Consultancy Services for conducting an Environmental and Social Impact Assessment (ESIA) of Urban Roads (Town roads) and non-urban roads and Major/Minor bridges and preparation of Environmental and Social Management instruments under MITP (World Bank) initiative

ESIA Report of Nongstoin-Maweit Road

CETEST Engineering Consultants

C. E. TESTING COMPANY PRIVATE LIMITED

Report No PI/CTKI21-19/R0

Revision No. 01

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CHAPTER-I: INTRODUCTION AND PROJECT BACKGROUND

Meghalaya is a hilly state in north eastern India. The state shares its international boundaries with Bangladesh-South & West of Meghalaya are adjacent to Mymensingh, Sylhet and Rangpur division of Bangladesh, respectively and northern part of this hilly state is boarded by another northeastern state, Assam. Economic growth of this state has been hampered compared to other states of India, due to socio-geographical reasons, poor communication, low agricultural and industrial outputs. The Public Works Department (PWD) of the Government of Meghalaya is the implementing rehabilitation / up-gradation of existing roads and construction of missing links/bypasses/bridges in the major stretches (Nongstoin-Maweit, Umsning-Jagi Road, Borsora road, Cherragoan road, Bagli and Nongpoh-Umden-Sonapur) in the State of Meghalaya.

The Government of Meghalaya has stepped up investments in the development of transport infrastructure using financial assistance (loan) from the World Bank (IBRD) under its Meghalaya Integrated Transport Project (MITP) for the enhancement of the transport Infrastructure in the State. The state Government has assigned the work of improvement/rehabilitation of roads and construction of bridges (under the World Bank funded MITP) to Public Works Department (PWD) of the Government of Meghalaya. This department designs plans for rehabilitation / up gradation of existing roads and construction of missing links / bypasses / bridges in the stretches from Nongstoin-Maweit (35km), Umsning- Jagi Road (40km), Borsora (6.50Km), Cherragoan (6.80 Km), Bagli (4.00 Km), Nongpoh-Umden-Sonapur (25.0km), Shillong town roads (12.591km), Jowai Town roads (34.843km), Nongstoin Town roads (20.752 km) and Williamnagar Town roads (23.451 km).

M/s Consulting Engineers Group Ltd. in JV with M/s C.E. Testing Company Pvt. Ltd. has been chosen by Public Works Department (PWD) of the Government of Meghalaya to perform Consultancy Services for Preparation of Detailed Project Report (DPR) for above discussed stretch.

The PWD of Meghalaya issued Letter of award vide letter No. PW/CE/NH/WB/4/2021/58 dated 13.07.2021. The agreement for the project has been signed on 13.07.2021.

Details of the project stretches are elaborated below:

Non-Urban Roads

1 **Nongstoin-Maweit corridorsection**hasa length of 35km in the West Khasi Hills districts of Meghalaya state. The Project Road will connect the major towns and villages.

2 **Umsning-Jagi Road corridor (SH-8) section**extendsup to 40 km length in district Ri-Bhoi of Meghalaya state. The project road starts from the junction with National Highway - 6 /Asian Highway. The NH-6 is a Jorabat to Shillong stretche and it is also part of the Asian Highway. It is mainly connected between the cities of Guwahati andShillong. The project scope ends at Km 40.00 of SH-8 near Sonidan town

3 **Up-Gradation/improvement of road to Export point from the main road Borsora corridor sections** coversa length of 6.50 Km, Cherragoan corridor sections has a length of 6.80 Km, and Bagli corridor sections has a Length of 4.00 Km. These roads are located under the Districts of South West Khasi Hills of Meghalaya state. (**Border road**)

4 **Nongpoh-Umden-Sonapur Road corridor section** has a length of 25 km in the districts Ri-Bhoi of Meghalaya state. The project road starts from Nongpoh connecting

with NH-6 /Asian Highway. The NH-6 is mainly connected between Guwahati to Shillong. The scope of project road ends at junctions of RDBR road near Umden town.

Urban Roads

1. **Shillong Town Roads**:

   All the project roads come under East Khasi Hills district, Meghalaya and passes through the Shillong town. Eleven roads are parts of this project road having total length of 12.59 Kms.

2. **Jowai Town Roads:**

   All the project roads come under West Jaintia Hills district and are a part of Jowai town. Total 54 roads are part of this project road having a total length of 34.85 Kms.

