/2019  
2. CE/AXOMMALA/9/2019/Pt-III/53 dtd. 29-05-2021.

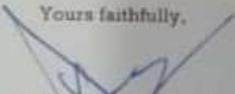
Sir,  
With reference to the subject cited above, I am furnishing the following information regarding Axom Mala Project Road from Disang Kinar Bengali to Bhadoi Panchali under Digboi Division.

1. Details of forest area: - There is no Reserve Forest along the proposed site for improvement of State Highway (SH) i.e. from Disang Kinar Bengali to Bhadoi Panchali falling within the jurisdiction of Digboi Forest Division and the trees standing either side of the road are not on forest land.
2. Information on Flora and fauna :  
Flora: - Krishnasura, Guwal, Dimoru, Simolu, Sotiyana, Gomari, Koroch, Strish, Indofera, Amora, Moj, Raintree, Jamuk, Sissoo, Sum, Aam, Paniyal, Nuni, Morolia, Gohora, Bhatgela, Akhrat, Sonaru, Katkora, Putenjawa, Jia, Panichikoti, Peepal, Modar, Ghoraneem, Sojina, Bell, Madhuri, Paroh, Bogori, Kothal, Ulbejeria Fale, Ajhar, Rabab Tenga, Bansiris, Debbaru, Pola, Keseru, Neem, Pola, Outenga, Tita Sopa etc.  
Fauna: - No major animal movement has been detected in the proposed area.
3. Type and number of animal present: - No major animal movement has been detected in the proposed area.
4. Length of forest area adjacent to project road: - The site of the Project Road is not on forest land.
5. Map and extent of forest cover: - Not applicable.
6. Numbers of trees required to be removed: - 1438 nos. Volume = 863.81 m3.
7. Cost of felling of trees, sectioning, dragging to diesel point, transportation to temporary depot, depot maintenance etc. @ Rs.3450/m3 :- Rs. 29,80,145.00 (Rupees Twenty nine lakhs Eighty thousand One hundred Forty five) only (copy of estimate is enclosed)

Please note that, the dragging cost etc. may accordingly to the actual volume of timber obtained after felling. Moreover, felling will be permitted only after getting approval from the Conservator of Forests Eastern Assam Circle, Jorhat.

This is for favour of your kind information and necessary action.

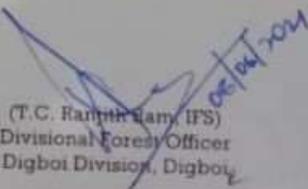
Encl: - As stated above.

Yours faithfully,  
  
(T.C. Ranjith Bam, IFS)  
Divisional Forest Officer  
Digboi Division, Digboi

Dated: 08-06-2021

Letter No B/Axom Mala/2021/936

Copy to the Conservator of Forests, Eastern Assam Circle, Jorhat for favour of his kind information and necessary action.

  
(T.C. Ranjith Bam, IFS)  
Divisional Forest Officer  
Digboi Division, Digboi



  
GOVT. OF ASSAM  
ENVIRONMENT & FOREST DEPARTMENT  
OFFICE OF THE DIVISIONAL FOREST OFFICER, DIBRUGARH DIVISION: DIBRUGARH  
P.O:- C.R. Building, Dist:- Dibrugarh-786003 (Assam)  
E-mail [dfo.t.dibrugarh@gmail.com](mailto:dfo.t.dibrugarh@gmail.com) & [dfo-t-dibrugarh@gov.in](mailto:dfo-t-dibrugarh@gov.in)

15  
150  
1500

Letter No. B/GC/87/R.S.T.-A-30:1/Genl/2020/.....<sup>5785</sup> Dt. ....<sup>15</sup>/12/2020

From: Shri Pradipta Baruah, AFS  
Divisional Forest Officer,  
Dibrugarh Division, Dibrugarh

To:  The Chief Engineer (EAP),  
PWRD, Assam,  
Fatasil, Guwahati-25.

Sub:- Regarding Tree Cutting Evaluation on project road..

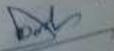
Ref:- Your letter No. CE/AXOM MALA/12/2019/9 dt. 5<sup>th</sup> Nov/2019.

Sir,

With reference to the subject cited above, I would like to send herewith the valuation report and enumeration list of standing Trees and amount of Cost of tree cutting and Transportation of logs, etc. which was received from the Range Forest Officer, Tinsukia Range, Khowang Range & Jeyapore Range, regarding Cutting Evaluation on A-30:1 Project Road side towards Moran, Naharkatia, Duliagan to Digboi Roads (Approx. 82.30 km.) corridor NoA30-1, pertaining to this Dibrugarh Forest Division, Dibrugarh as below:

Sl. No.	Name of Range Forest Office	Name of By-pass Road side	No. of Tree cutting (in Nos.)	Volume of Trees/Logs (in m <sup>3</sup> )	Valuation of tree cutting/ transportation of logs, etc. (in Rs.)	Remarks
1	2	3	4	5	6	7
1.	Tinsukia Range	Desang Kinar Bengali to Kathalguri via naharkatia by Pass Road(A-30-2 both side)	77	73.6373	10,96,950.00	
2.	Khowang Range	A-30-1 roads starting from Moran to Naharkatia ( Disang Kinar Bengali, Kuwari Gaon, Tinkhong)	1791	1216.6938	1,83,05,606.00	
3.	Jeyapore Range	Road side Tree stated from Kuwari Gaon and completed at Disang Kinar Bangali Gaon (Naharkatia By-pass)	762	439.623	6,41,791.00	
<b>Total:</b>			<b>2,630 Nos.</b>	<b>1,729.9541 m<sup>3</sup></b>	<b>Rs.2,00,44,347.00</b>	

This is for favour of your kind information and necessary action.  
Enclo:- As stated above.

Yours faithfully,  
  
Divisional Forest Officer,  
Dibrugarh Division.

2020-12-16 11:53



## Annexure 23: Biodiversity Assessment Report

### **ASSAM SECONDARY ROAD NETWORK IMPROVEMENT PROJECT**

### Biodiversity Assessment Report (Draft) (Revision 1)

Prepared for Public Works Roads Department Assam

September, 2021



### About the Authors of this Report

#### THE TEAM

Author

**Mr. Satish Kumar Damodara**  
Environmental &  
Biodiversity Expert

**Mr. Satish Kumar Damodara** is a graduate in civil engineering with postgraduate qualification in Environmental Planning, with an experience of 23 years. He is trained in Environmental Impact Assessments, Environmental Management and implementation, and in GIS mapping and remote sensing. His areas of expertise include, interpretation and impact assessments for environmental and social attributes, prediction modeling of air, noise and water quality, conducting land suitability analysis towards finalizing the strategic plan for the project towns and spatial analysis using SQL. He has been leading complex spatial and environmental assessment projects as Project Manager/Team Leader/Subject Lead covering master planning and infrastructure design components of large infrastructure development projects. He is a permanent employee of LASA and has International experience of working in South East Asia, South Asia, Sub Saharan Africa and Middle East.

**Mr. Satish** has been instrumental in preparing the Environmental Codes of Practice for PMGSY Roads in India, way back in 2004. The codes have been subsequently adopted in several rural road projects across India and have been followed in several state road projects. He has made his mark in environmental and social management plan not only in India but also in countries such as Ethiopia and Uganda where an ESMP for one of the World Bank project has been prepared way back in 2009. The ESMP has been subsequently adopted as a template in several projects across Uganda and Sub-Saharan Africa.

Many of the projects undertaken by Mr. Satish are funded by international funding agencies such as The World Bank, Asian Development Bank (ADB), AIIB, KfW, USAID and NORAD apart from national agencies and local bodies, like NHAI, State PWRDs, Urban Development Authorities, and Industrial Development Agencies.

Reviewed by

**Dr. P. C. Bhattacharjee**  
Renowned  
Biodiversity Expert

**Dr. P.C. Bhattacharjee**, a retired Professor & Head, Department of Zoology, Gauhati University, Assam, India is a renowned **Biodiversity Expert** with 41 years of teaching experience. He is instrumental in wildlife studies in North East India and he has published 100+ scientific papers, article and co-authored 3 books. He has guided a number of Ph.D students). He has attended a number of conferences, national and international seminars, workshops and delivered lectures, on topics related to Environment, Ecology and Biodiversity. He is a Biodiversity and Ecology Specialist for many important projects funded by ADB, World Bank etc.

Dr. P.C. Bhattacharjee is a **Trustee and Vice chairman of Wildlife Trust of India** and was a Member of National Biodiversity Authority, Member of Assam State Biodiversity Board, Assam State wildlife Board and Wetland Authority of Assam. He was also Vice-President, Primate Research Center (PRC). At present he is the President of North East Science Movement (NESM)- Affiliated to Vigyan Bharati.

Dr. P.C. Bhattacharjee is a member of **International Ornithological Congress** (Senior Fellow), **IUCN-SIS-Primate specialist Group**; He was Coordinator, North East, Mid-Winter water fowl census, under Wetland International (2004 to 2016). He is recipient of a number of life time achievement awards which includes Government of Assam, by Chief Minister of Assam, 2020 (Wildlife Conservation); Balipara Foundation, 2020.

Data collection and  
compilation by

**Md. Rehman  
Ms. Arunima  
Pandey**  
Environmental  
Specialist



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## **ABBREVIATIONS**

AIIB	:	Asian Infrastructure Investment Bank
ASRIP	:	Assam Secondary Road Network Improvement Project
EAP	:	Externally Aided Project
GoA	:	Government of Assam
Gol	:	Government of India
IUCN	:	International Union for Conservation of Nature
MDR	:	Major District Roads
MDB	:	Multilateral Development Banks
PPP	:	Public Private Partnerships
SH	:	State Highways



## 1. Introduction

Biodiversity encompasses all levels of biological diversity including natural ecosystems, wild species (flora, fauna), Aquatic ecosystem, agricultural ecosystems, domesticated species and varieties. This is an outcome of ecological and evolutionary processes taking place gradually in any ecosystem. The term biodiversity is usually defined as the total variety and variability among living organisms and the ecological complexes they inhabit. Biodiversity is vital to the fulfillment of human needs; a biodiversity rich region offers wide possibilities and opportunities for sustaining human welfare including adoption to changes.

## 2. Biodiversity of the State

India is one of the 17 Mega biodiverse countries in the world and accounts for 7 to 8 % of the recorded species. The State of Assam is an integral unit of the Eastern Himalayan Biodiversity Region; one of the two biodiversity "Hot Spots" in the country. Being the core component of Northeast India, Assam has the important feature of Indo Malayan, Indo Chinese characteristics contributing to its biodiversity. The climatic variations and wide variety in physical features have resulted in diversity of ecological habitats such as forests, grasslands, wetlands, which harbor and sustain wide ranging floral and faunal species placing.

The state of Assam possesses largely tropical type of vegetation containing areas of evergreen, semi-evergreen, deciduous forests and grasslands besides patches of riparian forest found along the river banks. As per Revised Survey of Forest Types in India, Champion and Seth categorized as many as fifty one different forest types/ sub types for this region. Broadly, these are Tropical Wet Evergreen Forests, Tropical Semi Evergreen Forests, Tropical Moist Deciduous Forests, Sub-tropical Broadleaf Hill Forests, Sub-tropical Pine Forests, Littoral and Swamp Forests, Grassland and Savannah.

With respect to Flora, Assam has rich biodiversity of bamboo, Cane, Medicinal Plant and many endemic plant species. Assam is home to a good number of plants having medicinal uses, altogether, 952 plants species have been identified which have uses in medical practices in some form or other. Endemic species are found in very limited areas of the state. Altogether about 165 species of plants have been reported, which are restricted in distribution to certain pockets in Assam and N.E. Region. However, around 100 such species have distribution restricted to Assam only. Some of these (Plants & trees) are e.g. *Accacia gageana*, *Adiantum assamicum*, *Alseodaphne andersonii*, *Alseodaphne khasyana*, *Angiopteris assamica*, *Cedrela fabrifuga*, *Cinnamomum cacharensis*, *Coelogyne assamica*, *Combretum wallichii*, *Dinochloa indica*, *Diospyros cacharensis*, *Dipterocarpus mannii*, *Eugenia cyanophylla*, bamboos e.g. *Bambusa cacharensis*, *Bambusa mastersii*, *Chimnobambusa griffithiana*, orchids e.g. *Bulbophyllum elassonotum*, *Bulbophyllum vireus*, *Dendrobium assamicum* etc.

With reference to **Rare and Endangered Floral** Species under IUCN red List, about 9 wild species are reported as extinct while around 284 species of plants are observed to be critically endangered, 149 species as endangered, 58 species as vulnerable, 13 species as near threatened.

Assam is a geographical part of the transitional zone between the Indian, Indo Malayan and Indo Chinese Biogeographical regions. Assam is endowed with favourable climate, topographic and edaphic factors support luxuriant growth of diverse ecosystem and wild fauna (mammals, primates, reptiles, amphibians, fishes, mollusks, birds, butterflies, moths etc.) as inhabitants.

**Mammalian diversity** of Assam is represented by 193 species, which are widely distributed in this region. But some of the species like one horned rhinoceros, water buffalo, pigmy hog, swamp deer, golden langur, hoolock gibbon have their distribution limited to isolated pockets and protected areas. In case of Primate Diversity, out of 15 Indian primate species 9 are found in Assam. Hoolock gibbon is the



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only ape found in India. The other major primate species are capped monkey, golden langur, rhesus macaque, stump tailed macaque, pigtail macaque, Assamese macaque, and slow Lorries.

With respect to Reptilian Diversity, Assam’s varied physiographic conditions support a rich variety of reptilian population like Gangetic gharial, 19 species of tortoises, 77 species of lizards and snakes. In Amphibian, Assam and other parts of the N.E. region have 70 species of Amphibians, Gangenophis fulleri and Ichthyphis garoensis are endemic to Assam.

Assam is one of the “endemic bird areas” of the world. Assam has 950 bird species; this is home to 53.5% of the bird species of Indian Sub-Continent, where 17 species of birds are endemic to Assam. 45 species of birds from Assam has been recognized as **threatened** under the Indian Red Data Book.

Due to having Brahmaputra and Barak River basin, Assam region is recognized as one of the hot spots of fresh water fish biodiversity. Amongst 197 species; food, sports and ornamental fish species are reported from the North East region, of which 185 species are reported from Assam. Commercially main fish species include, **Rohu, Katla, Pabha, Pabda Chital, Magur, Singi, Sol**, etc.

**Butterflies** play an important role in pollination of plants and biodiversity conservation. Around total 1500 species of butterflies from India, half are reported from Assam and Northeast India.

**Protected Area Network:** The protected area network of Assam includes 5 National Parks and 18 wildlife sanctuaries covering an area of 0.40 million ha constituting 4.98% of the geographical area. The state has three Tiger Reserves, namely Kaziranga NP, Manas NP, and Nameri NP. Kaziranga National Park and Manas National Park are in the list of Natural World Heritage sites. **Majuli Island is Biodiversity heritage site;** this is spread over an 875 sq. km. area. In addition to this, few of the Protected Area and its buffer zone have also been identified as **Elephant reserve** like Sonitpur ER, **Dihing-Patkai ER**, Kaziranga-Karbi Anglong ER, Dhansiri-Lungding ER, Chirang-Ripu ER.

**Eco-Sensitive Zone:** Ministry of Environment, Forest & Climate Change has notified 0-10 km ranges of Buffer area from the boundary of National Park and Wild Life sanctuary as Eco Sensitive Zone (under Wild Life conservation strategy 2002). In this context, many of the protected area’s buffer zone (0 - 10 km periphery) has been notified as eco sensitive zone by its default definition. In the state of Assam, recently a few of the Protected Areas (PA) have their notified Eco sensitive zone viz. **Nameri NP, Sonai Rupai WLS, Amchang WLS, Dibru Saikhowa NP, Hollongapar Gibbon WLS & Chakrashila WLS**. The process of demarcation of Buffer area as eco-sensitive zone is still under process in Assam for remaining PAs. Therefore, PAs, which has not demarcated its Eco sensitive zones, the buffer area of 10 km from the protected area boundary has been considered as eco sensitive zone.

### 3. Project Corridors

The GoA has embarked upon the Asom Mala to objectively develop the secondary network of the State in the next 15 years. The Asom Mala is an umbrella program with several transport related projects under it and funded from various sources, including those funded from the State Budget (SOPD), Externally Aided Project (EAP) funded by Multilateral Development Banks (MDB) like AIIB, ADB, World Bank, JICA, etc. The Assam Secondary Road Network Improvement Project (ASRIP) has been taken up as an EAP aided by AIIB. The Project corridors included under ASRIP are presented in table below:

Table 1: Project Corridors

Sl. No.	Corridor	Road improvement and upgradation works	District Name	Length (km)
1	A31	Balichapori, Majuli to Bhogalmara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river	Lakhimpur & Majuli	19.3
2	A15	Dhodar Ali (Kamargaon to Kamarbandha)	Golaghat	42.1
3	A07	Sarthebari Rampur Pathsala Raipur Road	Barpeta & Bajali	20.8



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Sl. No.	Corridor	Road improvement and upgradation works	District Name	Length (km)
4	A22	Dhakuakhana Butikur Tiniali Telijan	Lakhimpur & Dhemaji	32.8
5	A30	Moran Naharkatia Duliajan	Dibrugarh	70.6
6	A20	Sivasagar to Nakachari	Sivasagar & Jorhat	63.4
<b>Total =</b>				<b>250</b>

Biodiversity is assessed by mapping the study area with respect to (I) IUCN Red List (II) Protected areas, important species and biodiversity area, forest and other potentially sensitive areas. The present report describes briefly the biodiversity around the project corridors, sensitive hotspots in terms of significant flora & Fauna.

#### 4. Objective

The Biodiversity Assessment Report is a safeguard document that sets out the mitigation and management requirements and responsibilities to be implemented on site to fulfill the Project's biodiversity conservation intentions.

#### 5. Screening of the Project Corridors for Biodiversity

Ecological set-up, favourable geographical location and diversified topographical and climatic conditions were major factors driving the high biodiversity in the state of Assam. Different types of terrestrial and aquatic ecosystem are the ideal conditions for functioning of different types of natural seen in the state with rich biodiversity. Topographically, Assam may conveniently be divided into two major divisions, i.e., the plains and the hills. Assam falls under the regime of sub-tropical monsoon climate. The climate of Assam is characterized by moderate to heavy rainfall accompanied by high percentage of relative humidity and tolerably high temperature in summer and drought with considerably low temperature in winter.

Table below entails about the project corridors and their sensitive analysis with respect to biodiversity impact (please refer below **Table 2, Figure 1**).



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Table 2: Project corridors & its ecological sensitivity

Project Corridors						
Name of the corridor	A31	A15	A07	A22	A30	A20
Proximity to PAs or other sensitive areas	Balichapori, Majuli to Bhogaimara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river	Dhodar Ali (Kamargaon to Kamarbandha	Sarthebari Pathsala Raipur Road	Dhakuakhana Butikur Tiniali Teiljan	Moran Naharkatia Duliajan	Sivasagar to Nakachari
District	Lakhimpur & Majuli	Golaghat	Barpeta & Bajali	Lakhimpur & Dhemajji	Dibrugarh	Sivasagar & Jorhat
	<ul style="list-style-type: none"> <li>The Project corridor is located at a distance of around 1.5km from Pabho Reserve Forest and it crosses Luit River and Subansiri River near Majuli Island. The area is endowed with rare &amp; threatened Bird Species.</li> <li>Majuli is a major island of India and Asia, it is notified as Biodiversity Heritage site under Government of Assam Gazette Notification dated 29 March 2017 under Section 37 of Biological Diversity Act, 2000.</li> <li>The sensitive area around the road stretch may have good biodiversity of fishes, bird and Dolphins. Project involves bridge construction at Subansiri and Luit River. Construction specific Fish and dolphin management plan shall be incorporated in the EMP and PIU/PMU will ensure its effectively implementation by</li> </ul>	<ul style="list-style-type: none"> <li>Nambor Doigrung WLS is located at an aerial distance of around 5 km from the project road (Golaghat Town)</li> <li>Dhansiri River is flowing at a distance of around 50m from the project road from Ch 2+600 to Ch 3+400.</li> <li>Occasional Elephant Movement has been reported as per DFO Golaghat and Community consultation</li> <li>The Protected area has significant number of threatened and endangered wild life fauna and birds.</li> </ul>	<ul style="list-style-type: none"> <li>Manas NP is located at 23km towards north</li> <li>No major threatened flora and fauna reported along the corridor and in its indirect influential Zone.</li> </ul>	<ul style="list-style-type: none"> <li>No Protected Areas/ WLS falls within 10 km Boundary of Project Road.</li> <li>No major threatened flora and fauna reported along the corridor and in its indirect influential Zone.</li> </ul>	<ul style="list-style-type: none"> <li>Dehing Patkai Wildlife Sanctuary is around 4 km from the project road (Bhadoi Panchali).</li> <li>Dehing Patkai WLS has good habitat for elephant, the WLS is an Elephant Reserve.</li> <li>Elephant &amp; other wildlife movement is not reported as per DFO Digboi and community consultation.</li> <li>The corridor is not within the ESZ and wildlife movement has not been reported as per community consultation.</li> </ul>	<ul style="list-style-type: none"> <li>Hollongapar Gibbon Wild Life Sanctuary is located around 6km from the project road.</li> <li>The sanctuary has good number of primates and rich habitat of other wild fauna and avi fauna.</li> <li>The corridor is not within the ESZ and wildlife movement has not been reported as per community consultation.</li> </ul>



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Project Corridors						
Name of the corridor	A31	A15	A07	A22	A30	A20
	Balichapori, Majuli to Bhogaimara, Lakhimpur, including 2 RCC bridges over Subansiri and Luit river contractor.	Dhodar Ali (Kamargaon to Kamarbandha)	Sarthebari Pathsala Raipur Road	Dhakukhana Butikur Tiniali Telijan	Moran Naharkatia Dullajan	Sivasagar to Nakachari
<b>Flora</b>	Tropical Wet Evergreen Forest (No rare endangered species reported from Project area)	Tropical Semi Evergreen type (No rare endangered species reported from Project area)	Tropical Semi Evergreen type. (No rare endangered species reported from Project area)	Tropical Wet Evergreen Forest (No rare endangered species reported from Project area)	Tropical Rainforest (No rare endangered species reported from Project area)	Tropical Rainforest (No rare endangered species reported from Project area)
<b>Other</b>	Bamboo, Gamari, Jutuli, Chapa, Sissu, Silikha, Chom, Sualu, Neem, Hollock, Urium, Nahar, Alhar, Simul, Silikha, etc. are the tree species observed.	Bamboo, Gamari, Jutuli, Chapa, Sissu, Silikha, Chom, Sualu, Neem, Hollock, Urium, Nahar, Alhar, Simul, Silikha, etc. are the tree species observed.	Aegle marmelos, Anonas comosus, Areca catechu, Artocarpus heterophyllus, Azadirachta indica, Dalbergia sisoo, Bombax ceiba, Carica papaya, Citrus limon, Gmelina arborea, Gynocardia odorata, Lagerstomia parviflora, Litsea cubeba, Mangifera indica, Melia	Bamboo, Gamari, Jutuli, Chapa, Sissu, Silikha, Chom, Sualu, Neem, Hollock, Urium, Nahar, Alhar, Simul, Silikha, etc. are the tree species observed.	Hollang, Mekai, Dhuna, Udiyam, Nahar, Samkothal, Bheer, Hollock, Nahori, Elephant apple, different species of Dimoru were observed	Hollang, Mekai, Dhuna, Udiyam, Nahar, Samkothal, Bheer, Hollock, Nahori, Elephant apple, different species of Dimoru were observed.
	<b>Threatened Flora of Assam:</b> Cycas pectinate, Vatca lanceaeifolia, Paphiopedilum spicerianum, Mesua assamica, Magnolia griffithii, Magnolia cathcartii					

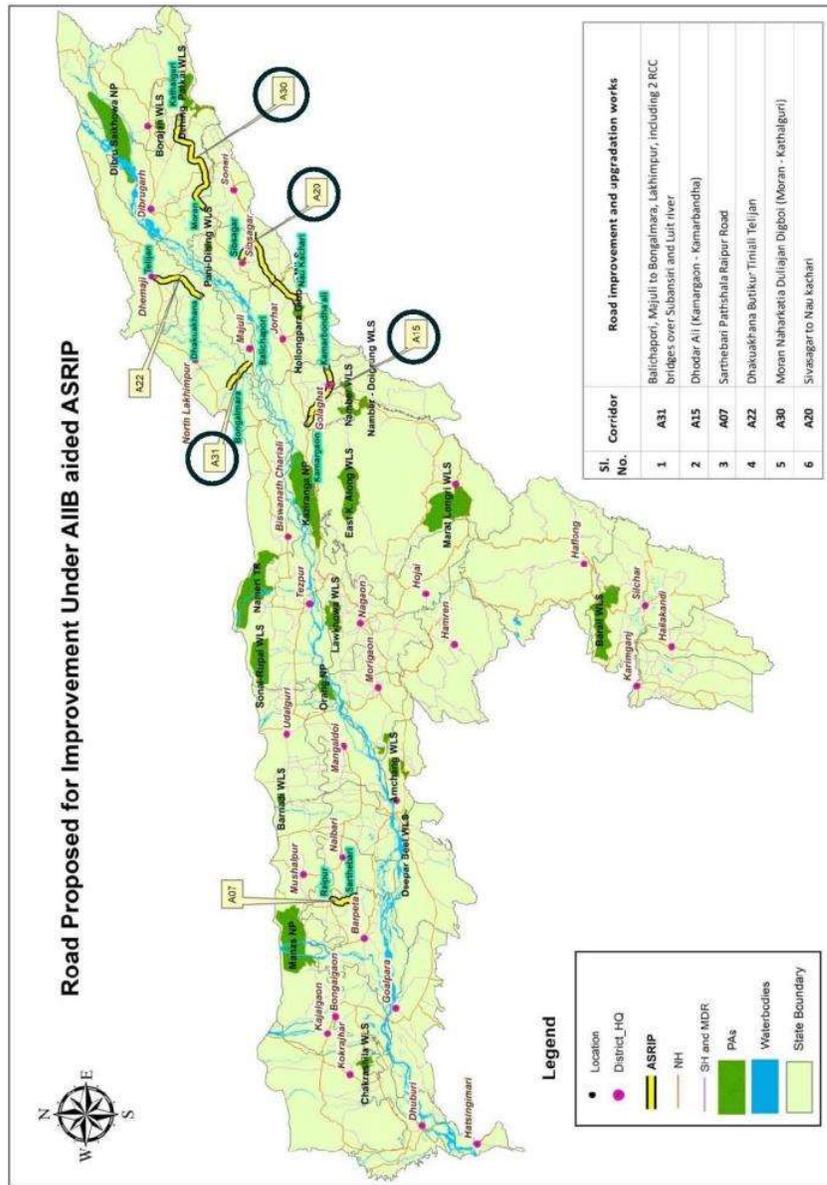


Figure 1: Project Corridor and Eco Sensitive area



## 6. Clearances

All the project corridors were pre-existing long before notification of any protected area. None of the project roads pass through any Wildlife Sanctuary or National Parks or Protected Areas. Moreover, none of the project roads are legally notified State Highways, hence clearance for environmental and wildlife from Ministry of Environment, Forest and Climate Change is not required.

## 7. Applicable Rules and Regulations

The following act & regulation of Government of India and State are enacted to ensure the protection of significant Flora and Fauna along with overall environmental security. Though project does not pass through any Wildlife Sanctuary / National Park, however, the security and protection of rare and endangered species is important because few PAs are noticed within 10 km periphery of the project corridors and further it shall need to ensure its compliance and protections by implementing the corridor specific Biodiversity Management Plan (Table 6 to Table 8) under strict supervision and monitoring by CSC/ AE/ PIU. The following acts shall be required to be ensured by contractor and construction worker should be aware of these act and penalties thereof.

Sl. No.	Regulations	Relevance	Purpose	Salient Feature
1	The Biological Diversity Act, 2002	<ul style="list-style-type: none"> <li>A31 - a portion of the project road is located within Majuli Island which is notified as Biodiversity Heritage Site by Govt of Assam in March 2017 under the Act.</li> </ul>	It aims at the conservation of biological resources, managing its sustainable use and enabling fair and equitable sharing benefits arising out of the use and knowledge of biological resources with the local communities.	<ul style="list-style-type: none"> <li>This act prohibits, any person or organization (either based in India or not) obtaining any biological resource occurring in India for its research or commercial utilization.</li> <li>The act stipulates all offences under it as cognizable and non-bailable.</li> </ul>
2	The Wild Life (Protection) Act, 1972	<ul style="list-style-type: none"> <li>A31-presence of Ganges River Dolphin in Subansiri River</li> <li>Applicable for A15 as there were incidences of occasional elephant crossing</li> </ul>	This Act provides Order, rules and regulations for protection of the country's wild animals, birds, and plant species, in order to ensure environmental and ecological security.	<ul style="list-style-type: none"> <li>The Act prohibited the hunting of endangered species animal specified in Schedule I &amp; II</li> </ul>
3	Forest Conservation Act 1980 and Amendments	<ul style="list-style-type: none"> <li>Applicable for all Corridors as roadside tree cutting is required.</li> </ul>	This Act governs Rules and Regulation for protection and security of Forest.	<ul style="list-style-type: none"> <li>Section 2 of this Act deals with a restriction on the de-reservation of forests or the use of forest land for non-forest purposes.</li> </ul>



## 8. Biodiversity Screening

### A. Corridor A15, A30, A20 - Applicable for Wild Fauna

In the indirect influence area i.e. 10 km periphery of the project corridors, the sensitivity and risk with respect to Wild life, natural habitat has been studied. Based on the details of protected area network of Assam, the corridors of A15, A30 & A20 have some sensitivity towards its natural habitats.

Though above mentioned corridors (A15, A30, A20 & A31) have land use of majorly agricultural and built-up areas, protected areas such as Dhing Patkai WLS, Biodiversity Heritage site i.e. Majuli Island, and River Dhansiri (river tributaries of Brahmaputra), Nambor Doigrung WLS & Hollongapar Gibbon WLS are observed within 10 km periphery of project corridors. In order to protect the critical wildlife habitats, the road upgradation work shall incorporate the requisite management measures for protection of significant wild life habitats.

**The Project Corridor A15 Dhodar Ali** (Kamargaon to Kamarbandha) is an existing intermediate lane road, originally constructed in around the year 1687, much before the notified protected areas. The Dhodar Ali is a 212-km-long road starting from Kamargaon (NH 715) in Golaghat to Jeypur in Dibrugarh touching Mariani and Jorhat. It runs through five districts of Upper Assam viz. Golaghat, Jorhat, Sivasagar, Charaideo and Dibrugarh, holding significance for several neighbouring states. This road connects mainly small scale and large-scale tea industries, oil refineries, Gas plants, and places of historic importance as well. The project road is located in Golaghat district of Assam, which is famous for its numerous small scale tea gardens and Numaligarh Oil Refinery, this corridor passes parallel to NH 129 and connects Golaghat town directly to NH 715 at Kamargaon. Moreover, it provides the inter-lineage between rural roads and NH which further provides connectivity to major growth centres in the Upper Assam region such as Jorhat (education hub), Sivasagar (historic importance), Dibrugarh, Tinsukia, Digboi (Industrial hub) and further connects to Nagaland, Arunachal Pradesh and Myanmar.

The Dhansiri River is flowing at a distance of around 50m from the road from Ch 2+600 to Ch 3+400. As per stakeholder consultations and confirmation with Forest Office, elephants used to cross the project road on and off at 1<sup>st</sup> Km, 4<sup>th</sup> Km and 6<sup>th</sup> Km. Elephant Underpass has been proposed at 2 locations i.e., 3+630 & 6+450 and approved by the Chief Wildlife Warden, Assam (Annexure 7). Nambor Doigrung WLS is located at an aerial distance of around 5 km from the project road (Golaghat Town). The protected area has good number of rare and endangered mammals, birds and reptiles. The major fauna of the Sanctuary includes Asiatic elephant (*Elephus maximus*), Hoolock Gibbon (*Hoolock hoolock*), Stumped Tailed Macaque (*Macaca arctoides*), Pig Tailed Macaque (*Macaca leonina*), Slow Loris (*Nycticebus bengalensis*), Assamese Macaque (*Macaca assamensis*), Rhesus Macaque (*Macaca mulatta*), Tiger (*Panthera tigris*), Leopard (*Panthera pardus*), Fishing Cat (*Prionailurus viverrinus*), Barking Deer (*M*

*untiacus muntjak*), Sambar (*Rusa unicolor*), Wild Boar (*Sus scrofa*), Gaur (*Bos gaurus*) etc. Some of the important bird species found are White Winged Wood Duck (*Asarcornis scutulata*), Great Pied Hornbill (*Buceros bicornis*), Wreathed Hornbill (*Rhyticeros undulatus*), Adjutant Stork (*Leptoptilos dubius*) etc. Tortoise (*Testudinidae*), Monitor Lizard (*Varanus*), Python (*Pythonidae*) are also found.

**The Project Corridor A30 Moran Naharkatia Road** is an existing intermediate lane road, originally constructed in around the year prior to 20<sup>th</sup> century, much before the notified protected areas. The project road is located in Dibrugarh District, it connects four important industrial towns of Upper Assam viz. Moran, Naharkatia, Duliajan and further to Digboi. Naharkatia is one of the commercial towns of Dibrugarh district. There are many small- and large-scale tea gardens and factories located throughout the corridor from Moran to Naharkatia. Duliajan is an industrial town of Dibrugarh District and it is particularly known for its oil industry. The Head Office of Oil India Limited, Shiv-Vani Oil & Gas Exploration Services Ltd and Assam Gas Company Limited are located in Duliajan. Digboi is known as the Oil City of Assam where the first oil well in Asia was drilled in 1866. The first refinery was started in Digboi as early as 1901. Digboi has the oldest oil well in operation. Apart from National highway 15



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connecting Dibrugarh and Tinsukia, the project corridor is the only alternative to connect these 4 important places. This road will play a major role in movement of commercial traffic related to oil, gas, coal and tea between upper Assam and all other parts of India. This corridor is also be a shorter one as compared to national highway 15 to travel between Dulijan, Naharkatia and Moran.

Dhing Patkai Wild life sanctuary is located at 4 km east from the road. The Dhing Patkai WLS has significant numbers of IUCN listed and WL Scheduled fauna; it is also an elephant reserve. As per ENVIS record MOEF&CC, the total numbers of Elephant population was 295 recorded in year 2005. The Biodiversity of the WLS has good numbers of rare and endemic fauna. The major fauna of the Sanctuary includes Tiger (stray) (*Panthera tigris*), Asiatic elephant (*Elephus maximus*), leopard (*Panthera pardus*), pangolin (*Manis crassicaudata*), jungle Cat (*Felis chaus*), Indian civet (*Viverridae spp.*), giant squirrel (*Retufa bicolor*), barking deer (*Muntiacus muntjak*), sambar deer (*Cervus unicolor*), wild pig etc. Some of the important tree species found in this forest area are Hollang, Mekai, Dhuna, Udiyam, Nahar, Samkothal, Bheer, Hollock, Nahor, Elephant apple, different species of Dimoru etc.

**The Project Corridor A20 Dhodar Ali** (Sivasagar to Nakachari) is also an existing intermediate lane road, originally constructed in around the year 1687, much before the notified protected areas. The road section from Nakachari to Simaluguri is a part of Dhodar Ali, an arterial road of great economic importance and traverse major cities and towns such as Golaghat, Titabor, Mariani, Amguri, Nazira, Simaluguri and Sonari. It starts at NH 715 in Golaghat district and ends at Jeypore in Dibrugarh district after passing through three other districts - Jorhat, Sivasagar and Charaideo. It provides commercial route for the major tea gardens, oil and gas fields, refineries, etc. It provides the inter-lineage between rural roads and NH which further provides connectivity to major growth centres in the Upper Assam region such as Jorhat (education hub), Sivasagar (historic importance), Dibrugarh, Tinsukia, Digboi (Industrial hub) and further connects to Nagaland, Arunachal Pradesh and on to Myanmar.

The project corridor is located around 6 km from Hollongapar Gibbon Wildlife Sanctuary and it is around 1.3 km from the ESZ. The WLS is falling under Jorhat District having total area of 20 sq.km. As per the Champion & Seth (1968) classification scheme, the major forest type in the WLS is Assam Plains Alluvial Semi Evergreen Forests /2/2B/C sparsely interspersed with wet evergreen forest patches. The vegetation is composed of several canopy layers, mostly are evergreen in nature. Major trees are Hollong (*Dipterocarpus macrocarpas*) and other associated top canopy with Hollong are Sam (*Artocarpus chaplasha*), Amari (*Amoora wallichii*), Sopas (*Mcheliai spp.*), Bhelu (*Tetramels mudiflora*), Udal (*Sterculia villosa*) and Hingori (*Castanopsis spp.*), these are suitable habitat for primates **capped langur (*Trachypithecus pileatus*)** and **pig tailed macaque (*Macaca nemestrina*)**, **Hoolock Gibbon (*Hoolock hoolock*)**. The Sanctuary supports 11 species mammals, 5 species of reptiles and amphibians and 31 avifaunal species.

The following section entails of sensitive wild life animal occupying in the sanctuary.

**Table 3: Threatened Wild Fauna of Protected Area**

IUCN Red List	WLPA Schedule	Types of Animal
<b>Endangered</b>	Sch I	Wild Elephant ( <i>Elephus Maximus</i> ), Tigers ( <i>Panthera tigris</i> ), Otter ( <i>Lutra lutra</i> ), Hoolock gibbon ( <i>Hoolock hoolock</i> ), Capped Langur ( <i>Trachypithecus pileatus</i> )
<b>Vulnerable</b>	Sch I	Clouded Leopard ( <i>Neofelis nebulosa</i> ), Marbled Cat ( <i>Pardofelis marmorata</i> ), Assamese macaque ( <i>Macaca assamensis</i> ), Himalayan black bear ( <i>Salena rotos tibetanus</i> ), common Leopard ( <i>panther Pardus</i> ), Sloth Bear ( <i>Melursus urisinus</i> )
<b>NA</b>	Sch I	Slow loris ( <i>Nycticebus bengalensis</i> ), Golden Cat ( <i>Catopuma temminckii</i> )
<b>NA</b>	Sch II	Jungle Cat and Wild Cat ( <i>Felis chaus</i> ), Rhesus macaque ( <i>Macaca mulatta</i> ), Pigtailed macaque ( <i>Macaca leonina</i> ), Stump tailed macaque ( <i>Macaca arctoides</i> )
<b>LC</b>	SchII	Flying fox ( <i>Pteropus</i> ), Wild pig ( <i>Sus scrofa</i> ), Sambar ( <i>Rusa unicolor</i> ), Barking deer



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IUCN Red List	WLPA Schedule	Types of Animal
		( <i>Muntiacus muntjak</i> ), Gaur ( <i>Bes gaurus</i> ), Serow ( <i>Capricornis</i> ), Malayan giant squirrels ( <i>Ratufa bicolor</i> ), Porcupine ( <i>Hystrix brachyura</i> ) etc.
<b>Reptile</b>	Sch I	Rock python ( <i>python molurus</i> ), Water Monitor ( <i>varanus</i> ), Asian leaf turtle ( <i>Cyclernys dentata</i> ), Monitor Lizard ( <i>Varanus</i> ), etc.
	SchII	King cobra ( <i>Ophiophagus Hannah</i> ), crab eating mongoose ( <i>Herpestes urva</i> )
<b>Important Birds</b>		Presented in Table 4

In view of above, the significant management measures to protect the biodiversity were incorporated into the designing, construction and operation phases of the Project.