3. **Nongstoin Roads:**

   All the project roadscome under West Khasi Hills district and are a part of Nongstoin town. Total 24 roads are part of this project having a total length of 20.75 Kms.

4. **Williamnagar Town:**

   All the project roads come under East Garo Hills district and are a part of Williamnagar town. 35 roads are part of this project having a total length of 23.45 Kms.

   The present Environment and Social Impact Assessment (ESIA)report has been prepared for the **Nongstoin-Maweit Road corridor** under Non-urban Roads.

Nongstoin-Maweit Road:

- Nongstoin-Maweit Road section has a length of 35 km in the district West Khasi Hills of Meghalaya state.
- The project road starts from the junction with Riangdo-Shillong road near the bridge over Nondein river at Nongstoin.
- The project road ends at Km 34.801 near the first bridge at Nonghyllam-Maweit road.
- It connects towns/ Villages viz. Nongpyndeng, Mawlait, Nongthraw, Wahlyndoh, Nongsbah, Mawdong, Miangshang, Nongpathar, Maweit and Nonglyer
- The project road passes through hilly and rolling terrains.

The Project Road

Nongstoin-Maweit Road extendsup to 35 km length in the West Khasi Hills district of Meghalaya state. The road project starts from the junction with Riangdo-Shillong Road near bridge over Nondein river at Nongstoin. The project road ends at 34.801 km near the first bridge at Nonghyllam-Maweit road.

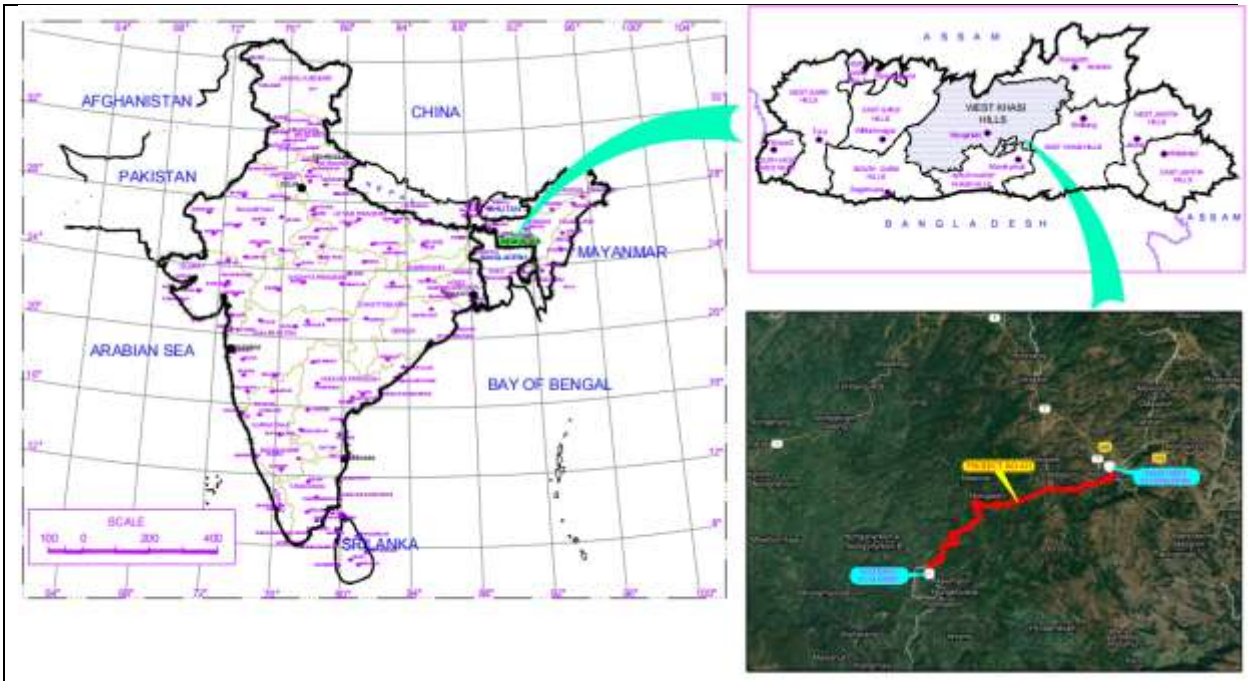


Figure 1: Location Map of the Nongstoin-Maweit Road

Objective of the Project:

Project aims to improvethe transport efficiency of the state road network, which will contribute to expansion of economic opportunities and poverty reduction. This will be realized by

- up gradation/ reconstruction/ widening as well rehabilitationof selected roads:
- improving the state highway network,
- facilitating safe and appropriate road usage,
- Improving public and external stakeholder support and awareness.
- increasing efficiency of transport services and
- Enhancing GoM capacity for road asset development

Project immediate outcome will be improved accessibility to social services and markets, increased fuel efficiency, reduced travel time, reduced accidents, reduced vehicle emissions and better employment opportunities outside agriculture, both through improved access to economic centres and increased industrial activities in the project area.

Scope of the Project:

The proposed subprojects are part of Meghalaya Integrated Transport Program (MITP) for which the Environmental and Social Safeguard Management Framework (ESMF) has been prepared and disclosed at the websites of MIDFC and the World Bank. It is also noted that specifically for the rural roads the ESMF guidelines delineated under PMGSY RRP II (P165402) and subsequently revised for Additional Finance in 2018 is to be followed.

- Preparation of application and supplementary reports (survey and preparation) as required for obtaining project clearances like forest /environmental/wildlife

clearances, if applicable, and presentation before expert panel committees of MoEF&CC, Govt. of India.

2. Undertake the given special and additional assessments, as applicable.
3. Application of scientific and expert judgement for adding or skipping any element of the assessment
4. Preparation of screening report for all the subprojects and defining the Scope of Work (SoW) for detailed assessment, if required.
5. Screening report willinclude the Environment and Social Management Plans, Health and Safety Plans including COVID 19 management plans, Stakeholder Engagement Plan, Public Disclosure, Grievance Redressal Mechanism and Resettlement Action Plan, if required.
6. It willconsider but not be limited to the following:

2) Conducting a comprehensive Environmental and Social Screening for all the subprojects.

3) Establishing an environmental and social baseline for the project area.

4) Conducting detailed Environmental and Social Impact Assessment (ESIA) only for those subprojects against which the need for detailed assessment has been recommended as an outcome of the Screening Activity.

5) Integration of ESIA findings and ESMP budget in engineering feasibility studies.

6) Preparation of any Environmental and Social Management Plan (ESMP), Health and Safety Plans including COVID 19 management plan, Resettlement Action Plan (RAP), Tribal (Indigenous) Development Plan (TDP), Gender Action Plan; Labor Management Procedure and Stakeholder Engagement Plan (SEP) etc.

7) Preparation of application and supplementary reports (survey and preparation) required as per local regulatory requirements for obtaining project clearances like forest/environmental/wildlife clearances, if applicable, and presentation before expert panel committees of MoEF&CC, Govt. of India.

8) Conduct consultations with identified stakeholders and project-affected parties /community from early project planning and design stages of the assignment.

9) Develop monitoring programme to ensure that the proposed mitigation measures are being implemented effectively.

Table 1:Project Salient Features

Sl.	Salient Features	Details
1	Design Chainage	0+000 to 34+801
2	Overall Length (Km)	34.801
3	Proposed Carriageway width	5.5m C/W throughout the project road
		7.0m C/W is proposed in 900 m length of project road
4	Major Junctions (Nos.)	4
5	Minor Junctions (Nos.)	32
6	Major Bridge	Nil

Sl.	Salient Features	Details
7	Minor Bridge (up to 30m waterway)	14
8	Minor Bridge (more than 30m waterway)	1
9	Total Culverts (Nos)	164
10	Bus Shelters (Nos.)	20 locations (both side), 40 Nos.
11	Slope Protection	Hydro seeding at Gabion Wall, Breast Wall
12	Project Cost	191.51

Structure of ESIA Report

As per the EIA notification of the MoEF& CC dated 14 September 2006 & subsequent amendments, a generic structure for the EIA report has been documented
The EIA report for the project road has been prepared complying to the country regulations and The World Bank Guidelines for Environmental Assessment. The report has been structured into the following Chapters:

Chapter -I: Introduction and Project Background

Chapter -II: Project Description

Chapter -III: Need of Environmental & Social Impacts Assessment

Chapter -IV: Legal Framework

Chapter -V: Description of Environment

Chapter -VI: Analysis of Potential Environmental & Social Impacts & Mitigation Measures