### B. Corridor A31-Applicable for Birds

The Project Corridor A31 Majuli to Bhogalmara via Dhunaguri is an existing road located in the Island District of Majuli and Lakhimpur district. At present the Majuli Island<sup>1</sup> is not connected by road and the island is accessible by ferries from the mainland. It is proposed to connect the island to the mainland on the northern bank of the Brahmaputra River by construction of bridges over Subansiri River and Luit River. Majuli is a lush green environment-friendly, a pristine and pollution-free freshwater island in the river Brahmaputra. Mostly inhabited by Tribes, the culture of Majuli is unique and quite interesting which is one of the key reasons for tourism. Majuli is also called the cultural capital of Assam, it is famous for its Satras<sup>2</sup>. In 15th century the first Satra was founded in Majuli. These Satras attracts tourism from all around the globe throughout the year.

The project corridor is about 1.5 km from Pabho Reserve Forest & traversing Luit and Subansiri River. Both locations are Bird Hotspot Area. Majuli is a major Island of India and Asia, the surrounding area has Threatened Bird Species. The indirect influence area i.e. 10 km periphery of the project road are noted to have significant species of Avifauna. Majuli Island is a notified Biodiversity Heritage site by Government of Assam dated 29 March 2017.

It traverse two perennial rivers i.e. Subansiri River and Luit River. It encompasses a large riverine island with innumerable small islets, locally called chapories. The topography of the region is flat floodplain with lakes (beels) and marshes. Majuli, with its fertile floodplains and highly productive wetlands, forms ideal habitats for a variety of birds. This area not only supports diverse resident birds, but also attracts a large number of migratory birds, including some uncommon species. The area has evergreen and deciduous trees, grasses, a wide variety of marsh vegetation, bamboos and canes. As per secondary reference and stakeholder consultation Majuli Island is the habitat for the following threatened bird species:

#### Habitat:

The majorly bird species are found in colonies in trees close to large waterbody / lakes with other extensive wetlands, preferably at height of 10–40 feet (3.0–12.2 m).

Table 4: Threatened Avifauna of Protected areas / WLS

IUCN Red list	WPA 1972	Type of Avifauna
<b>Critical Endangered</b>	Sch I	Oriental White-backed Vulture ( <i>Gyps bengalensis</i> ), Slender-billed Vulture ( <i>Gyps tenuirostris</i> ), Bengal Florican ( <i>Houbaropsis bengalensis</i> )
<b>Endangered</b>	Sch I	Greater Adjutant ( <i>Leptoptilos dubius</i> ), White-winged Duck ( <i>Cairina scutulata</i> )
<b>Vulnerable</b>	Sch I	Pallas's Fish-Eagle ( <i>Haliaeetus leucoryphus</i> ), Lesser Adjutant ( <i>Leptoptilos</i> )

<sup>1</sup> Majuli District is the largest river island of Asia, situated on the Brahmaputra River in Northeastern Assam.

<sup>2</sup> Institutional centers associated with the tradition of Vaishnavism



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IUCN Red list	WPA 1972	Type of Avifauna
		<i>javanicus</i> ), Spot-billed Pelican ( <i>Pelecanus philippensis</i> ), Swamp Francolin ( <i>Francolinus gularis</i> )
NT	Sch I	Great Pied Hornbill ( <i>Buceros bicornis</i> ) (NT),
--	Sch I	Grey peacock Pheasant ( <i>polyplectron bicalcaratum</i> ), Wreathed Hornbill ( <i>Aceros undulates</i> ),
<b>Other Species (NA)</b>	Sch IV	Lesser Whistling-Duck ( <i>Dendrocygna javanica</i> ), Ruddy Shelduck ( <i>Tadorna ferruginea</i> ), Alexandrine Parakeet ( <i>Psittacula eupatria</i> ), Purple crimson sunbird ( <i>Leptocoma zeylonica</i> ), Scarlet backed Flower pecker ( <i>Dicaeum cruentatum</i> ), Steaked weaver ( <i>Ploceus manyar</i> ), Black Kite ( <i>Milvus migrans</i> ) Rock Pigeon ( <i>Columba livia</i> ), Oriental turtle dove ( <i>Streptopelia orientalis</i> ), Spotted Dove ( <i>Spilopelia chinensis</i> ), Black Myna ( <i>Gracula religiosa</i> ), Red collared Dove ( <i>Streptopelia tranquebarica</i> ), Indian Spot billed Duck ( <i>Anas poecilorhyncha</i> ), Partridge ( <i>Francolinus gularis</i> ), Asian koel ( <i>Eudynamys scolopaceus</i> ), Grey Headed Sandpiper ( <i>Actitis hypoleucos</i> ), Asian Open Bill ( <i>Anastomus oscitans</i> ), Great Egret ( <i>Ardea alba</i> ), Indian Pond heron ( <i>Ardeola grayii</i> ), Great cormorant ( <i>Phalacrocorax carbo</i> ), Darter ( <i>Anhingidae</i> ), Kaleej Pheasant ( <i>Lophura leucomelanos</i> ), Pied Falconet ( <i>Micthierax melanoleucos</i> )

### C. Corridor A31-Applicable for Fisheries and Dolphin

The Project Corridor A31 Majuli to Bhogalmara via Dhunaguri traverses two rivers i.e. Subansiri River & Luit River. Majuli is the largest river island of Asia, situated on the River Brahmaputra in northeastern Assam. It embraces a large riverine island with innumerable small islets, locally termed as chapories. The major fishes of River Subansiri and aquatic mammal is presented in below table:

**Habitat:**

All the mentioned fish's species are freshwater fishes, basically found in drainage of Subansiri & Brahmaputra River Basin.

**Table 5: Significant Fishes diversity of River Subansiri**

IUCN status	WPA 1972	Name of Fish & Family
{NT}	NA	Chitala chitala Notopterus notopterus (Pallas) (Family-Notopteridae)
{LC}	NA	Anguilla bengalensis (Anguillidae)
{LC}	NA	Amblypharyngodon mola, Danio dangila, Devario devario, Puntius rasbora, Cirrhinus mrigala, Labeo bata, Labeo pangusi, Labeo rohita (Family Cyprinidae)
{LC}	NA	Gagata gagata, Rita rita, Ailia coila (family- Sisoridae)
{LC}	NA	Rhinomugil corsula (Family- Mugilidae)
{LC}	NA	Xenentodon cancilla (Family- Belonidae)
Other species	NA	Psilorhynchus sucatio (psilorhynchidae), Aborichthys rosammai (Nemachelidae)
	NA	Other species of families Engraulidae, Psilorhynchidae, Balitoridae, Cobitidae, Bagridae, Siluridae, Schilbeidae, Pangasidae, Amblycipitidae, Erethistidae, Claridae, Channidae etc.



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**Aquatic Mammal**

With regard to threatened aquatic mammal, only aquatic mammal ‘Gangetic River Dolphin’ is reported in the river (as per secondary records<sup>3</sup>). Locally this animal is known as Sisu. The Ganges River Dolphin belongs to the family Plantaniidae and inhabits Fresh water area. This species is reported in basins of River Ganga-Brahmaputra Basin, Meghana, Karnaphuli-Sangu River system. The subspecies is “endangered” under International Union for Conservation of Nature (IUCN) Red List. In the monsoon season, Ganges River Dolphin locally migrate to tributaries and then back to large River channels in dry, winter season. They also move along the coast of West Bengal. It is a national Aquatic Animal of India. The number of inhabitants in the world was estimated to be 2000 in 1990s. The main reason of declining the population trend is poaching, over catching, loss/division of habitats, River pollution, of modification of the river through inflow, or extraction sediments.

The Gangetic dolphins are found in the River Subansiri in sectors of Katori Chapori to Bodhakora, Bodhakora to Solmari, Solmari to Boroliya and Boroliya to Silikhaguri (Source: Protection of Endangered Ganges River Dolphin in Brahmaputra River, Assam, India 2009), **Bodoti area is falling near the project corridor.**

Sectors	Area name	Location	Best estimate
I	Katoi sapor - Badhakora	N27°25', E94°15' - N27°18', E94°11'	2
II	Badhakora-Solmari	N27°17', E94°11' - N27°09', E94°10'	3
III	Solmari-Borolia	N27°09', E94°10' - N27°01', E94°06'	9
IV	Boroliya-Bodoti	N27°01', E94°06' - N26°56', E93°58'	7
V	Bodoti-Hilikaguri	N26°55', E93°57' - N26°51', E93°52'	2
<b>Total</b>			<b>23</b>

Multiple site visits along with local people were carried out at different timings for dolphin sighting but none was sighted in the project area (upstream and download of proposed bridge over Subansiri River). During community consultations, it was informed that sometimes one/two dolphins are usually sighted during monsoon season.

Although during winter season, the number of Dolphin could be less, construction activity may alter the habitat factors like availability of food fishes, browsing areas; alter water quality and other factors which may have adverse impact on the small population. The impact during preconstruction, construction stage may affect the aquatic habitat of the river body. Ganges river dolphin population will not suffer from habitat fragmentation as the Dolphins and other aquatic species can pass under the bridge and no habitat fragmentation will occur.

**9. Anticipated Impact due to the project**

Project activities which may cause negative impact on biodiversity are clearing of native vegetation (including habitat); works around watercourses; noise; disturbance of soils, consequential erosion and the mobilisation of sediment; and use of chemicals / fuels (potential for spills).

**Direct Impact:** Removal of native vegetation; loss of terrestrial and wetland fauna habitat; and loss of aquatic fauna habitat

**Indirect Impact:** Habitat fragmentation; Potential fauna displacement, altered surface water hydrology; Erosion, sedimentation and contamination; Dust; Light, noise and vibration; Mobilisation of contaminated soils; Spread of pests and pathogens; and Fire.

<sup>3</sup> IUCN published: Protection of Endangered Ganges River Dolphin in Brahmaputra River, Assam



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Other activities of impact:

- ▶ Emanating some amount of debris during construction, that may affect the Soil & water quality
- ▶ Impact on aquatic life, dolphin due to underwater noise, drilling and blasting activity
- ▶ Noise from different equipment, construction vehicle may disturb the migratory birds & Wild Fauna
- ▶ Several small species amphibians, reptiles, fishes may suffer from habitat change due to construction activities, bridges, culverts, embankments.
- ▶ Spillage of oil and other hazardous chemicals
- ▶ Worker camps, spillage from parking areas etc.
- ▶ Pollution of surface and sub surface water
- ▶ Temporary construction and labour camps for workers can be a source of significant temporary and even permanent impact on wildlife and other resources within high-biodiversity areas. Consequently, poaching of wildlife, illegal fishing, harvest of trees for fuelwood, and other illegal activities may take place in these areas.

For any road improvement and upgradation works there would be effects on biodiversity due to road improvement works. The proposed project corridors are existing roads with single to intermediate lane which are proposed for improvement and upgradation to two lane, consisting of 7m carriageway with 1.5m paved shoulder on either side, along with 1m earthen shoulder on each side.

Mostly construction specific activities are confined and temporary in nature, these are physical construction specific impacts where the extent of effect is moderate which can be reversed once the construction completes and further minimized by having an effective construction and operation specific management measures.

## 10. Biodiversity Management Plan (Corridor A15, A30 & A20)

To ensure that damage to biodiversity (or other environmental concerns) is avoided or properly mitigated in the field, proper environmental management and supervision of road works is required. Additional to Environmental management measures as suggested in EIA report, Biodiversity Management Plan are required to be incorporated in project management during pre-construction, construction and operation phases. This is especially important for projects close to natural habitats and other environmentally sensitive areas, riverine ecosystem etc. **Table 6 to Table 8** below presents the necessary Biodiversity Management Plan applicable to minimize the species wise risk for Mammals, Reptile, Amphibian Birds & fishes.



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Table 6: Biodiversity Management Plan (A15 Dhodar Ali)

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
<b>Pre-construction Stage</b>						
1.	Disturbance to Natural Vegetative community	<ul style="list-style-type: none"> <li>Prior to clearing and grubbing work, the Biodiversity Specialists will conduct pre-construction checks, to avoid accidental injury or death to sensitive species.</li> <li>The Biodiversity Specialists will prepare a monitoring report and sensitive map/ area showing sensitive locations. This will be shared with workers through toolbox talks, regular awareness campaigns so that sensitive areas can be avoided or bespoke mitigation implemented</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
2.		<ul style="list-style-type: none"> <li>Pre-construction checks will include bird nesting within hollow trees and other places of shelter on trees in corridor of impacts.</li> <li>Identification of sites and peak visiting period for migratory birds in the project area of influence.</li> </ul>	Avifauna (Birds)	Throughout the project stretch	Contractor	CSC/ PIU
3.		<ul style="list-style-type: none"> <li>Prior to construction, it is important to determine the area, locations which are preferentially used by Wild animal (large mammals &amp; Amphibians, reptiles, Arboreal) during feeding time possibly Morning and evening near the buffer area of PAs, close to Project areas, so that conservation effort can be focused on these locations.</li> <li>As per stakeholder consultations and confirmation with Forest Office, elephants used to cross the project road on and off at 1st Km, 4<sup>th</sup> Km and 6<sup>th</sup> Km.</li> <li>Elephant Underpass has been proposed at 2 locations i.e., 3+630 &amp; 6+450 and approved by the Chief Wildlife Warden, Assam, (Annexure 7).</li> </ul>	Overall Sensitive Fauna	Throughout the project stretch	Contractor	CSC/ PIU
4.	Debris Management	<ul style="list-style-type: none"> <li>Debris management plan as suggested in EIA should be followed strictly at site</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
5.	Location of Labour camp	<ul style="list-style-type: none"> <li>Labour camps should be prohibited in protected and high-biodiversity areas / Buffer areas/Reserve Forest</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna, Avifauna, Fisheries	Specific Location	Responsibility	Supervision
<b>Construction Stage</b>						
6.	Sensitivity among worker and project staff	<ul style="list-style-type: none"> <li>Workers will be made aware of the ecological sensitivities of the areas and will be trained in mitigation for any unforeseen events, including the presence of uncommon habitats and species.</li> <li>Hunting and gathering by Project staff will be prohibited, Hunting by Project staff should be viewed as a serious violation</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
7.	Disturbance due to excess light in eco sensitive areas	<ul style="list-style-type: none"> <li>Work during night time will be kept to a minimum where possible. Wherever lighting required, lights will be kept away from areas of woodland and hedges and lighting will be directed to where it is needed with marginal light spillage.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
8.	Waste Management Issue	<ul style="list-style-type: none"> <li>A waste management plan will be implemented. Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Vulture, kites that regularly forage in waste dumps to potentially damaging waste products.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
9.	Dust issues	<ul style="list-style-type: none"> <li>Vehicle speeds on access and haul roads will be controlled to minimise dust emissions and the risk of mortality of animals.</li> <li>Water sprinkling shall be practised at construction sites, earthen access and haul roads.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
10.	Labour sensitivity	<ul style="list-style-type: none"> <li>Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Waste water from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
11.	Construction Activity	<ul style="list-style-type: none"> <li>Temporary construction material sites, quarries, borrow pits, and storage areas can also have an effect on habitat loss and degradation. Such sites shall be rehabilitated as appropriate, following their use but before construction is</li> </ul>	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
12.	Overall Safety Measure	<p>completed.</p> <ul style="list-style-type: none"> <li>To minimize harm to biodiversity during road construction (or improvement, rehabilitation, or maintenance), it is important to regulate the behaviour of workers in the field. Specifically, workers under the projects should be prohibited from hunting, fishing, wildlife capture (including for pets), plant collection, or burning of vegetation, anywhere in or near the project area.</li> <li>Construction of road with proper slope for elephant crossing at the location of identified passage along with marking of wildlife crossing and speed limit.</li> </ul>	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
<b>Post Construction Phases</b>						
13.	Monitoring of sensitive species (reported during detailed survey along the corridor)	<ul style="list-style-type: none"> <li>Monitoring must take place under the direction of an appropriately qualified person and the results of the monitoring must be kept in a written record</li> </ul>	Overall	Throughout the project stretch	Contractor	PIU
14.	Landscaping & compensatory afforestation	<ul style="list-style-type: none"> <li>Landscaping and green belt along the corridor will utilize predominantly native vegetation endemic to the region, sourced and consulted from local area. This will attenuate the negative impact originated from construction activities.</li> <li>All re-vegetation carried out for the Project will be carefully reviewed and monitored to avoid accidental introduction of invasive alien species</li> </ul>	Overall	Throughout the project stretch	Contractor	PIU
15.	Accidental discharge in water	<ul style="list-style-type: none"> <li>To avoid Accidental discharge; leakage from oil receptors, refuelling of vehicle, washing of vehicles should follow the approach of routine and periodical maintenance</li> <li>Oil interceptor shall be installed at plant and vehicle workshop</li> </ul>	Fishes	At bridge construction locations	Contractor	PIU
16.	Overall Management oil contamination	<ul style="list-style-type: none"> <li>Automotive workshop establishment shall be avoided and discouraged along the corridor especially which is undergoing commercial activities without maintaining</li> </ul>	Overall species	At bridge construction locations	Contractor	PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
17.	Sensitivity among project people, locals etc.,	<p>preventive measure of oil contamination/spillage.</p> <ul style="list-style-type: none"> <li>Awareness programme as training, workshop shall be organized to spread the awareness for protection of endangered species and provisions of punishment against poaching or disturbing as per WPA 1972 under GOI.</li> </ul>	Overall species	Throughout the project stretch	Contractor	PIU
18.	Road safety Treatment	<ul style="list-style-type: none"> <li>Wildlife warning signages with flashing lights and variable message boards have the potential to be more effective than static warning signs (As per World Bank Report). Such signs are most effective if employed during peak wildlife crossing periods (e.g., migration, morning, evening) or are associated with animal-activated detection systems that trigger flashing and/or message signs only when animals are present.</li> </ul>	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
19.		<ul style="list-style-type: none"> <li>Solar-powered flashing lights (with batteries for night-time operation) can be attached to static signs for operation during key periods such as elephant migration.</li> <li>Period maintenance of signages installed.</li> </ul>	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
20.		<ul style="list-style-type: none"> <li>To effectively reduce wildlife-vehicle collision incidence, lower design speed considerations will be integrated into road design and construction. Specific design speeds are used to engineer various geometric design features into a roadway, with minimum standards applied for different design speeds.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
21.		<ul style="list-style-type: none"> <li>Traffic calming managements, such as curb extensions, raised medians, rumble strips in the pavement, speed bumps, Reduced speed warning shall be undertaken by contractor for stretch close to sensitive areas</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
22.		<ul style="list-style-type: none"> <li>The Endangered species as listed in table will be monitored throughout the Project and additional mitigation implemented if necessary.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
23.		<ul style="list-style-type: none"> <li>To prevent animal casualty during operation phase, care has to be taken by the APWRD in consultation with the wildlife official and DFO. One forest check post has to be</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna, Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		<p>erected on both the end of roads falling close to protected area - <b>Nambor Doirung WLS</b>. Forest guards or CCTV cameras has to be installed at both the end and in between to keep eye on the plying vehicles. Sign Board 500 meters ahead of Wildlife Area has to be placed for traveller's information.</p> <ul style="list-style-type: none"> <li>No honk zone &amp; speed limits of 20-30km/hr sign board has to be erected at every 500 meters on the roads falling near ecological-sensitive area</li> <li>Sign board of animal's movement zone and CCTV Surveillance zone has to be installed before the check posts and in between the road.</li> <li>The death of animals if happening has to be reported along with locations. If repetitive deaths are happening at the same location or area, then PWRD has to take some preventive measures like adding animal's underpass or animal's accident zone sign board with speeds breakers.</li> </ul>				

Table 7: Biodiversity Management Plan (A30 Moran Naharkatia Duliajan)

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna, Avifauna, Fisheries	Specific Location	Responsibility	Supervision
<b>Pre-construction Stage</b>						
1.	Disturbance to Natural Vegetative community	<ul style="list-style-type: none"> <li>Prior to clearing and grubbing work, the Biodiversity Specialists will conduct pre-construction checks, to avoid accidental injury or death to sensitive species.</li> <li>The Biodiversity Specialists will prepare a monitoring report and sensitive map/ area showing sensitive locations. This will be shared with workers through toolbox talks, regular awareness campaigns so that sensitive areas can be avoided or bespoke mitigation implemented</li> <li>Pre-construction checks will include bird nesting within hollow trees and other places of shelter on trees in</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
2.			Avifauna (Birds)	Throughout the project stretch	Contractor	CSC/ PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
3.		<ul style="list-style-type: none"> <li>corridor of impacts.</li> <li>Identification of sites and peak visiting period for migratory birds in the project area of influence.</li> <li>Prior to construction, it is important to determine the area, locations which are preferentially used by Wild animal (large mammals &amp; Amphibians, reptiles, Arboreal) during feeding time possibly Morning and evening near the buffer area of PAs, close to Project areas, so that conservation effort can be focused on these locations.</li> </ul>	Overall Sensitive Fauna	Throughout the project stretch	Contractor	CSC/ PIU
4.	Debris Management	<ul style="list-style-type: none"> <li>Debris management plan as suggested in EIA should be followed strictly at site</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
5.	Location of Labour camp	<ul style="list-style-type: none"> <li>Labour camps should be prohibited in protected and high-biodiversity areas / Buffer areas/Reserve Forest</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
<b>Construction Stage</b>						
6.	Sensitivity among worker and project staff	<ul style="list-style-type: none"> <li>Workers will be made aware of the ecological sensitivities of the areas and will be trained in mitigation for any unforeseen events, including the presence of uncommon habitats and species.</li> <li>Hunting and gathering by Project staff will be prohibited, Hunting by Project staff should be viewed as a serious violation</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
7.	Disturbance due to excess light in eco sensitive areas	<ul style="list-style-type: none"> <li>Work during night time will be kept to a minimum where possible. Wherever lighting required, lights will be kept away from areas of woodland and hedges and lighting will be directed to where it is needed with marginal light spillage.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
8.	Waste Management Issue	<ul style="list-style-type: none"> <li>A waste management plan will be implemented. Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Vulture, kites that regularly forage in waste dumps to potentially damaging waste products.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna, Avifauna, Fisheries	Specific Location	Responsibility	Supervision
9.	Dust issues	<ul style="list-style-type: none"> <li>Vehicle speeds on access and haul roads will be controlled to minimise dust emissions and the risk of mortality of animals.</li> <li>Water sprinkling shall be practised at construction sites, earthen access and haul roads.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
10.	Labour sensitivity	<ul style="list-style-type: none"> <li>Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Waste water from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
11.	Construction Activity	<ul style="list-style-type: none"> <li>Temporary construction material sites, quarries, borrow pits, and storage areas can also have an effect on habitat loss and degradation. Such sites shall be rehabilitated as appropriate, following their use but before construction is completed.</li> </ul>	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
12.	Overall Safety Measure	<ul style="list-style-type: none"> <li>To minimize harm to biodiversity during road construction (or improvement, rehabilitation, or maintenance), it is important to regulate the behaviour of workers in the field. Specifically, workers under the projects should be prohibited from hunting, fishing, wildlife capture (including for pets), plant collection, or burning of vegetation, anywhere in or near the project area.</li> </ul>	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
<b>Post Construction Phases</b>						
13.	Monitoring of sensitive species (reported during detailed survey along the corridor)	<ul style="list-style-type: none"> <li>Monitoring must take place under the direction of an appropriately qualified person and the results of the monitoring must be kept in a written record</li> </ul>	Overall	Throughout the project stretch	Contractor	PIU
14.	Landscaping & compensatory afforestation	<ul style="list-style-type: none"> <li>Landscaping and green belt along the corridor will utilize predominantly native vegetation endemic to the region, sourced and consulted from local area. This will attenuate the negative impact originated from construction activities.</li> </ul>	Overall	Throughout the project stretch	Contractor	PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
15.	Accidental discharge in water	<ul style="list-style-type: none"> <li>All re-vegetation carried out for the Project will be carefully reviewed and monitored to avoid accidental introduction of invasive alien species</li> <li>To avoid Accidental discharge; leakage from oil receptors, refuelling of vehicle, washing of vehicles should follow the approach of routine and periodical maintenance</li> <li>Oil interceptor shall be installed at plant and vehicle workshop</li> </ul>	Fishes	At bridge construction locations	Contractor	PIU
16.	Overall Management oil contamination	<ul style="list-style-type: none"> <li>Automotive workshop establishment shall be avoided and discouraged along the corridor especially which is undergoing commercial activities without maintaining preventive measure of oil contamination/spillage.</li> </ul>	Overall species	At bridge construction locations	Contractor	PIU
17.	Sensitivity among project people, locals etc.,	<ul style="list-style-type: none"> <li>Awareness programme as training, workshop shall be organized to spread the awareness for protection of endangered species and provisions of punishment against poaching or disturbing as per WPA 1972 under GOI.</li> </ul>	Overall species	Throughout the project stretch	Contractor	PIU
18.	Road safety Treatment	<ul style="list-style-type: none"> <li>Wildlife warning signages with flashing lights and variable message boards have the potential to be more effective than static warning signs (As per World Bank Report). Such signs are most effective if employed during peak wildlife crossing periods (e.g., migration, morning, evening) or are associated with animal-activated detection systems that trigger flashing and/or message signs only when animals are present.</li> </ul>	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
19.		<ul style="list-style-type: none"> <li>Solar-powered flashing lights (with batteries for night-time operation) can be attached to static signs for operation during key periods such as elephant migration.</li> </ul>	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
20.		<ul style="list-style-type: none"> <li>To effectively reduce wildlife-vehicle collision incidence, lower design speed considerations will be integrated into road design and construction. Specific design speeds are used to engineer various geometric design features into a roadway, with minimum standards applied for different design speeds.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
21.		<ul style="list-style-type: none"> <li>Traffic calming managements, such as curb extensions, raised medians, rumble strips in the pavement, speed bumps, Reduced speed warning shall be undertaken by contractor for stretch close to sensitive areas</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
22.		<ul style="list-style-type: none"> <li>The Endangered species as listed in table will be monitored throughout the Project and additional mitigation implemented if necessary.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
23.		<ul style="list-style-type: none"> <li>To prevent animal casualty during operation phase, care has to be taken by the APWRD in consultation with the wildlife official and DFO. One forest check post has to be erected on both the end of roads falling close to protected area – <b>Dihing Patkai WLS</b>. Forest guards or CCTV cameras has to be installed at both the end and in between to keep eye on the plying vehicles. Sign Board 500 meters ahead of Wildlife Area has to be placed for traveller's information.</li> <li>No honk zone &amp; speed limits of 20-30km/hr sign board has to be erected at every 500 meters on the roads falling near ecological-sensitive area</li> <li>Sign board of animal's movement zone and CCTV Surveillance zone has to be installed before the check posts and in between the road.</li> <li>The death of animals if happening has to be reported along with locations. If repetitive deaths are happening at the same location or area, then PWRD has to take some preventive measures like adding animal's underpass or animal's accident zone sign board with speeds breakers.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU



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Table 8: Biodiversity Management Plan (A20 Sivassagar to Nakachari)

Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
<b>Pre-construction Stage</b>						
1.	Disturbance to Natural Vegetative community	<ul style="list-style-type: none"> <li>Prior to clearing and grubbing work, the Biodiversity Specialists will conduct pre-construction checks, to avoid accidental injury or death to sensitive species.</li> <li>The Biodiversity Specialists will prepare a monitoring report and sensitive map/ area showing sensitive locations. This will be shared with workers through toolbox talks, regular awareness campaigns so that sensitive areas can be avoided or bespoke mitigation implemented</li> <li>Pre-construction checks will include bird nesting within hollow trees and other places of shelter on trees in corridor of impacts.</li> <li>Identification of sites and peak visiting period for migratory birds in the project area of influence.</li> <li>Prior to construction, it is important to determine the area, locations which are preferentially used by Wild animal (large mammals &amp; Amphibians, reptiles, Arboreal) during feeding time possibly Morning and evening near the buffer area of PAS, close to Project areas, so that conservation effort can be focused on these locations.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
2.		<ul style="list-style-type: none"> <li>Pre-construction checks will include bird nesting within hollow trees and other places of shelter on trees in corridor of impacts.</li> </ul>	Avifauna (Birds)	Throughout the project stretch	Contractor	CSC/ PIU
3.		<ul style="list-style-type: none"> <li>Prior to construction, it is important to determine the area, locations which are preferentially used by Wild animal (large mammals &amp; Amphibians, reptiles, Arboreal) during feeding time possibly Morning and evening near the buffer area of PAS, close to Project areas, so that conservation effort can be focused on these locations.</li> </ul>	Overall Sensitive Fauna	Throughout the project stretch	Contractor	CSC/ PIU
4.	Debris Management	<ul style="list-style-type: none"> <li>Debris management plan as suggested in EIA should be followed strictly at site</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
5.	Location of Labour camp	<ul style="list-style-type: none"> <li>Labour camps should be prohibited in protected and high-biodiversity areas/ Buffer areas/Reserve Forest</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
<b>Construction Stage</b>						
6.	Sensitivity among worker and project staff	<ul style="list-style-type: none"> <li>Workers will be made aware of the ecological sensitivities of the areas and will be trained in mitigation for any unforeseen events, including the presence of uncommon habitats and species.</li> <li>Hunting and gathering by Project staff will be prohibited, Hunting by Project staff should be viewed as a serious violation</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna, Avifauna, Fisheries	Specific Location	Responsibility	Supervision
7.	Disturbance due to excess light in eco sensitive areas	<ul style="list-style-type: none"> <li>Work during night time will be kept to a minimum where possible. Wherever lighting required, lights will be kept away from areas of woodland and hedges and lighting will be directed to where it is needed with marginal light spillage.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
8.	Waste Management Issue	<ul style="list-style-type: none"> <li>A waste management plan will be implemented. Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Vulture, kites that regularly forage in waste dumps to potentially damaging waste products.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
9.	Dust Issues	<ul style="list-style-type: none"> <li>Vehicle speeds on access and haul roads will be controlled to minimise dust emissions and the risk of mortality of animals.</li> <li>Water sprinkling shall be practised at construction sites, earthen access and haul roads.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
10.	Labour sensitivity	<ul style="list-style-type: none"> <li>Construction camps shall be located away from habitation (at least 1 Km Away) and water bodies. Waste water from labour camps will be treated through septic tanks. No untreated/treated sanitary wastewater shall be discharged into surface water bodies.</li> </ul>	Overall Sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
11.	Construction Activity	<ul style="list-style-type: none"> <li>Temporary construction material sites, quarries, borrow pits, and storage areas can also have an effect on habitat loss and degradation. Such sites shall be rehabilitated as appropriate, following their use but before construction is completed.</li> </ul>	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU
12.	Overall Safety Measure	<ul style="list-style-type: none"> <li>To minimize harm to biodiversity during road construction (or improvement, rehabilitation, or maintenance), it is important to regulate the behaviour of workers in the field. Specifically, workers under the projects should be prohibited from hunting, fishing, wildlife capture (including for pets), plant collection, or burning of vegetation, anywhere in or near the project area.</li> </ul>	Overall sensitive species	Throughout the project stretch	Contractor	CSC/ PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
<b>Post Construction Phases</b>						
13.	Monitoring of sensitive species (reported during detailed survey along the corridor)	<ul style="list-style-type: none"> <li>Monitoring must take place under the direction of an appropriately qualified person and the results of the monitoring must be kept in a written record</li> </ul>	Overall	Throughout the project stretch	Contractor	PIU
14.	Landscaping & compensatory afforestation	<ul style="list-style-type: none"> <li>Landscaping and green belt along the corridor will utilize predominantly native vegetation endemic to the region, sourced and consulted from local area. This will attenuate the negative impact originated from construction activities.</li> <li>All re-vegetation carried out for the Project will be carefully reviewed and monitored to avoid accidental introduction of invasive alien species</li> </ul>	Overall	Throughout the project stretch	Contractor	PIU
15.	Accidental discharge in water	<ul style="list-style-type: none"> <li>To avoid Accidental discharge; leakage from oil receptors, refuelling of vehicle, washing of vehicles should follow the approach of routine and periodical maintenance</li> <li>Oil interceptor shall be installed at plant and vehicle workshop</li> </ul>	Fishes	At bridge construction locations	Contractor	PIU
16.	Overall Management oil contamination	<ul style="list-style-type: none"> <li>Automotive workshop establishment shall be avoided and discouraged along the corridor especially which is undergoing commercial activities without maintaining preventive measure of oil contamination/spillage.</li> </ul>	Overall species	At bridge construction locations	Contractor	PIU
17.	Sensitivity among project people, locals etc.,	<ul style="list-style-type: none"> <li>Awareness programme as training, workshop shall be organized to spread the awareness for protection of endangered species and provisions of punishment against poaching or disturbing as per WPA 1972 under GOI.</li> </ul>	Overall species	Throughout the project stretch	Contractor	PIU
18.	Road safety Treatment	<ul style="list-style-type: none"> <li>Wildlife warning signages with flashing lights and variable message boards have the potential to be more effective than static warning signs (As per World Bank Report). Such signs are most effective if employed during peak wildlife crossing periods (e.g., migration, morning, evening) or are associated with animal-activated detection systems that trigger flashing and/or message signs only when animals</li> </ul>	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
19.		<p>are present.</p> <ul style="list-style-type: none"> <li>Solar-powered flashing lights (with batteries for night-time operation) can be attached to static signs for operation during key periods such as elephant migration.</li> </ul>	Wild Fauna (Mammal)	Throughout the project stretch	Contractor	PIU
20.		<ul style="list-style-type: none"> <li>To effectively reduce wildlife-vehicle collision incidence, lower design speed considerations will be integrated into road design and construction. Specific design speeds are used to engineer various geometric design features into a roadway, with minimum standards applied for different design speeds.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
21.		<ul style="list-style-type: none"> <li>Traffic calming managements, such as curb extensions, raised medians, rumble strips in the pavement, speed bumps, Reduced speed warning shall be undertaken by contractor for stretch close to sensitive areas</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
22.		<ul style="list-style-type: none"> <li>The Endangered species as listed in table will be monitored throughout the Project and additional mitigation implemented if necessary.</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU
23.		<ul style="list-style-type: none"> <li>To prevent animal casualty during operation phase, care has to be taken by the APWRD in consultation with the wildlife official and DFO. One forest check post has to be erected on both the end of roads falling close to protected area – <b>Hollongapar Gibbon WLS</b>. Forest guards or CCTV cameras has to be installed at both the end and in between to keep eye on the plying vehicles. Sign Board 500 meters ahead of Wildlife Area has to be placed for traveller's information.</li> <li>No honk zone &amp; speed limits of 20-30km/hr sign board has to be erected at every 500 meters on the roads falling near ecological-sensitive area</li> <li>Sign board of animal's movement zone and CCTV Surveillance zone has to be installed before the check posts and in between the road.</li> <li>The death of animals if happening has to be reported along with locations. If repetitive deaths are happening at the</li> </ul>	Overall Wild fauna	Throughout the project stretch	Contractor	PIU



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Sl. No.	Type of Impact	Mitigation Measure	Applicable Wild Fauna. Avifauna, Fisheries	Specific Location	Responsibility	Supervision
		same location or area, then PWRD has to take some preventive measures like adding animal's underpass or animal's accident zone sign board with speeds breakers.				



### A. Budget of Biodiversity Management Plan (Corridor – A15, A30, A20)

Table 9 below present the cost towards monitoring and management of biodiversity. The applicable corridors (A15, A30 & A20) have eco sensitive protected areas within its 10 km periphery. Although some management measure under biodiversity management which are linked with environmental management are already covered in EMP Cost. However, other measures like awareness; training and monitoring etc. of rare and threatened species as described in the Biodiversity Management Plan has been taken into the consideration. Following tables provides the total budget of BMP.

Table 9: Budget under Biodiversity Management (A15, A30 & A20)

Particular	Duration of Project	Frequency	Unit Rs. (LS)	Total (INR)
Awareness and training biodiversity conservation	Construction (3 years)	Monthly	20,000	7,20,000
	Operation & Maintenance (one year)	Six Monthly	--	50,000
Carryout systematic field survey (involves hiring of biodiversity expert, Site survey and monitoring and keeping record of Endangered species around 10km radius project corridors	Construction (3 years)	Monthly	3,00,000	1,08,00,000
	Operation & Maintenance (one year)	Six Monthly	---	6,00,000
Silt Protection measure,	Already covered in EIA Budget			
Oil interceptors				
Compensatory Afforestation				
Water quality Monitoring				
Noise Quality Monitoring				
Air Quality Monitoring				
Awareness regarding environmental health and safety				
Elephant Underpass at 2 locations i.e., 3+630 & 6+450 (A15).	Already covered in Civil BoQ (INR 16,70,47,544)			
<b>Total Budget (INR)</b>				<b>1,21,70,000</b>

### 11. Biodiversity Management Plan (Corridor A31)

The preferred option for conservation is to restrain from interfering with the natural flow regime and to avoid constructing barriers to animals and sediment movement. However, socio-political conditions make it impractical to completely halt water developmental activities especially in the Subansiri basin, so the immediate goal must be to manage such activities in ways that will minimize the harm to dolphins and other aquatic species.

Access to floodplains should be preserved to ensure natural spawning and rearing habitat for fishes which are prey base of the dolphin. Information on the pre-development ecological conditions of a river



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is essential for evaluating mitigation efforts (like provision of fish ways etc.) and to implement future development decisions. Post-development empirical studies are needed to monitor the operational aspects of projects as well as the effects on

- ▶ Upstream and downstream populations of cetaceans and their habitat.
- ▶ Cumulative and synergistic impacts of multiple developments should be considered in assessments of environmental impact

National Awareness about the Ganges River dolphin and the importance of freshwater ecosystems should be done by

- ▶ Identifying the target groups to execute conservation actions
- ▶ Designation of Brand Ambassadors for awareness campaigns.
- ▶ Development of education and publicity material.
- ▶ Development of a dedicated web portal for the Ganges River dolphin.
- ▶ Since the Ganges River dolphin is an endangered species, every single animal is an important source for the gene pool. Rescue and rehabilitation of dolphins is a specialized operation and there is a need to establish Rescue and Rehabilitation Centres and specialized teams in the Subansiri basin at appropriate locations.
- ▶ Dolphin Watch Programme' should be initiated to popularize Dolphin Conservation & Management Activities.

#### A. Project Impacts on Aquatic Ecology

As the project corridor do not passes through any protected areas and Reserved Forest, the impact is very less on biodiversity. Only the aquatic ecosystem will be affected as the bridge will be constructed over the river Subansiri. The impacts due to pre-construction, construction, and operation of the proposed project that will affect various aquatic habitats and biodiversity of the project area and monitoring are also described in next sections. Ganges river dolphin population will not suffer from habitat fragmentation as the dolphins and other aquatic species can pass under the bridge and no habitat fragmentation will be occur.