Chapter -VII: Environmental Monitoring Program

Chapter -VIII: Climate Change Impact & Risk

Chapter -IX: Public Consultation

Chapter -X: Resettlement Action Plan

Chapter -XI: Abbreviated Resettlement Action Plan

Chapter -XII: Environment and Social Management Plan

Chapter -XII: Conclusions & Recommendations

CHAPTER-II: Project Description

Nongstoin-Maweit Road section has a length of 35 km in the West Khasi Hills district of Meghalaya state. The project road starts from the junction with Riangdo-Shillong Road near bridge over Nondein river at Nongstoin. The project road ends at 34.801 km near the first bridge at Nonghyllam-Maweit road. It is under jurisdiction of PWD, Nongstoin Division. The project road will pass through mostly hilly and rolling terrain. This road passes through towns/ Villages viz. Nongpyndeng, Mawlait, Nongthraw, Wahlyndoh, Nongsbah, Mawdong, Miangshang, Nongpathar, Maweit and Nonglyer.

Need for the Project

The project stretch has bitumen surface throughout. The entire bituminous surface has stripped away as a result of water accumulation for long periods. Existing road is not motorable and thus 'poor' in condition. The safety provision of road is also inadequate. Therefore, it is imperative to upgrade this road section to standard configuration with adequate safety measures in order to enhance traffic operational efficiency and to ensure safety to road users, so that the objective of improving the connectivity to the Khudoi Falls and the Kohmang Falls is met.

Project Location

The project road starts from the junction with Riangdo-Shillong Road near bridge over Nondein river at Nongstoin. The project road ends at 34.801 km near the first bridge at Nonghyllam-Maweit road. The Project Highway corridor is situated in Eastern Part of India in the state of Meghalaya. The project is located in the Universe Transverse Meter (UTM) zone 46. The height of the dissected Meghalaya Plateau is 150 meters - 1961 meters above sea level. The project road start point is at latitude of 25°31'40.25"N and longitude of 91°15'24.74"E. The end point is at latitude of 25°25'50.97"N and longitude of 91°04'24.82"E. The existing road level varies from 1325 meter at start point to 720 meter at end point of the project road.

Figure 2:Project Start Point at junction with Riangdo-Shillong road

Figure 3: Project End Point at Nonghyllam-Maweit Road

Existing Features of the Project

The existing project features are given below.

Table 2: Project Feature

Sl.	Project Component	Details
1	Location of Project	Nongstoin-Maweit (35km). Project road is situated in Eastern Part of India in the state of Meghalaya.
2	Administrative locations	West Khasi Hills
3	State	Meghalaya
4	Length of the project section	34.801 km
5	Terrain	The project road passes mostly through hilly terrain and few stretches pass through rolling terrain
6	Major Settlement along the Project Stretch	Nongpyndeng, Mawlait, Nongthraw, Wahlyndoh, Nongsbah, Mawdong, Miangshang, Nongpathar, Maweit and Nonglyer
7	Land use	The adjoining land is generally hilly with vegetation. Agricultural land used for cultivation is also observed in a few locations.
8	Forest area	No forest area along the project area
9	Bridge	There are total 15 Nos. of Bridges along the project road
10	Road Configuration	Existing project road is single lane
11	Pavement condition	Existing road is not motorable, thus 'poor' in condition.
12	High embank road stretches	Nil

Right of Way (RoW)

The existing right of way along the project road varies from 7 m to 20 m. Care has been taken to design the project road without land acquisition to reduce the corridor of impact.

Proposed Land Acquisition

As the Proposed Right of Way is well within the existing Right of Way, so No New Land is required and thus No Land Acquisition.