##### I. Potential direct and indirect impacts of the project during construction phase in the aquatic ecology are as follows:

- ▶ The construction phase of the bridge will lead to the release of some amount of debris and this may impact aquatic life.
- ▶ During the construction of the proposed bridge, there is a high possibility of dolphins and their habitats impacts due to high underwater noise.
- ▶ Several endangered chelonian species can potentially suffer from habitat change by the construction activities.
- ▶ Noise from different equipment, vehicles, and human traffic has the potential to disturb migratory birds.
- ▶ Filling of low-lying areas for construction of embankments for the approach road.
- ▶ Impacts on the drainage pattern due to raised embankment, introduction of new culverts.
- ▶ Increased noise level due to the movement of vehicles and construction activities.
- ▶ Increased soil erosion.
- ▶ Spillage of oils and other hazardous materials.
- ▶ Pollution of surface and sub-surface water resources.
- ▶ No direct negative impact is anticipated on other species, but care should be taken to prevent indirect negative impact such as the deterioration of habitat. There will be some temporary



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physical disturbance to the aquatic environment during construction, but no chemical pollution will be caused and therefore no irreversible damage will be caused for the aquatic species.

**II. Potential direct and indirect impacts of the project during operation phase are the following:**

- ▶ Increased noise pollution due to the vehicular movement.
- ▶ Impact on natural drainage pattern of the project area.
- ▶ Pollution of water bodies and impacts on its ecosystem due to hazardous chemical or oil spillage into the nearby surface water bodies.

**III. ACTIVITY WISE NEGATIVE IMPACT ON AQUATIC ECOLOGY:**

**Table 10: Negative impacts on Aquatic ecology**

Sl. No	Activities	Impacts on Physical Environment	Biological Environment		Natural Drainage
			Flora	Fauna	
	<b>Construction Phase</b>	<b>Water</b>			
1	Labour Camp Activities	-Ve/T			
2	Drilling & Blasting		-Ve/T	-Ve/T	
3	Pavement Works	-Ve/T	-Ve/T	-Ve/T	
4	Use of Construction Equipment	-Ve/T			
5	Pillaring of Bridge	-Ve/T		-Ve/T	
6	Culvert & Bridge Construction	-Ve/T		-Ve/T	-Ve/P
7	Earthwork				-Ve/T
8	Quarrying				-Ve/T
9	Debris generation				-Ve/P

**IV. PRE-CONSTRUCTION STAGE**

**a) Anticipated impacts on aquatic ecology**

Impact on aquatic ecology of the river and its inherent biota owing to the construction of bridge will be probably minimal once the bridge is fully operationalized. However major, negative impact on aquatic ecology of the river is perceived to occur during the construction phase of the bridge. The possible impact on aquatic life during the construction phase of the bridge is discussed below:

- ▶ Significant sediment deposition and accumulation around bridge locations may occur as soon as construction of the bridge begins owing to natural flow obstruction. Construction of pillars acts as barriers to the natural flow leading to siltation. It has been well documented that increased sediment deposition can adversely change habitat conditions of aquatic life. Siltation can lead to fish mortality, reduced growth rates due to stress and spawning failure i.e. non-hatching of eggs. In addition, sediment deposition and accumulation can modify the suitability of fish habitats. Identified mechanisms causing changes in sediment suitability include: Altered porosity in the streambed affecting the development of fish embryo and benthic invertebrate production; reduction in the area of inter-gravel habitat for and juvenile fish; and benthic organisms; and reduction in available over wintering habitat for fish by filling of pools and interstitial voids.
- ▶ Construction activities can alter potential habitat for aquatic life or may cause direct loss of habitat of aquatic organisms. It may lead to loss of breeding and nursery grounds of fishes, owing to changes in water quality, siltation etc.
- ▶ Dredging of river bed for construction purpose, disturbs the river bed and re-suspension of sediment in the water column is likely to occur as a result of dredging action at the sediment water interface, transfer of the sediment to a transporting vessel, slop or leakage from the vessel, and disposal of the sediment. Re-suspension of the sediments causes increased turbidity which may adversely affect aquatic life by clogging gills, decreasing visibility, and preventing oxygen diffusion. Increased water turbidity with less oxygen level is particularly harmful for fishes and more importantly for river dolphins.



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- ▶ A long-term impact associated with the removal of sediments during dredging is the potential exposure of contaminated sediments. Mining and other sources of pollution can result in contamination of surface sediments. Over time, deposition of upstream sediments can bury the contaminated sediments, effectively sealing them off from the aquatic organisms. During the dredging activities, the upper layers of sediment are removed, potentially exposing previously contaminated sediments. Benthic organisms are exposed to the contaminants through uptake from pores, body walls, respiratory surfaces, and through ingestion.
- ▶ Construction of the bridge would generate noise from equipment such as motors, chain saws, frontend loaders, cranes, pile drivers and power generators. The effects of construction noise would be most noticeable in the area immediately surrounding the construction site. This would have a scaring effect upon fishes and may hamper their natural movement in search of food and movement to meet other biological requirements. If blasting with explosives and pile driving is required during construction, vibration as well as noise would be generated. In-water blasting and pile driving would generate pressure waves that would pose a consistent and adverse threat to fish and other aquatic resources.
- ▶ Water that comes into contact with cement, uncured concrete, concrete dust etc. used during construction quickly produces a strong alkaline solution that causes chemical burns to fish, insects and plants. If even a small volume of concrete wastewater is allowed to enter streams, lakes or wetlands it can cause immense damage to the environment.
- ▶ Dumping or accidental discharge of chemicals used during construction may cause immense harm to the aquatic ecosystem.
- ▶ There may be physical damage on aquatic organisms leading to mortality as a result of the construction activities.
- ▶ Aquatic mammals, particularly the river dolphin, a sizeable population of which is found in Subansiri may be negatively affected owing to the construction activities. Sound and vibrations in water as well as use of high pressure water jets can affect the echolocation properties of dolphins. Moreover, concrete structures may also hamper their echolocation through which they search for food. Poor water quality in the form of high turbidity which affects feeding in dolphins, high pH and low oxygenated waters can create an unfavourable environment for dolphins in the area. Moreover, physical injury and accidental trapping of dolphins in the construction area can cause immediate mortality.

**b) Mitigation Measures**

- ▶ Lowering the turbidity levels of water by all possible means, by taking special care during dredging and other construction related activities can help a lot in minimizing the impact of the bridge construction activity upon aquatic life. In cases relating to high turbidity levels in water coagulants can be used.
- ▶ Care should be taken to minimize the noise and vibration created during construction.
- ▶ In cases where it is seen that breeding and nursery grounds of fishes are destroyed, artificial pools can be created along the river, preferably upstream of the construction site which will act as site for breeding and nursery rearing of fishes.
- ▶ Care should be taken not to discharge the waste materials or any construction material like cement etc. directly in to water as it affects water quality.
- ▶ Biological monitoring can be carried out as pre-construction and at regular intervals during construction which track the health of biological systems. Measuring and evaluating the condition of biological systems, and the consequences of human activities for those systems, is central to biological monitoring. It aims to distinguish between naturally occurring variation and changes caused by human activities. Biological assessments are evaluations of the condition of water-bodies using surveys and other direct measurements of resident biological organisms (macro invertebrates, fish and plants).



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- ▶ Construction work should be conducted during the periods that ensured that the fisheries resources were not impacted. A primary goal in every bridge construction project should be to develop construction methods that would minimize or alleviate disturbances to the underlying ecosystem as much as possible.
- ▶ Wash water or slurry mixed with cement should be directed onto an area of ground close to the work area, where the alkaline water is absorbed by the soil and neutralized by naturally occurring chemicals in the ground. Great care should be taken to ensure the water or slurry does not run overland to the waterway. A shallow pit dug into the ground may help avoid this and constant monitoring is necessary to prevent overflow.

**V. CONSTRUCTION STAGE**

**a) Water Environment Impacts**

- ▶ The construction phase of the bridge will lead to the release of some amount of debris which needs to be managed judiciously in order to maintain ecology of the area and aquatic life.
- ▶ During the construction of the proposed bridge, there is a high possibility of dolphins and their habitats impacts due to high underwater noise, water quality change, habitat geomorphology changes, prey-base depletion etc.
- ▶ Several endangered chelonian species are found in area. These species can potentially suffer from habitat change by the construction activities, but the main cause of decline of the turtles is illegal hunting by humans for their meat. Therefore, in order to minimize the negative impacts on the turtle species, habitat change should be kept at minimum and hunting activities must be completely prohibited under the contractors activities.
- ▶ Noise from different equipment, vehicles, and human traffic has the potential to disturb migratory birds, which may cause them to leave or change their flight route until the activities are over.
- ▶ Spillage of oils and other hazardous materials.
- ▶ Pollution of surface and sub-surface water resources.

**b) Mitigation Measures**

- ▶ Regular monitoring of the impacts of construction activities on the Gangetic dolphins and other important species should be done by dedicated wildlife experts and forest officials, so that immediate prevention activities can be undertaken.
- ▶ Channels will be kept free at all times for free movement of dolphins.
- ▶ To minimize impacts, noisy operations should be avoided during winter (Nov-Feb; when dolphin congregates into the deeper channel and pre-monsoon season (Mar-Jun; dolphin breeding time), thus from November to June, which are also the breeding season for the turtles.
- ▶ Migratory birds also stay around the area during the winter months, so avoiding noisy operations during these months also reduce the impacts on them.
- ▶ Construction activities should be carried out in close supervision of the dolphin expert.
- ▶ Measures such as the creation and monitoring of an exclusion zone of a 500m radius for at least 30 minutes before the start of construction activities shall be followed. If dolphins are observed in the exclusion zone, construction works should be delayed until they have left the area. If dolphins enter the exclusion zone after construction has commenced, construction works should cease until they have left. The contractors are recommended to adopt these mitigation measures during construction works inside the river. Acoustic deterrents can be tested to keep the dolphin away during from construction zone under the supervision of dolphin ecologist.
- ▶ Relevant information (e.g. encounter with vulnerable species during engineering work) shall be shared with the State Environment and Forest Department and concerned regional



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environmental experts with which the project authority will discuss potential measures to promote conservation and monitoring of the ecosystem.

- ▶ Before construction of piers the construction site must be checked for the presence of threatened turtles, migratory birds, and other threatened species and their nests. If the turtles and/or their nest are found inside or near the construction area the animals and/or the eggs must be physically moved to safer habitat areas under the guidance of the local wildlife experts.
- ▶ All boats or ferries transporting construction material and workers will have propeller guards installed to prevent injury and death of dolphins, turtles and other aquatic fauna.
- ▶ One of the threats to bird and turtle habitat is conversion of the river edges from natural soft embankments into hard concrete embankments. Therefore, the natural bank slope is preserved and location of the bridge piers will avoid such areas. No construction camp, borrow areas or disposal sites will be established within 100m of the shorelines at the highest water level period.
- ▶ All avoidance, mitigation and enhancement measures and monitoring plans proposed to address impacts on flora, fauna and the threatened species should be updated during the detailed design stage by conducting detailed studies such as identification of the migrating routes of dolphins and birds, exact locations of turtle nesting grounds, etc.

**c) Surface Water Impacts**

Since, the proposed bridge shall be constructed over the Subansiri river, there shall be a direct and significant impact on the water quality of this river. Further, the proposed approach road is traversing through the other surface water bodies and water logging area such as ponds at several locations. Hence, significant impacts are anticipated on the water quality of these water bodies during construction phase. Silt load in the Subansiri River will pollute its water quality thereby affecting the river ecosystem.

Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers' camps and from spillage in vehicle parking and/or fuel and lubricant storage areas.

**d) Mitigation Measures**

Major construction works close to the Subansiri River and other water bodies shall be avoided during monsoon period. Disposal of waste arising from the project activities as per norms of PCB, Assam and collecting and storing of bituminous wastes and taking it to approved disposal sites shall minimize the impacts.

The probability of accidents is minimal since enhancement of road safety measures such as improvement of curves and widening of the roads and other pedestrian facilities are taken care of the design stage. To minimize the oil contamination and sediment load to water bodies, provision of sedimentation tank and oil interceptor chamber can be provided.

Apart from the provision of mitigation measures, their effectiveness and further improvement in designs to reduce the concentration of pollutants in water due to construction activity shall be monitored. The frequency, duration and responsibility shall be as per the Environmental Monitoring Plan.

The issue of blocking of cross drainage should be taken care throughout the project stretch. Further, the engineering designing of left arm and right arm of south bank is totally designed to avoid any major impact on river ecology.

**e) Ground Water**

During the construction stage the project is not expected to alter the existing water quality on a permanent basis. There are various water bodies, along the road including rivers, and open wells. Some impacts are anticipated on the water quality of these aquifer during the construction phase.

The piling depth may cause the contamination in aquifer quality and the activity of approach road may impact the open well. In case of any water supply system at the downstream of the bridge location, prior information should be provided to the concerned department on the bridge construction across the river and the construction activities should avoid discharge of any hazardous chemicals in to the river water. Laying of pavement within the formation width may lead to reduction in the ground water recharge capacity.

**f) Mitigation Measures**

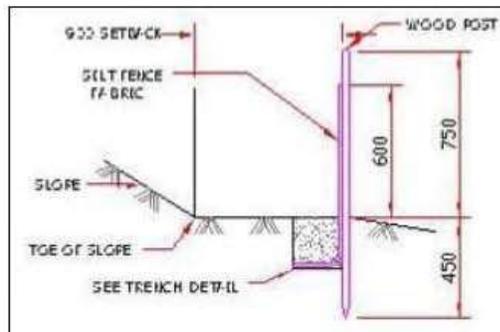
- ▶ The proposed approach road and their slope to meet the approach road is not close to bank of river. The piling of bridge structure would be in capped manner to avoid any contamination in the river Subansiri.
- ▶ As the area involved in the road construction is very less, the chances of reduction in the ground water recharge capacity due to laying of pavement within the formation width influence shall be non-significant.
- ▶ The depth of piling and any activities below ground level should be restricted to upper surface only which shall not impact the aquifer quality, extend possible.
- ▶ The closure piling shall be carried out to minimize contamination of construction material to the Subansiri river.
- ▶ Ground water quality shall be monitored as per environmental monitoring programme during construction phase as well as operation phase.
- ▶ Corrective action shall be taken if the ground water quality is found deteriorating.
- ▶ The Contractor may be directed to provide immediate control measures to prevent soil erosion and sedimentation that shall adversely affect construction operations, damage adjacent properties or cause contamination of nearby streams or other watercourses.

**g) Silt Fencing**

Silt fencing shall be provided to prevent sediments from the construction site entering into the nearby watercourses. The silt fencing consists of geo textile with extremely small size supported by a wire mesh mounted on a panel made up of angle / wooden frame and post.

It is expected a single person shall be able to drive the angles by pressing from the top. The frame shall be installed at the edge of the water body along which construction is in progress. The numbers of such units to be installed can be decided depending upon the length of the water body along the side of the road construction. The silt fencing is given in Figure 2.

Silt fencing is proposed for a length of 250m which is sufficient to cover all minor and major bridge locations and the road side water bodies. Depending on the length of the individual water body, the number of units of silt fencing to be established is decided by the Independent Engineer.

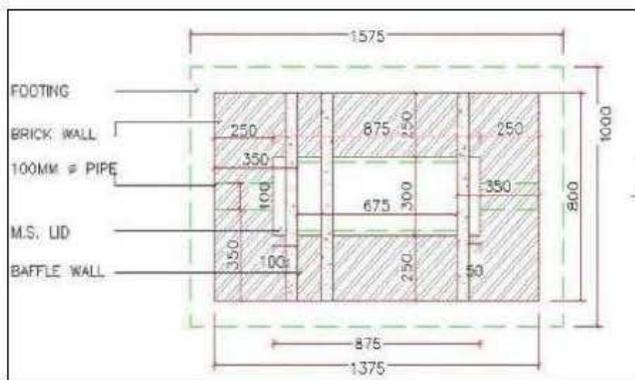


**Figure 2: Silt Fencing**

**h) Oil Interceptor**

Oil and grease from road run-off is another major concern during construction as well as operation. During construction, discharge of oil and grease is most likely from workshops, oil and waste oil storage locations, vehicle parking areas and the construction camps. A total of 3 oil interceptors shall be provided at all such locations to arrest oil and grease, as per Figure 3. The arrested products shall be disposed as per MoEF&CC and PCB, Assam guidelines.

The location of all fuel storage and vehicle cleaning area shall be at least 300m from the nearest drain / water body.



**Figure 3: Oil Interceptor**

**VI. OPERATION STAGE**

**a) Ground Water Quality- Impact**

Ground Water may get contaminated due to the following reasons:

- ▶ Accidental spillage
- ▶ Refueling of vehicle (bus, truck, etc.)
- ▶ Leakage of oil during transportation
- ▶ Washing of vehicles
- ▶ Routine and periodical maintenance of the approach road

**b) Mitigation Measures**

- ▶ Drain along with oil interceptor shall be provided on both side of bridge and its approaches.
- ▶ Automobile service centers shall be discouraged from establishing along the corridors without installing preventive measures against petroleum and oil contamination.
- ▶ It is suggested that regular monitoring by the forest department and relevant environment and wildlife experts should be done.
- ▶ Awareness programmes as training, workshops, seminars, brainstorming etc., need to be organized to promote responsible consumerism, sustainable economic practices and the protection of endangered species for all the stakeholders.
- ▶ Research on Ganges River Dolphins needs to be conducted to study in details the abundance, distribution, ecology and threats of the Ganges River Dolphin in and around the project sites. Community engagement and awareness activities regarding the conservation of Gangetic dolphin also need to be done.

## B. Aquatic Conservation and Management Plan

The Aquatic Conservation and Management Plan for the proposed project have been framed with an objective to:

- ▶ Conserve and preserve natural aquatic ecosystems around the proposed project;
- ▶ Minimize project impacts on rare, endangered or threatened species and rehabilitate keystone species, if any; and
- ▶ Develop the information database on aquatic biodiversity at the project site.

### I. Establishment of an Aquatic Environment Monitoring Committee

An Aquatic Environment Monitoring Committee shall be constituted for effective implementation, monitoring and aquatic environment of the project. The committee shall be headed by Chief Engineer, Project, PWRD, and representatives from the PWRD, members of the Department of Forests / Environment, Assam Biodiversity Board, Fisheries Department and Independent subject specialists.

The committee will look after the demarcated areas (10 KM radius from ROW), monitor and enforce regulatory provisions and ensure that the structure and functions of the natural ecosystems in the area are not changed or subjected to any threat. It would also propose other approaches for the biodiversity conservation plan, whenever deemed necessary.

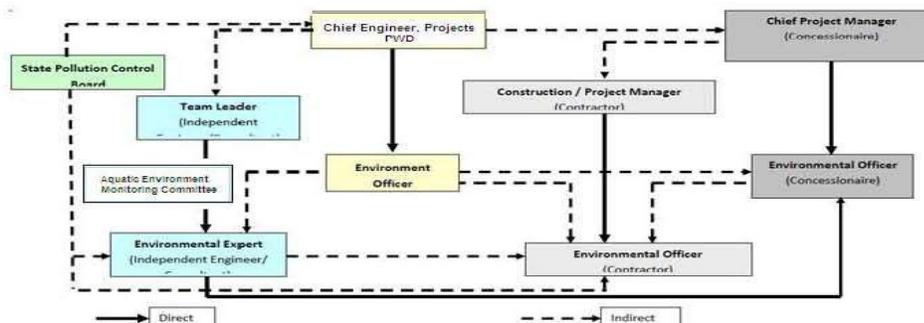


Figure 4: Proposed Organization Chart

### II. Aquatic Wildlife Conservation

- ▶ Stakeholders confirmed sightings of dolphin in and around the project area. Under IUCN conservation status, River Dolphin, Endangered; are on Schedule I of the Indian Wildlife Protection Act (1972) which is the highest protection accorded to species in India.
- ▶ Promote Surveys and Monitoring in and around the Project Area (extending upto 10 Km radius of ROW). This activity is aimed at adding to the existing knowledge base on aquatic wildlife presence and movements in the vicinity of the project area. This is especially recommended so that the data collected can add to the baseline information collected during the EIA preparatory phase (adding to the seasonal data). The surveys will improve the understanding of aquatic wildlife presence, distribution, movements and seasonality in the wider vicinity of the project area. This will ensure strict monitoring of any encroachments, and also add to the biodiversity database especially for endangered species. This aquatic wildlife survey will be conducted with the assistance of the Wildlife Division, Department of Environment and Forests.
- ▶ Conservation actions as proposed by IUCN (during construction and during the initial project operation) such as conducting a comprehensive survey and monitoring in and around the project area to establish range, distribution and population status of vulnerable and critical habitats in the project area for assessing its habitat requirements and identifying threats will be undertaken.



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BIODIVERSITY ASSESSMENT REPORT (DRAFT)

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III. **Anti-Poaching Measures**

- ▶ Hunting and poaching is a possibility due to the presence of construction workers. The possibility of hunting and trapping by workers during construction period will be monitored by the contractor. The overall magnitude of impact is considered to be low, extent is site specific and duration is short period.
- ▶ **Awareness Raising Programs:** Awareness will be raised among workers and contractors regarding illegal poaching and copies of the Indian Wildlife Act, Biodiversity Act, Prevention of Cruelty to Animals Act (1986), other relevant Rules and Regulations as well as Biodiversity Mitigation and Monitoring in EMP will be made available in the local language. Copies will be made available at the project site and forest ranger stations of the vicinity. Workers must be made aware of the fines and penalties for poaching, as well as the risk of job loss, if caught in these illegal activities. This will be done during the pre-construction phase, but after the Contractor has been selected and continue intermittently through the construction phase.
- ▶ **Strengthen Patrolling:** To minimize the risks of poaching, awareness raising programs will be combined with an increase in patrolling by local forest rangers (in coordination with forest department) and construction of check posts and watch towers at key locations. The choices of location of check posts and watch towers will be guided by consultations with forest rangers in the area.
- ▶ **Community Watch Program:** The project will also discuss possibilities for funding a community watch program, through hire of village guards to alert Forest Ranger officials of any illegal activities in the worker camps or at project sites.



Table 11: Biodiversity Management Plan (Corridor - A31) Pre-Construction & Construction

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
<b>Pre - Construction</b>					
Bottom sediment	Mobilization of bottom sediments will require	Subansiri River	During boring survey	Contractor	Project Implementation Unit (PIU)
Vegetation clearing and tree cutting	Identification and marking of endangered plant species ( <i>Magnolia peiliana</i> ) for transplantation	Throughout Project Corridor	Prior to tree cutting during joint survey with forest department	Contractor	Project Implementation Unit (PIU)
<b>Construction</b>					
Soil erosion in Embankments (Impact on topography/)	Pitching shall be done for slope stabilization as per the IRC guidelines	At the embankments		Contractor and Authority Engineer	Project Implementation Unit (PIU)
Water pollution	<ul style="list-style-type: none"> <li>Construction vehicles / equipment shall be operated and maintained in such a manner to avoid contamination of water bodies due to oil spillage.</li> <li>Fuel storage shall only be done on wasteland and will be kept away from drainage channels and natural water bodies.</li> <li>Oil and grease traps will be provided at fueling locations</li> <li>No excavation from the bund of the water bodies.</li> <li>No debris disposal near any water body.</li> <li>Prior written permission from authorities for use of water for construction activity shall be submitted to IE.</li> <li>Construction labours to be restricted from polluting the source or misusing the source.</li> <li>Shifting of source to be completed prior to disruption of the actual source.</li> <li>Alternate measures to be taken / ensured during disrupted period.</li> </ul>	Near labor camp and sites of the installation of Construction		Contractor and Authority Engineer	Project Implementation Unit (PIU)



BIODIVERSITY ASSESSMENT REPORT (DRAFT)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
<ul style="list-style-type: none"> <li>Source to be replaced immediately, in case of accidental loss.</li> <li>Construction work shall be restricted to 3m – 4m width from the existing formation near ponds.</li> <li>The volume of water storage lost shall be compensated for by excavation of an equal volume of similar depth at closest possible location in the direction of flow and shall be done with the approval of the independent engineer.</li> </ul>	<ul style="list-style-type: none"> <li>Diversions shall be constructed during dry season, with adequate drainage facility, and shall be completely removed before the onset of monsoon.</li> <li>Debris generated due to the excavation of foundation or due to the dismantling of existing structure shall be removed from the water course.</li> <li>Temporary silt fencing to be provided on the mouth of discharge into natural streams.</li> <li>Continuous drain (lined /unlined) is suggested / shall be provided. Obstruction, if any, shall be removed immediately.</li> </ul>	Throughout Project Corridor, all access roads, temporarily acquired sites.	Whenever encountered during construction	Contractor and Authority Engineer	Project Implementation Unit (PIU)
Silting / sedimentation	<ul style="list-style-type: none"> <li>Measures suggested under “soil erosion and sedimentation control” shall be enforced.</li> <li>Silt fencing is provided around water bodies.</li> <li>Construction activities shall be stopped near water bodies during monsoon.</li> <li>Soil trap are suggested / shall be provided in all ancillary sites and camps.</li> </ul>		Throughout construction period	Contractor and Authority Engineer	Project Implementation Unit (PIU)
Water pollution from labor camp.	<ul style="list-style-type: none"> <li>Labor camp shall not be allowed near any of the water bodies.</li> <li>The proper sanitation facilities shall be provided.</li> </ul>	Preapproved locations away from the water bodies		Contractor and Authority Engineer	Project Implementation Unit (PIU)
Deposition of dust in open wells near	<ul style="list-style-type: none"> <li>The mouth/opening of the well shall be covered with suitable material during any of the construction</li> </ul>	All the wells along the project corridor.		Contractor and Authority Engineer	Project Implementation Unit (PIU)



BIODIVERSITY ASSESSMENT REPORT (DRAFT)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
construction site	activity so as to prevent dust from entering in the well.				
Fauna	<ul style="list-style-type: none"> <li>Construction workers must protect natural resources and wild animals.</li> <li>Aquatic fauna shall not be affected.</li> <li>Hunting shall be prohibited. Nesting grounds &amp; migratory paths shall be protected.</li> <li>All avoidance, mitigation and enhancement measures and monitoring plans proposed to address impacts on flora, fauna and the threatened species should be updated during the detailed design stage by conducting detailed studies such as identification of the migrating routes of dolphins and birds, exact locations of turtle nesting grounds, etc.</li> </ul>		During construction	Contractor and Authority Engineer	Project Implementation Unit (PIU)
Impact on Surface water quality due to eroded soils	<ul style="list-style-type: none"> <li>Construction work close to the watercourses or other water bodies will be avoided, especially during the monsoon period.</li> <li>Increase coverage of open surface area by planting grass and creepers so that the washing away of materials from sloped surfaces would be reduced by a significant extent.</li> <li>Silt curtain should be used for all underwater works.</li> <li>Water quality monitoring</li> </ul>	All the respective locations		Contractor and Authority Engineer	Project Implementation Unit (PIU)
Bottom sediment	<ul style="list-style-type: none"> <li>Silt curtain shall be installed to prevent move of the sediment.</li> <li>Construction works shall be suspended when flood warning is issued.</li> </ul>			Contractor and Authority Engineer	Project Implementation Unit (PIU)
Endangered species	<ul style="list-style-type: none"> <li>Relevant information (e.g. encounter with vulnerable species during engineering work) shall be shared with the State Environment and Forest Department and concerned regional environmental experts.</li> <li>Anti-poaching measures during the construction</li> </ul>	Throughout the project area		Contractor and Authority Engineer	Project Implementation Unit (PIU)



BIODIVERSITY ASSESSMENT REPORT (DRAFT)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
<p>phase should be strengthened to check for any violation of existing regulations. Awareness campaign to be made among the workers to aware them on the endangered and other important species.</p> <ul style="list-style-type: none"> <li>• Construction vehicles must be operated at safe speed to avoid collision with wildlife. Training should be provided for the vehicle operator send warning signs should be installed.</li> <li>• Change of geology and topography should be kept minimum. Avoid constructing labor camps and construction yards near the river banks.</li> <li>• To minimize impacts, noisy operations should be avoided during breeding season of the dolphins.</li> <li>• River flow should not be blocked at all times for free movement of dolphins.</li> <li>• Measures such as the creation and monitoring of an exclusion zone of a 500m radius for at least 30 minutes before the start of construction activities shall be followed. If dolphins are observed in the exclusion zone, construction works should be delayed until they have left the area. If dolphins enter the exclusion zone after construction has commenced, construction works should cease until they have left.</li> <li>• All activities that increase soil erosion or contribute to nutrients and pollutants to water need be minimized both on-site and off-site by using measures such as silt curtain.</li> <li>• Construction activities should be carried out in close supervision of the dolphin ecologist.</li> <li>• Construction works should be avoided or kept minimum in vicinity of the dolphins' favorable microhabitats (downstream of shallow areas/sandbars, tributary junctions)</li> </ul>					



BIODIVERSITY ASSESSMENT REPORT (DRAFT)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
<ul style="list-style-type: none"> <li>Dolphins are likely to prefer water depth range between 4.1 to 6 m. Therefore, movement of sediment and influx of soil/silt etc. should be avoided to keep the favorable depth range.</li> <li>In case rare birds of prey are observed near the construction area, the construction work will be avoided during their breeding season.</li> <li>Before construction of piers the construction site must be checked for the presence of threatened turtles, migratory birds, and other threatened species and their nests. If the turtles and/or their nest are found inside or near the construction area the animals and/or the eggs must be physically moved to safer habitat areas under the guidance of the local wildlife experts.</li> <li>All boats or ferries transporting construction material and workers will have propeller guards installed to prevent injury and death of dolphins, turtles and other aquatic fauna.</li> <li>One of the threats to bird and turtle habitat is conversion of the river edges from natural soft embankments into hard concrete embankments. Therefore, the natural bank slope is preserved and location of the bridge piers will avoid such areas. No construction camp, borrow areas or disposal sites will be established within 100m of the shorelines at the highest water level period.</li> </ul>					
<ul style="list-style-type: none"> <li>Underwater noise impacts on aquatic species.</li> </ul>	<ul style="list-style-type: none"> <li>Use vibratory hammer. Under conditions where impact hammers are required for reasons of seismic stability or substrate type, it is recommended that the pile be driven as deep as possible with a vibratory hammer prior to the use of the impact hammer.</li> <li>Monitor sound levels during pile driving to ensure</li> </ul>			Contractor and Authority Engineer	Project Implementation Unit (PIU)



BIODIVERSITY ASSESSMENT REPORT (DRAFT)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
	<p>that they do not exceed the NOAA (National Oceanic and Atmospheric Administration, USA) or any other international recognized criteria.</p> <ul style="list-style-type: none"> <li>Implement measures to attenuate the sound when sound pressure levels exceed the NOAA or any other international recognized criteria. Methods to reduce the sound pressure levels include but are not limited to:               <ul style="list-style-type: none"> <li>Installation of underwater enclosures to minimize sound</li> <li>Surrounding the pile with an air bubble curtain system or air-filled coffer dam.</li> <li>Using a smaller hammer to reduce the sound pressure. The sound produced in pile driving has a direct relationship to the force used to drive the pile. A smaller hammer will have less force on the pile therefore producing less sound.</li> </ul> </li> <li>Construction works should be ceased when the dolphins are observed near the work area.</li> </ul>			Contractor and Authority Engineer	Project Implementation Unit (PIU)
Water use	<ul style="list-style-type: none"> <li>To minimize the river pollution during construction, mitigation measures will be applied such as installing a silt fence in places close to the residential area.</li> </ul>	At respective planned construction			
Monitoring dolphin	<ul style="list-style-type: none"> <li>Monthly monitoring</li> <li>Preparation of River Dolphin rescue team</li> <li>Study bio-accumulation of toxins, and their effects, in the River dolphins.</li> </ul>				
Awareness on dolphin conservation	<ul style="list-style-type: none"> <li>Awareness</li> <li>Up gradation of dolphin monitoring stations/observatory towers</li> </ul>	Fringe area	monthly		
Workshop on dolphin conservation			one		



BIODIVERSITY ASSESSMENT REPORT (DRAFT)

Issues	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
Monitoring fish, migratory birds and turtle	<ul style="list-style-type: none"> <li>Monthly monitoring.</li> <li>Carry out systematic field survey and monitor the fish diversity of the area. Monitoring of fishing activity.</li> <li>Awareness for conservation.</li> </ul>				
Improvement of tank fisheries	<ul style="list-style-type: none"> <li>To improve the productivity of fishes by the local fishing community.</li> </ul>		12 nos		
<b>Operation Phase</b>					
Water Quality	<ul style="list-style-type: none"> <li>Water quality monitoring</li> </ul>		As in the EMP	Project Implementation Unit (PIU)	
Monitoring dolphin and awareness generation on dolphin conservation			Once in 6 months		
Monitoring fish, migratory birds and turtle and awareness.			Once in 6 months		



**BIODIVERSITY ASSESSMENT REPORT (DRAFT)**

**IV. Conservation of river Dolphin**

- ▶ Monitoring River dolphin populations during construction and operation phase (3 years) within 10 km radius of the project.
- ▶ Prepare safe handling of River Dolphin team for rescue efforts if required.
- ▶ Study and monitor the impact of the construction activities upon dolphin population, their behaviour and habitat.
- ▶ Assessment of the habitat of the River dolphin.
- ▶ Study the movement and dispersal pattern of the River dolphin to assess the home range and habitat utilising modern technologies.
- ▶ Study bio-accumulation of toxins, and their effects, in the River dolphins.
- ▶ Ensuring Critical Levels of Water Flow in Riverine Habitats of Dolphins.
- ▶ Increase Awareness about the River dolphin and the importance of freshwater ecosystems.
- ▶ Identification of target groups to execute conservation actions.
- ▶ Development of education and publicity material.
- ▶ A workshop to be conducted for conservation of River Dolphins in the Subansiri River.
- ▶ Community Involvement in river dolphin monitoring and Conservation.

**Conservation Budget:** A total of **Rs. 3 crore** rupees is earmarked for conservation of dolphins. Details of the budget are as follows.

**Table 12: Detail budget for Dolphin Conservation**

Sl. No	Particular	Duration of Project	Frequency	Unit INR (LS)	Total (INR)
1	Monitoring dolphin (including hiring boat)	Construction (36 months)	Monthly	3,00,000	1,08,00,000
		Operation phase (36 months)	Once in 6 Months	2,50,000	15,00,000
2	River dolphin rescue team	Hiring of Boat (36 months)	Rs. 60000/ Month	21,60,000	81,00,000
		Procurement of equipment	Once	59,40,000	
		Construction (36 months)	Monthly	1,00,000	36,00,000
		Operation phase (36 months)	Once in 6 Months	1,80,000	10,80,000
3	Awareness on dolphin conservation	Construction (36 months)	Monthly	10,000	3,60,000
		Operation phase (36 months)	Once in 6 Months	10,000	60,000
4	Workshop on Dolphin Conservation				25,00,000
5	Publicity materials				3,00,000
6	Community involvement in river Dolphin Monitoring and Conservation				5,00,000
7	Study bio-accumulation of toxins and their effects in the River dolphins.				10,00,000
9	Miscellaneous				2,00,000
<b>Total</b>					<b>3,00,00,000</b>



### C. Aquatic Ecology Monitoring Plan

Table 13: Environmental Monitoring Plan

Mitigation Measure	Phase	Parameters	Locations	Duration and frequency	Implementation	Monitoring
Water Quality	Construction	Parameters as Mentioned in IS 10500	6	Three times during the Construction Phase per year (Pre-monsoon, Monsoon and Post Monsoon)	Contractor through an NABL approved Monitoring agency	Environment Cell PWRD
	Operation		4	End of summer before the onset on monsoon, Monsoon and After Monsoon every year for 5 years	PIU	
Noise and Vibration	Construction	Noise Level in dB (A)		Noise monitoring near the pile construction (2 in each pile)	Contractor through an NABL approved Monitoring agency	Environment Cell PWRD
Fish monitoring, migratory birds and turtle monitoring	Construction			Monthly	Independent expert	Environment Cell PWRD
	Operation			Once in every 6 months	Independent expert	Environment Cell PWRD
Dolphin Monitoring	Construction			Monthly	Independent expert	Environment Cell PWRD
	Operation			Once in every 6 month	Independent expert	Environment Cell PWRD

### D. Budget of Biodiversity Management Plan (Corridor A31)

Table 14 below present the cost towards monitoring and management of biodiversity of Corridors A15. Although some management measure under biodiversity management which are linked with environmental management are already covered in EMP Cost. However, other measures like awareness; training and monitoring etc. of rare and threatened species as described in the Biodiversity Management Plan has been taken into the consideration. A total of **Rs. 3 crore** rupees is earmarked for Biodiversity Management Plan, following tables provides the total budget of BMP.

Table 14: Budget of Biodiversity Management Plan (Corridor A31)

Item No.	Component	Qty.	Unit cost INR	Total Cost INR
1	Dolphin Conservation			3,00,00,000
2	Provision of Oil Interceptors		Already covered in EIA Budget	0
3	Silt fencing			
4	Water Quality monitoring and noise assessment			
<b>Total</b>				<b>3,00,00,000</b>



Annexure 1: Corridor 31 - Majuli Biodiversity Heritage Gazette Notification by Government of Assam

পঞ্জীকৃত নম্বৰ - ৭৬৮/৯৭

Registered No.-768/97



THE ASSAM GAZETTE

অসাধাৰণ

EXTRAORDINARY

প্ৰাপ্ত কৰ্তৃত্বৰ দ্বাৰা প্ৰকাশিত

PUBLISHED BY THE AUTHORITY

নং 224 দিশপুৰ, শুক্ৰবাৰ, 26 মে, 2017, 5 জ্যৈষ্ঠ, 1939 (শক)  
No. 224 Dispur, Friday, 26th May, 2017, 5th Jaistha, 1939 (S.E.)

GOVERNMENT OF ASSAM  
ORDERS BY THE GOVERNOR  
ENVIRONMENT & FOREST DEPARTMENT  
DISPUR :: GUWAHATI-6

**NOTIFICATION**

The 29th March, 2017

No. FRW 57/2005/Vol.-II/14.-In exercise of the power conferred by sub section (1) of Section-37 of the Biological Diversity Act, 2002 (No. 18 of 2003) and Rule 24(1) of the Assam Biodiversity Rules 2010, the Government of Assam hereby notifies Majuli as 'Majuli Biodiversity Heritage Site' as detailed in the schedule given below :

1. **Short Title:** This notification may be called "Declaration of Majuli as Biodiversity Heritage Site"(BHS). It shall come into force on the date of publication in the Assam Gazette.
2. **Extent of application:** This notification shall apply within the administrative boundary of Majuli District.
3. **The total area covered:** 875 Sq. Km.
4. **GPS coordinates:** The co-ordinates of Majuli qualifying the extreme points in the North, South, East, West boundaries and centre are as follows:



BIODIVERSITY ASSESSMENT REPORT (DRAFT)

2 THE ASSAM GAZETTE, EXTRAORDINARY, MAY 26, 2017

Sl. No.	Latitude	Longitude	Direction
1	26° 58' 30.268" N	94° 2' 23.180" E	NW
2	27° 3' 1.588" N	94° 10' 16.040" E	N
3	27° 5' 59.835" N	94° 16' 45.799" E	N
4	26° 53' 46.073" N	93° 57' 25.340" E	W
5	26° 57' 59.475" N	94° 10' 26.105" E	C
6	27° 1' 21.972" N	94° 17' 47.452" E	C
7	27° 10' 59.178" N	94° 33' 48.374" E	NE
8	26° 50' 57.455" N	94° 0' 11.644" E	SW
9	26° 50' 45.120" N	94° 6' 13.571" E	S
10	26° 53' 3.278" N	94° 17' 45.343" E	S
11	26° 57' 49.773" N	94° 24' 12.447" E	S
12	27° 8' 50.634" N	94° 35' 41.669" E	SE

5. Boundaries: Majuli Biodiversity Heritage Sites

North : Lakhimpur District  
South : Jorhat District  
East : Sivasagar & Dibrugarh Districts  
West : Sonitpur District.