Proposed Cross Section Details

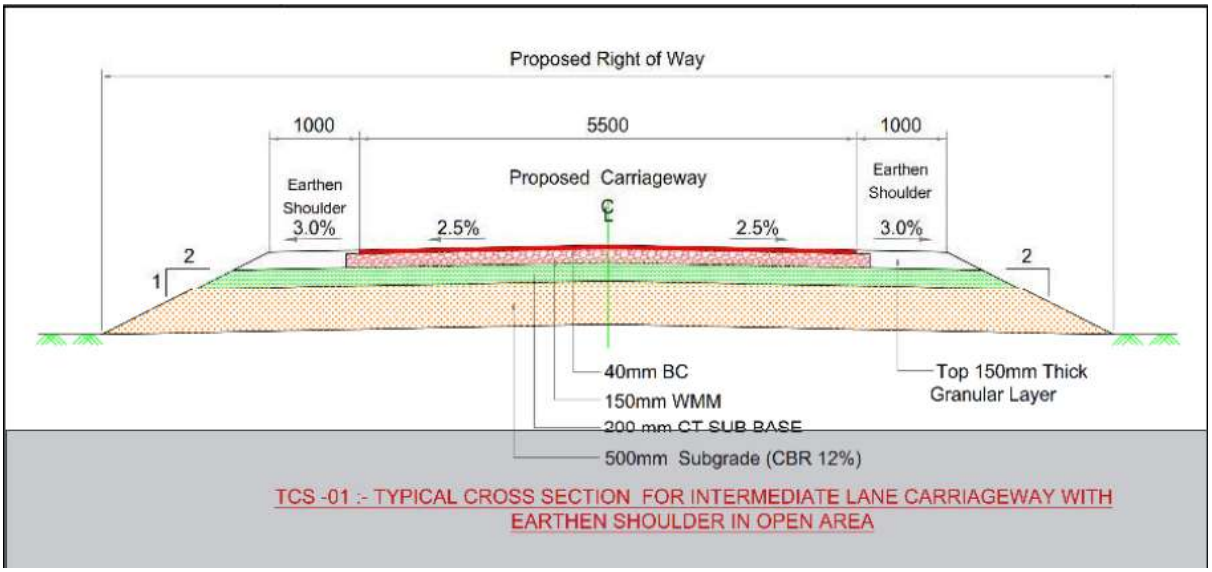
Carriageway Width: The carriageway configuration of two lanes with a paved and hard shoulder is proposed for the project road having a 7.0 m carriageway width.
Shoulder: Paved Shoulder and Earthen shoulders are proposed to be 1.0m and 1.0m respectively on both sides of the Carriageway.
Footpath: The 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.
Embankment Slopes: Side slopes shall not be steeper than 2H:1V.
Typical Cross Section: The Typical cross section summary for the complete project stretch is shown in the table below:

Table 3:Typical Cross Section Summary

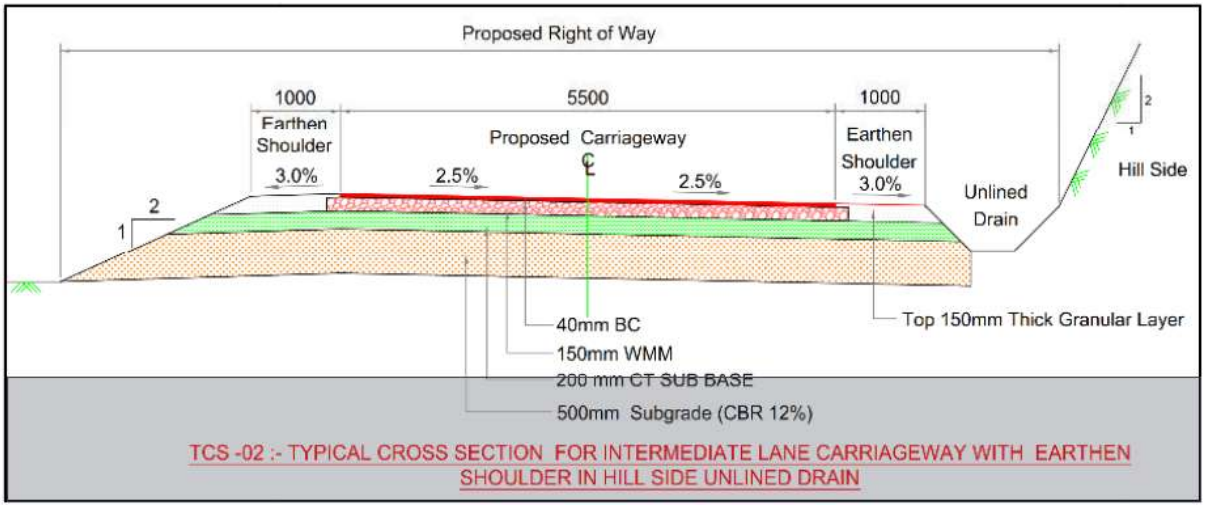
TCSNo.	Description	Net Length(m)	CD StructureLength (m)	TotalLength(m)
TCS-1	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulderIn Open Area	1785.5	134.5	1920.0
TCS-2	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulderIn Hill SideUnlinedDrain	11697.6	103.5	11801.0
TCS-3	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill SidePCC Drain	9944.8	115.2	10060.0
TCS-4	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulderIn Valley SideGabion Wall	287.1	47.9	335.0
TCS-5	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InValleySideREWall withGabion Facia (Both side)	372.9	87.1	460.0
TCS-6	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InValleySideGabion Wall &In Hill SideUnlinedDrain	783.0	2.0	785.0
TCS-7	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill Side PCC Drain AndValley SideGabion Wall	571.0	4.0	575.0
TCS-8	Typical Cross Section	2586.0	4.0	2590.0