6. This comes into effect from the date of publication in the official Gazette.

**P. K. BORTHAKUR,**  
Principal Secretary to the Government of Assam,  
Environment and Forest Department.



Annexure 2: Corridor 30 – Letter from DFO, Digboi Division, Digboi

  
Government of Assam  
Office of the Divisional Forest Officer  
Digboi Division: Digboi

Ph. No. 0373126433  
Letter No. B/Axom Mala/2021/1551  
Email ID: dfodigboi@gmail.com  
Dated: 08-06-2021

To  
The Chief Engineer (EAP), PWRD,  
Assam, Faisal Ambari,  
Guwahati-25.

Sub- Improvement and upgradation of A30. 2 Disang Kinar Bangali to Kathalguri Road under Axom Mala.  
Ref- Your letter No 1. CE/AXOM MALA/12/2019/9 dtd.05/11/2019  
2. CE/AXOMMALA/9/2019/P-I/53 dtd. 29-05-2021.

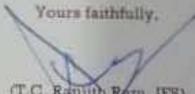
Sir,  
With reference to the subject cited above, I am furnishing the following information regarding Axom Mala Project Road from Disang Kinar Bangali to Bhadoi Panchali under Digboi Division.

1. Details of forest area: - There is no Reserve Forest along the proposed site for improvement of State Highway (SH) i.e. from Disang Kinar Bangali to Bhadoi Panchali falling within the jurisdiction of Digboi Forest Division and the trees standing either side of the road are not on forest land.
2. Information on Flora and fauna  
Flora: - Krishnasura, Guwal, Dimoru, Simolu, Sotiyana, Gomari, Koroch, Strish, Indofera, Amora, Moj, Raintree, Jamuk, Susoo, Sum, Aam, Paniyal, Nuni, Morolia, Gohora, Bhatgela, Akhrat, Sonaru, Katkora, Putejawa, Jia, Panichikoti, Peepal, Modar, Ghoraneem, Sojina, Bell, Madhuri, Paroh, Bogori, Kothal, Ulbejeria Fale, Ajhar, Rabab Tenga, Bansiris, Debdaru, Pola, Keseru, Neem, Pola, Outenga, Tia Sopa etc.  
Fauna: - No major animal movement has been detected in the proposed area.
3. Type and number of animal present: - No major animal movement has been detected in the proposed area.
4. Length of forest area adjacent to project road: - The site of the Project Road is not on forest land.
5. Map and extent of forest cover: - Not applicable.
6. Numbers of trees required to be removed: - 1438 nos. Volume = 863.81 m<sup>3</sup>.
7. Cost of felling of trees, sectioning, dragging to diesel point, transportation to temporary depot, depot maintenance etc. @ Rs.3450/m<sup>3</sup> - Rs. 29,80,145.00 (Rupees Twenty nine lakhs Eighty thousand One hundred Forty five) only (copy of estimate is enclosed).

Please note that, the dragging cost etc. may accordingly to the actual volume of timber obtained after felling. Moreover, felling will be permitted only after getting approval from the Conservator of Forests Eastern Assam Circle, Jorhat.

This is for favour of your kind information and necessary action.

Encl: - As stated above.

Yours faithfully,  
  
(T.C. Ranjith Ram, IFS)  
Divisional Forest Officer  
Digboi Division, Digboi

Letter No. A/Axom Mala/2021/996  
Dated: 08-06-2021

Copy to the Conservator of Forests, Eastern Assam Circle, Jorhat for favour of his kind information and necessary action.

  
(T.C. Ranjith Ram, IFS)  
Divisional Forest Officer  
Digboi Division, Digboi



Annexure 3: Corridor 20 – Eco Sensitive Zone Notification of Hollongapar Gibbon WLS

22

THE GAZETTE OF INDIA : EXTRAORDINARY

[PART II—SEC. 3(ii)]

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE  
NOTIFICATION

New Delhi, the 23rd September, 2019

**S.O. 3462(E)**—WHEREAS, a draft notification was published in the Gazette of India Extraordinary, *vide* notification of the Government of India in the Ministry of Environment, Forest and Climate Change number S.O.1828 (E), dated 7<sup>th</sup> May, 2018, inviting objections and suggestions from all persons likely to be affected thereby within the period of sixty days from the date on which copies of the Gazette containing the said notification were made available to the public;

**AND WHEREAS**, copies of the Gazette containing the said draft notification were made available to the public on the 7<sup>th</sup> May, 2018;

**AND WHEREAS**, no objections and suggestions were received from persons and stakeholders in response to the aforesaid draft notification;

**AND WHEREAS**, the Hollongapar-Gibbon Sanctuary was notified by the Government of Assam *vide* notification No. FRS/3797/13, dated 30.07.1997, by upgrading the conservation status of the Hollongapar Reserve Forest declared earlier *vide* notification No. 8, dated 27.08.1881;

**AND WHEREAS**, the Sanctuary is an important protected area situated in Jorhat District in the state Assam covering an area of 20,986.21 square kilometers; the perennial river Bhogdoi along with its catchment passes through the Sanctuary and makes the ecological environment of the Sanctuary unique, several seasonal small streams comprising of Hollongapar Mouza (Taluka) and Nakachari Mouza (Taluka) of Jorhat District are the main sources of water for the animals in the Sanctuary;

**AND WHEREAS**, the floral biodiversity of the Sanctuary includes 74 tree species, 17 species of shrubs and 12 species of climbers; the important tree species recorded from the Sanctuary are hollong (*Dipierocarpus retusa*), sam (*Artocarpus chaplasha*), amari (*Amoora wallichii*), sopas (*Michelia spp.*), bhelu (*Tournefortia nudiflora*), udal (*Sterculia villosa*), hingori (*Castanopsis spp.*), nahor (*Mesua ferrea*), Bandordima (*Dysoxylum procerum*), Dhuna (*Canarium resiniferum*), Bhomora (*Terminalia belerica*), ful Gomari (*Gmelina Spp.*), bon bogori (*Pterospermum lanceofolium*), morhal (*Vatica lanceofolia*), sassi (*Aquilaria agolacha*), otenga (*Dillenia indica*), ajar (*Lagerstroemia flos-reginae*), bon-am (*Mangifera sylvatica*), amora (*Spondias Mangifera*), uriam (*Bischofia javanica*), Selleng (*Saptium baccatum*), mahi thekera (*Garcinia morella*), katholua (*Palaquium obovatum*), kumbhi (*Careya arborea*), gahori Sopa (*Magnolia Pealiana*), gomari (*Gmelina arborea*), gohora (*Premna bengalensis*), Gondhsoroi (*Cinnamomum grandifolium*), Salmugra (*Hydrocarpus kurzil*), poreng (*Elaeocarpus robustus*), sotiona (*Alosionia scholaris*), chom (*Machilus odoratissima*), chewa (*Caryota urens*), jutuli (*Altingia exulsa*), Jori (*Ficus benjamine*), titasopa (*Michelia champaka*), pan chopra (*Magnolia sphenocarpa*), bohoh (*Artocarpus lakoocha*), fakkema (*Triwea orenalis*), phul sopa (*Magnolia hookeri*), borhomthuri (*Talauma Hodgsonii*), Bogi jamuk (*Eugenia kurzii*), Bor jamuk (*Eugenia jambulana*), bagh nola (*Litsea Sebifera*), bhatghilla (*Oroxylum Indicum*), bomora (*Terminalia belerica*), mejangkori (*Litsea citraea*), khokon (*Dubhanja sonneratioides*), rudrakha (*Elaeocarpus ganitrus*), raghu (*Anthocephalus cadamba*), simul (*Bombax ceiba*), leteku (*Baccaurea sapeda*), hilikha (*Terminalia chebula*), houara (*Trophis aspera*), haldu Sopa (*Adne cardifolia*), holokh (*Terminalia myrtocarpa*), heloch (*Anatidesma ghesaembilla*), bhelkor (*Trewia nudiflora*), Boal (*Cordia oblique*), bonsum (*Phoebe goalparensis*), borpat (*Ailanthus grandis*), dimaru (*Ficus Spp.*), ghora neem (*Melia indica*), hualu (*Litsea polyantha*), Jalpai (*Elaeocarpus varanasi*), kanchan (*Bauhinia purpurea*), keseru (*Heteropanax fragrans*), koroi (*Albizia procera*), moj (*Albizia lucida*), morolia (*Mallois albus*), nagabhe (*Schima wallichii*), paroli (*Sterospermum chelonoides*), poma (*Cedrela toona*) and tepor tenga (*Garcinia spp.*);

**AND WHEREAS**, the shrubs and climbers species include Harpagondha (*Rauwolfia serpentina*), Guphul (*Lantana camera*), Jarmoni (*Eupatorium odoratum*), Jetuli poka (*Rubus malacanus*), Tora (*Alpinea allaghas*), Dhopotatta (*Phlogarthus criviflorus*), Nal (*Arundonax*), Khogori (*Phragmites karka*), Nilaji bon (*Mimosa pudica*), Patidoi (*Elinogyne dichotoma*), Pochotia (*Buddleia asiatica*), Phutuka (*Osbeckia rasirata*), Bioni Habota (*Desmodium labornifolium*), Bahok tita (*Adhatoda spp.*), Kaupat (*Phrynium spp.*), Makhiti (*Flemingia stria*), Mejenga (*Viburnum colebrookianum*), Amoilota (*Menispermum glabrum*), Harjura lota (*Cissus quadrangularis*), Akashilota (*Trachelospermum fragrans*), Panilota (*Dillia sermenosa*), Kolialota (*Merremia umbellata*), Pipoli (*Piper longum*), Latumoni (*Abrus Precariorous*), Mekuri chali (*Combretum decandrum*), Jengu bet (*Calamus erectus*), Jati bet (*Calamus tenwise*), Raidang bet (*Calamus flagellum*) and Lejai bet (*Calamus floribundus*), etc.

**AND WHEREAS**, the important rare species found in the Hollongapar-Gibbon Sanctuary are *Dipierocarpus retusa* (hollong), *Ficus spp.* (fig), *Artocarpus chaplasha* (Sam-goch, Chamkathal), *Litsea citraea* (Mejangkori), *Aquilaria agallocha* (Aloewood), etc.

**AND WHEREAS**, the Sanctuary supports 11 species mammals, 5 species of reptiles and amphibians and 31 avifaunal species; the major fauna of the Sanctuary includes Tiger (stray) (*Panthera tigris*), Asiatic elephant (*Elephas maximus*), leopard (*Panthera pardus*), pangolin (*Manis crassicaudata*), jungle Cat (*Felis chaus*), Indian civet (*Viverridae spp.*), giant squirrel (*Reufa bicolor*), barking deer (*Muntiacus muntjak*), sambar deer (*Cervus anticolor*), wild pig (*Sus*



*scorfa*), five-striped palm squirrel (*Funambulus pennanti*), Indian python (*Genus python*), common monitor lizard (*Varanus griseus*), Indian tent turtle (*Kachuga tecta tecta*), gecko (*Calodactylodes aureus*), common cobra (*Naja spp.*), white winged wood duck (*Cairina scutulata*), horn bill (*Ptilolaemus tickali aasen*), Indian pied horn bill (*Anthracoseros malabaricus*), osprey (*Pandion haliaeetus*), hill myna (*Gracula religiosa indica*), kalij pheasant (*Lophura leucomata*), babbler (*Timaliinae spp.*), barbets (*Captonidae spp.*), bitterns (*Ardeidae spp.*), kingfisher (*Alcedinidae*), orioles (*Oriolidae*), bulbuls (*Pycnonotidae spp.*), owls (*Syrigidae*), egrets (*Ardeidae*), cormorants (*Phalacrocoracidae*), mynah (*Sturnidae*), cuckoos (*Cuculidae*), magpies (*Corvidae*), pigeons (*Columbidae*), darters (*Phalacrocoracidae*), doves (*Columbidae*), blue jays (*Coraciidae*), teals (*Anatidae*), tree Pies (*Corvidae*), bayas (*Ploceidae*), jungle fowl (*Phasianidae*), minivets (*Campephagidae*), munias (*Esrildnae*), parakeets (*Psittacidae*), wood peckers (*Picidae*) and tits (*Paridae*), etc., and the Sanctuary also protects (7) seven rare primate species that enrich the biodiversity;

**AND WHEREAS**, heterogeneous landscapes of the Sanctuary is an integral part of a critical elephant corridor along with Disai and Disai Valley reserved forests, and the adjoining landscape of the State of Nagaland on the south;

**AND WHEREAS**, the Sanctuary is situated about 3 kilometers from Mariani Mouza (Taluka) and 18 km from Jorhat city and due to the fast urbanisation it may have adverse affect on birds, animals of the Sanctuary in the long run and railway line and road also pass through the Sanctuary opening it to vehicular traffic and causing damage to the ecosystem of the Sanctuary;

**AND WHEREAS**, the Sanctuary is home to a variety of flora, fauna and avifauna, and provides protection to rare and endangered species of wildlife endemic, hence, it is necessary to conserve and protect the area, the extent and boundaries of which are specified in paragraph 1, around the Hollongapar-Gibbon Sanctuary as Eco-sensitive Zone from ecological, environmental and biodiversity point of view and to prohibit industries or class of industries and their operations and processes in the said Eco-sensitive Zone;

**NOW, THEREFORE**, in exercise of the powers conferred by sub-section (1) and clauses (v) and (xiv) of sub-section (2) and sub-section (3) of section 3 of the Environment (Protection) Act 1986 (29 of 1986) (hereafter in this notification referred to as the Environment Act) read with sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby notifies an area to an extent varying from 0 (zero) kilometer (sharing inter-State boundary with the State of Nagaland) to 22.54 kilometers around the boundary of Hollongapar-Gibbon Sanctuary, in Jorhat District in the State of Assam as the Hollongapar-Gibbon Sanctuary Eco-sensitive Zone (hereafter in this notification referred to as the Eco-sensitive Zone) details of which are as under, namely:-

1. **Extent and boundaries of Eco-sensitive Zone.** - (1) The Eco-sensitive Zone shall be to an extent of 0 (zero) kilometer (sharing interstate boundary with the State of Nagaland) to 22.54 kilometers around the boundary of Hollongapar-Gibbon Sanctuary and the area of the Eco-sensitive Zone is 264.62 square kilometres.
  - (2) The boundary description of Hollongapar-Gibbon Sanctuary and its Eco-sensitive Zone is appended in **Annexure-I**.
  - (3) The maps of the Hollongapar-Gibbon Sanctuary demarcating Eco-sensitive Zone along with boundary details and latitudes and longitudes are appended as **Annexure-IIA** and **Annexure-IBB**.
  - (4) List of geo-coordinates of the boundary of Hollongapar-Gibbon Sanctuary and Eco-sensitive Zone are given in **Table A** and **Table B** of **Annexure-III**.
  - (5) The list of villages falling in the Eco-sensitive Zone along with their geo co-ordinates at prominent points is appended as **Annexure-IV**.
2. **Zonal Master Plan for Eco-sensitive Zone.** - (1) The State Government shall, for the purposes of the Eco-sensitive Zone prepare a Zonal Master Plan within a period of two years from the date of publication of this notification in the Official Gazette, in consultation with local people and adhering to the stipulations given in this notification for approval of the competent authority in the State.
  - (2) The Zonal Master Plan for the Eco-sensitive Zone shall be prepared by the State Government in such manner as is specified in this notification and also in consonance with the relevant Central and State laws and the guidelines issued by the Central Government, if any.
  - (3) The Zonal Master Plan shall be prepared in consultation with the following Departments of the State Government, for integrating the ecological and environmental considerations into the said plan:-
    - (i) Environment;
    - (ii) Forest and Wildlife;
    - (iii) Agriculture and Horticulture;



ANNEXURE- I

**BOUNDARY DESCRIPTION FOR ECO-SENSITIVE ZONE OF HOLLONGAPAR-GIBBON  
SANCTUARY IN THE STATE ASSAM**

**East:-** From GPS Point No. 1 ( $94^{\circ} 23' 14.681''$  E &  $26^{\circ} 41' 29.920''$  N) the boundary runs along the Tea Garden crossing the GPS Point No.2 till it meets the GPS Point No. 3 ( $94^{\circ} 22' 16.632''$  E &  $26^{\circ} 40' 17.275''$  N). From GPS Points No.3 the boundary runs towards south along the road till it meets the GPS Points No.4 ( $94^{\circ} 22' 27.612''$  E &  $26^{\circ} 40' 3.979''$  N). From GPS Points No.4 again the boundary runs along the Tea Garden boundary crossing the GPS Point No.5 till it meets the GPS Points No.6 ( $94^{\circ} 23' 9.328''$  E &  $26^{\circ} 39' 47.632''$  N). From GPS Points No.6 again the boundary runs towards south along the road till it meet the GPS Points No.7 ( $94^{\circ} 23' 36.674''$  E &  $26^{\circ} 39' 15.625''$  N). From GPS Points No.7 the boundary runs along the Tea Garden till it meets the GPS Points No.8 ( $94^{\circ} 23' 54.414''$  E &  $26^{\circ} 38' 45.600''$  N). From GPS Point No. 8 the boundary runs towards east along the reserve forest boundary of Disai Reserve Forest crossing the GPS Point No. 9 & 10 till it meets the GPS Point No.11 ( $94^{\circ} 27' 10.359''$  E &  $26^{\circ} 39' 16.601''$  N). From GPS Point No.11 the boundary runs along the reserve forest boundary (Assam Nagaland Inter-State Boundary) till it meet the GPS Point No.12 ( $94^{\circ} 27' 57.392''$  E &  $26^{\circ} 38' 0.138''$  N).

**South:-**From GPS Point No. 12 ( $94^{\circ} 27' 57.392''$  E &  $26^{\circ} 38' 0.138''$  N) the boundary runs towards west along the reserve forest boundary of Disai & Disai Valley reserve forests (Assam Nagaland Inter-State Boundary) crossing the GPS Point No. 13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28 & 29 till it meets the GPS Point No. 30 ( $94^{\circ} 18' 59.946''$  E &  $26^{\circ} 27' 32.039''$  N).

**West:-**From GPS Point No. 30 ( $94^{\circ} 18' 59.946''$  E &  $26^{\circ} 27' 32.039''$  N) the boundary runs towards north along the reserve forest boundary of Disai Valley reserve forest (Assam Nagaland Inter-State Boundary) crossing the GPS Points No. 31,32,33,34 & 35 till it meets the GPS Point No. 36 ( $94^{\circ} 17' 4.305''$  E &  $26^{\circ} 33' 44.203''$  N). From GPS Point No. 36 the boundary turn towards east along the Disai Valley reserve forest boundary crossing the GPS Points No. 37,38,39,40 & 41 till it meets the GPS Point No. 42 ( $94^{\circ} 23' 6.610''$  E &  $26^{\circ} 37' 57.755''$  N). From GPS Point No. 42 the boundary runs towards north along the right bank of river Bhogdai or Disai river crossing the GPS Points No. 43,44,45,46,47,48,49 & 50 till it meets the GPS Point No.51 ( $94^{\circ} 16' 48.306''$  E &  $26^{\circ} 43' 59.786''$  N).  $23^{\circ} 24.281''$  E &  $26^{\circ} 44' 18.300''$  N). From GPS Point No. 56 the boundary runs towards south along the road crossing the GPS Point No.57 till it meets the GPS Point No. 58 ( $94^{\circ} 24' 2.960''$  E &  $26^{\circ} 41' 18.688''$  N). From GPS Point No. 58 the boundary runs towards west along the road till it meets the GPS Point No. 59 ( $94^{\circ} 23' 16.032''$  E &  $26^{\circ} 40' 50.899''$  N).

**North:-** From GPS Point No. 59 the boundary runs towards north along the road till it meet the GPS Point No. 1 ( $94^{\circ} 23' 14.681''$  E &  $26^{\circ} 41' 29.920''$  N). The Western boundary of the Sanctuary share inter-state boundary with Nagaland and hence is 0.0 km of Eco-Sensitive Zone is being proposed. The extent of Eco-Sensitive Zone varies from 0.0 Km (interstate boundary with Nagaland) to 22.54 km.

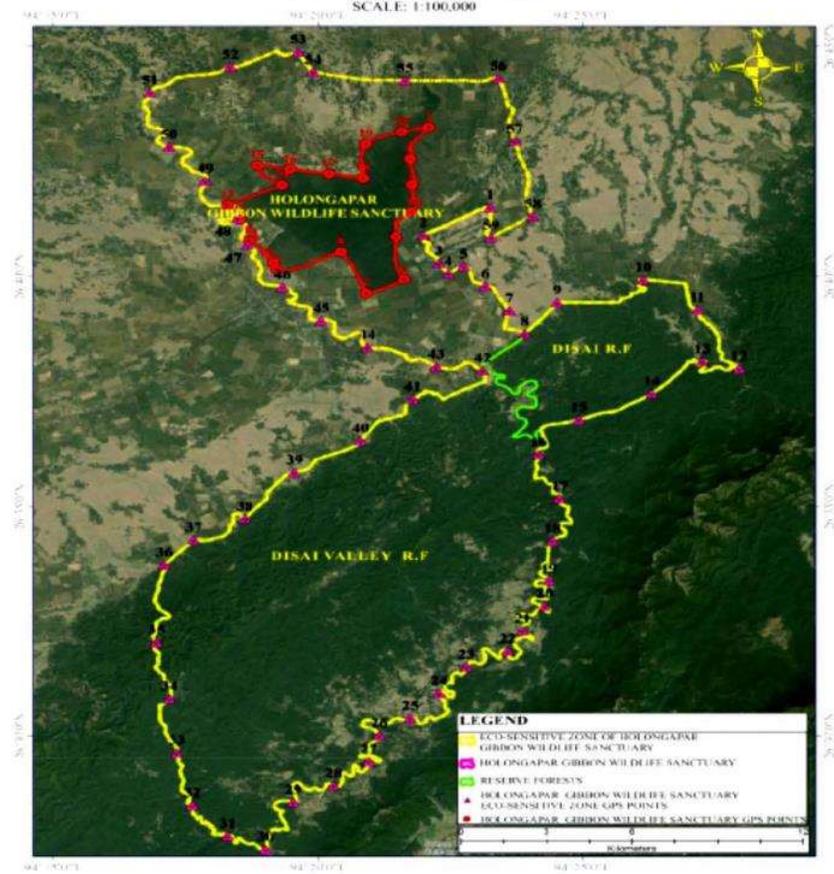


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ANNEXURE- I

GOOGLE MAP OF ECO-SENSITIVE ZONE OF HOLLONGAPAR-GIBBON SANCTUARY ALONG WITH  
 LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS

ECO-SENSITIVE ZONE OF HOLLONGAPAR GIBBON  
 WILDLIFE SANCTUARY

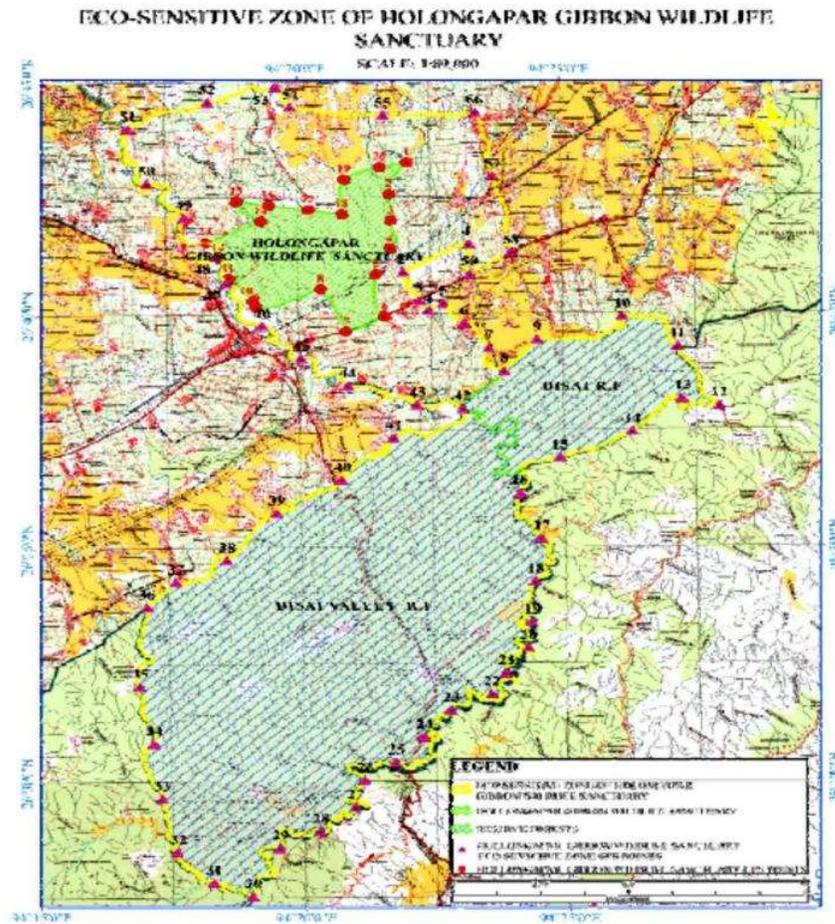




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ANNEXURE- IIB

MAP SHOWING LANDUSE PATTERN OF ECO-SENSITIVE ZONE OF HOLLONGAPAR-GIBBON SANCTUARY ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS





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**ANNEXURE-III**

**TABLE A: GEO- COORDINATES OF PROMINENT LOCATIONS OF HOLLONGAPAR-GIBBON SANCTUARY**

GPS POINTS	LONGITUDE	LATITUDE
1	94° 22' 5.369" E	26° 43' 14.526" N
2	94° 21' 44.154" E	26° 42' 33.281" N
3	94° 21' 45.902" E	26° 41' 59.451" N
4	94° 21' 44.588" E	26° 41' 24.186" N
5	94° 21' 28.134" E	26° 40' 51.434" N
6	94° 21' 37.449" E	26° 39' 56.337" N
7	94° 20' 54.065" E	26° 39' 37.576" N
8	94° 20' 25.370" E	26° 40' 32.105" N
9	94° 19' 13.121" E	26° 40' 8.556" N
10	94° 19' 8.815" E	26° 40' 17.324" N
11	94° 18' 41.036" E	26° 40' 46.645" N
12	94° 18' 30.120" E	26° 41' 14.195" N
13	94° 18' 15.841" E	26° 41' 32.983" N
14	94° 19' 18.964" E	26° 41' 59.067" N
15	94° 18' 50.889" E	26° 42' 24.862" N
16	94° 19' 27.784" E	26° 42' 19.920" N
17	94° 20' 12.239" E	26° 42' 13.733" N
18	94° 20' 50.712" E	26° 42' 7.986" N
19	94° 20' 53.612" E	26° 42' 52.873" N
20	94° 21' 34.283" E	26° 43' 8.484" N

**TABLE B: GEO-COORDINATES OF PROMINENT LOCATIONS OF ECO-SENSITIVE ZONE**

GPS POINTS	LONGITUDE	LATITUDE
1	94° 23' 14.681" E	26° 41' 29.920" N
2	94° 21' 58.733" E	26° 40' 54.190" N
3	94° 22' 16.632" E	26° 40' 17.275" N
4	94° 22' 27.612" E	26° 40' 3.979" N
5	94° 22' 44.856" E	26° 40' 13.435" N
6	94° 23' 9.328" E	26° 39' 47.632" N
7	94° 23' 36.674" E	26° 39' 15.625" N
8	94° 23' 54.414" E	26° 38' 45.600" N
9	94° 24' 31.095" E	26° 39' 26.119" N
10	94° 26' 8.448" E	26° 39' 56.055" N
11	94° 27' 10.359" E	26° 39' 16.601" N
12	94° 27' 57.392" E	26° 38' 0.138" N



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भारत का राजपत्र : असाधारण

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13	94° 27' 15.774" E	26° 38' 9.378" N
14	94° 26' 18.451" E	26° 37' 27.401" N
15	94° 24' 55.909" E	26° 36' 53.720" N
16	94° 24' 9.908" E	26° 36' 8.385" N
17	94° 24' 33.452" E	26° 35' 10.842" N
18	94° 24' 25.974" E	26° 34' 15.262" N
19	94° 24' 21.288" E	26° 33' 23.163" N
20	94° 24' 16.844" E	26° 32' 49.680" N
21	94° 23' 51.958" E	26° 32' 17.464" N
22	94° 23' 34.682" E	26° 31' 50.761" N
23	94° 22' 47.947" E	26° 31' 30.131" N
24	94° 22' 16.926" E	26° 30' 55.641" N
25	94° 21' 44.231" E	26° 30' 23.364" N
26	94° 21' 9.009" E	26° 30' 0.605" N
27	94° 20' 57.257" E	26° 29' 26.790" N
28	94° 20' 17.557" E	26° 28' 55.367" N
29	94° 19' 31.392" E	26° 28' 33.835" N
30	94° 18' 59.946" E	26° 27' 32.039" N
31	94° 18' 16.389" E	26° 27' 49.605" N
32	94° 17' 36.034" E	26° 28' 29.485" N
33	94° 17' 18.566" E	26° 29' 38.238" N
34	94° 17' 10.442" E	26° 30' 48.756" N
35	94° 16' 55.540" E	26° 32' 2.181" N
36	94° 17' 4.305" E	26° 33' 44.203" N
37	94° 17' 37.623" E	26° 34' 16.571" N
38	94° 18' 35.813" E	26° 34' 44.390" N
39	94° 19' 32.812" E	26° 35' 44.785" N
40	94° 20' 47.911" E	26° 36' 26.203" N
41	94° 21' 46.973" E	26° 37' 20.167" N
42	94° 23' 6.610" E	26° 37' 57.755" N
43	94° 22' 13.726" E	26° 38' 2.520" N
44	94° 20' 55.265" E	26° 38' 27.840" N
45	94° 20' 3.032" E	26° 39' 2.789" N
46	94° 19' 19.293" E	26° 39' 46.253" N
47	94° 18' 39.098" E	26° 40' 41.041" N
48	94° 18' 27.490" E	26° 41' 15.839" N
49	94° 17' 51.098" E	26° 42' 4.516" N
50	94° 17' 9.801" E	26° 42' 49.134" N
51	94° 16' 48.306" E	26° 43' 59.786" N



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52	94° 18' 19.472" E	26° 44' 33.213" N
53	94° 19' 37.013" E	26° 44' 52.619" N
54	94° 19' 53.855" E	26° 44' 26.751" N
55	94° 21' 38.543" E	26° 44' 15.740" N
56	94° 23' 24.281" E	26° 44' 18.300" N
57	94° 23' 42.683" E	26° 42' 56.295" N
58	94° 24' 2.960" E	26° 41' 18.688" N
59	94° 23' 16.032" E	26° 40' 50.899" N



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Annexure 4: Corridor 31 – Letter from DFO, Majuli (T) Forest Division, Majuli



GOVERNMENT OF ASSAM  
OFFICE OF THE DIVISIONAL FOREST OFFICER  
MAJULI (T) FOREST DIVISION, MAJULI

Letter No. B/MAJULI/G-29/2020/.*tb4*

Dated 26/02/2020

To,

The Chief Engineer (EAP)  
PWRD, Assam  
Fatasil Aambari, Guwahati-25

Sub: Tree cutting evaluation on Project roads.

Ref: Letter no. CE/AXOM MALA/12/2019/9 dated 5/11/2019

Sir,

I have the honour to furnish here with the details as desired.

1. Details of forest area : There is no Reserve Forest on the proposed Majuli (From Balichapori Tinali)- Balijan Ghat in Majuli district. However, the trees on either side of the road falls on Govt land and Forest department has control over the same.

2. Information on flora and fauna:

Flora: Mainly tree/ grass species are found on either side of the road viz. Simalu, Gamari, Bhelko, Ajar, Jari, Dimaru, Nahor, Bowal, Huwalu, Sationa, Uriam, Som, Aam, Krishnachura, Hilikha, Aamari, Owtenga etc and Bamboos.

Fauna: Except some birds no major fauna is available.

3. Type and number of animals present: Animals not present

4. Length of the forest area adjacent to the Project road: Govt land all along the road.

5. Map and extent of forest cover: N/A

6. Total trees to be removed: 347 = 299.2226 M3 ( In Majuli district part)

7. Cost of cutting, de-branching, sectioning, dragging to diesel point, loading, transporting to temporary depot/s unloading, stacking and formation of lots complete

299.2226 M3 @ Rs. 3300/- M3 : Rs, 9,88,000.00

(The actual volume can only calculated after completion of the timber operation)

Yours faithfully

  
Divisional Forest Officer  
Majuli (T) Forest Division,  
Majuli



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Annexure 5: Corridor 31 – Letter from FBO, Bihpuria, Lakhimpur Forest Division, Lakhimpur

8/3/2020

GOVERNMENT OF ASSAM  
OFFICE OF THE FOREST BEAT OFFICER, BIHPURIA BEAT:  
BIHPURIA

Memo No. B/09/Roadside Tree/2020/49

Date: 14-03-2020

To  
The Forest Range Officer  
Harmutty Range, Harmutty

Sub: Tree Cutting Evaluation on project works.

Sir,

With reference to the subject as mentioned above, I have the honour to inform you that, the M/S Fortress Infracon Ltd and Feedback Infra Ltd. on behalf of PWRD,GoA, has given a list of various plants falls at the roadside to be proposed for remove during road construction from Bongalmora to Dhunaguri which is under process for DPR preparation. The agency has marked all plant from shrubs, bamboos to battle nut trees falls within 8 meter from the center line of project road and included in the list. During field verification, the trees which have non valued outturn either firewood or timber has eliminated from the list and total 1044 no.s tree carrying total approximate volume 631.705 cum has been enumerated among the marked which details is hereby enclosed.

Also, as the data has been requested from PWRD,GoA, it is to be informed that, no any Forest area or Wildlife Sanctuary is exist there in that land from where the road passes within Bongalmora to Dhunaguri.

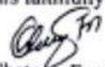
The total cost to be estimated for enumeration, felling, sectioning, dragging and also depot maintaining etc. for those trees is as follows:

Total 631.705 cum x Rs.3400/cum = Rs. 21,47,797/= (Twenty One Lakhs Forty Seven Thousand Seven Hundred Ninety Seven)

This is for favour of your kind information and necessary action

Encl:As stated above.

Yours faithfully

  
( Sri G. Chetry, Forester I )  
Forest Beat Officer,  
Bihpuria Beat  
Bihpuria



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Annexure 6: Corridor 31 – NOC from Director, Inland Waterways Authority of India, Regional Office, Guwahati



भारतीय अन्तर्देशीय जलमार्ग प्राधिकरण  
(पत्तन, पोत परिवहन और जलमार्ग मंत्रालय, भारत सरकार)  
INLAND WATERWAYS AUTHORITY OF INDIA  
(MINISTRY OF PORTS, SHIPPING AND WATERWAYS, GOVT. OF INDIA)

Regional Office : Pandu Port Complex, Pandu, Guwahati – 781 012 (ASSAM)  
• Telefax No. 0361-2570099, 2570055 • Ph. No. 0361-2570109, 2676925, 2676927, 2676929  
• E-mail: lwaighy@yahoo.co.in / dirguw.iwai@nic.in • Gram: JALMARG

No.JWAI/GHY/3(20)/NCL/2016-17 (Vol-IV)/401

Date: 16-03-2021

*D. Gouami  
ACE  
To  
R. Prusty  
19/5/21*

To:  
The Chief Engineer  
PWRD (EAP), Assam  
Fatasil Ambari, Guwahati-25

Sub: **NOC for construction of River Bridge across Subansiri River in NW-95-reg.**

Ref: (1) Your letter No. CE/AXOM MALA/9/2019/PI-III/25 dated 10-08-2020  
(2) Report on Joint Inspection dated 22-01-2021  
(3) Drawing No. LSB/SR/GAD-01 dated 06-07-2020

Sir,

Reference above, Competent Authority has accorded the approval of "Navigational Clearance" on your proposal for construction of River Bridge across Subansiri River (NW-95).

2. This approval (Navigational Clearance) is granted for construction of aforesaid bridge as indicated by you in the prescribed format of IWAI and the GAD, submitted with the proposal. The proposed construction is to be carried out as per Annex-II of IWAI's Office Memorandum dated 27-08-2007 (copy enclosed).

3. It is requested to inform the time/date of commencement of the proposed construction (stage wise/periodical) to IWAI so that the same can be monitored to ensure the required Navigational Clearance. Also, during the construction of the structure, safety of the vessels plying in the vicinity is to be ensured.

Yours faithfully,

*[Signature]*  
Director

Encl: As above.

Copy to: Chief Engineer (Tech), IWAI, Noida

*Ms. S. Gouami, AE  
Pl. fwd. up  
D.  
22/5/21*



BIODIVERSITY ASSESSMENT REPORT (DRAFT)

Annexure 7: Corridor 15 – NOC for Elephant Underpass

GOVERNMENT OF ASSAM  
OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS (WILDLIFE) AND  
CHIEF WILDLIFE WARDEN, ASSAM :: PANJABARI :: GUWAHATI-37

Email ID: [pcef.wl.assam@gmail.com](mailto:pcef.wl.assam@gmail.com)

No. WL/FG.35/Upgradation of Dhodar Ali,

Dated: 22.03.2021

To,

The Chief Engineer (EAP),  
PWRD Assam,  
Fatasil Ambari, Guwahati-25.

Sub: Improvement and upgradation of Dhodar Ali road (Kumargaon to Kamarbandha) under Asom Mala.

Ref: (i) No. CE/AXOM MALA/9/2019/Pt-I/27, Dt. 29.12.2020.  
(ii) No. CE/AXOM MALA/12/2019/Pt-I/53, Dt. 22.02.2021  
(iii) No. CE/AXOM MALA/12/2019/Pt-I/49, Dt. 16.03.2021

Sir,

With reference to your letter cited above, I wish to inform you that the improvement & upgradation of Dhodar Ali of length 42.1 Km between Kumargaon to Kamarbandha under the programme Axom Mala may be carried out subject to the modification with revised design of two underpasses of 30 mtr. length and 7 mtr. height on the identified section of the road (as per your specifications) where elephants used to cross.

This is for your kind information and necessary action.

Yours faithfully,

(M.K. Yadava, IFS)

Addl. Principal Chief Conservator of Forests, Wildlife  
& Chief Wildlife Warden, Assam.

Copy for information to:

1. The Principal Chief Conservator of Forests & Head of Forest Force, Assam.
2. The Addl. Principal Chief Conservator of Forests (T), Upper Assam Zone, Guwahati.
3. The Conservator of Forests, Eastern Assam Circle, Jorhat,
4. The Divisional Forest Officer, Golaghat division, Golaghat.

Addl. Principal Chief Conservator of Forests, Wildlife  
& Chief Wildlife Warden, Assam.