	ForIntermediateLaneCarriageway With EarthenShoulder with both sideUnlined Drain			
TCS-9	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill SideDrain CumBreastWall and othersideUnlineddrain	598.0	2.0	600.0
TCS-10	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill Side DrainCumBreastWall	1307.0	8.0	1315.0
TCS-11	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill Side DrainCumBreastWall And Valley Side GabionWall	228.0	2.0	230.0
TCS-12	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill SideDrain CumBreastWall and othersidePCC drain	1255.0	20.0	1275.0
TCS-13	Typical Cross Section ForIntermediateLaneCarriageway With BothSidePaverBlock In Built-Up Area	2837.0	18.0	2855.0
Total=	**34252.9**	**548.15**	**34801**	

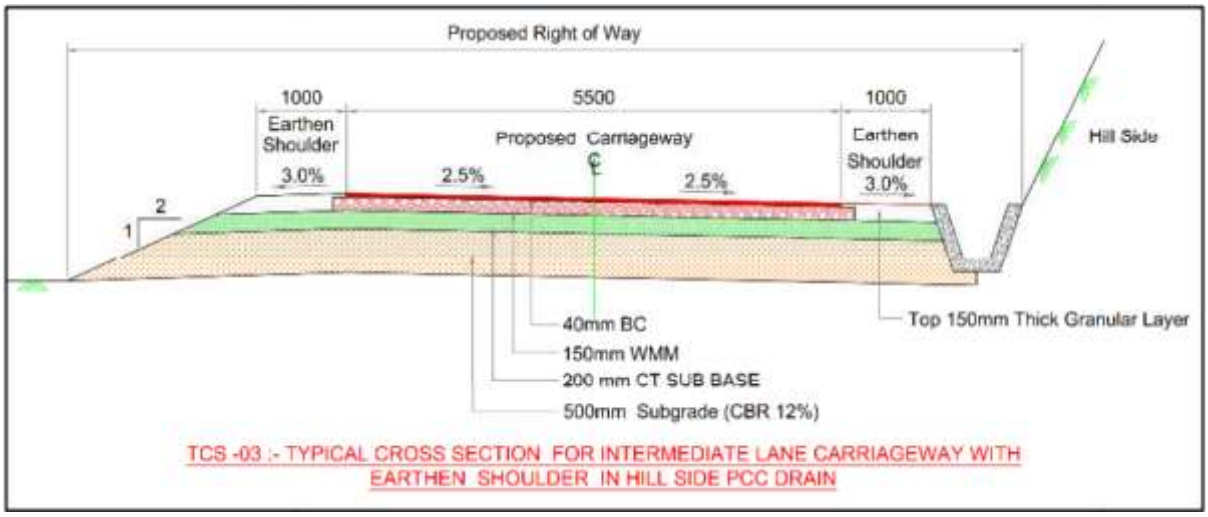
Typical cross sections (TCS) for various configurations proposed in built up area and open country area in rolling/hilly terrain are shown below:



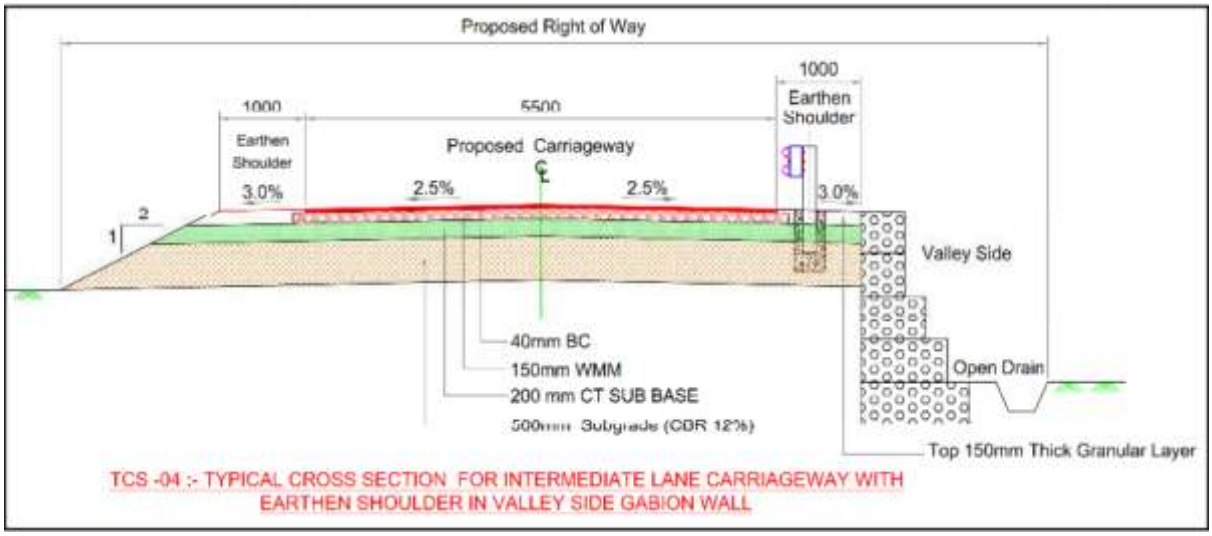
TCS -01 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN OPEN AREA



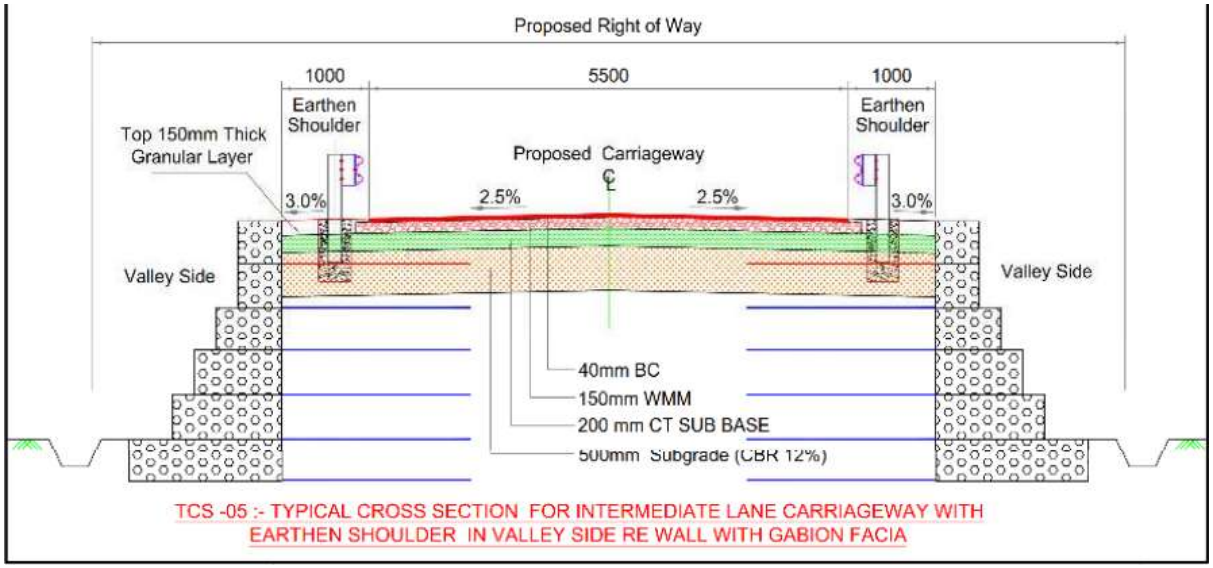
TCS -02 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE UNLINED DRAIN



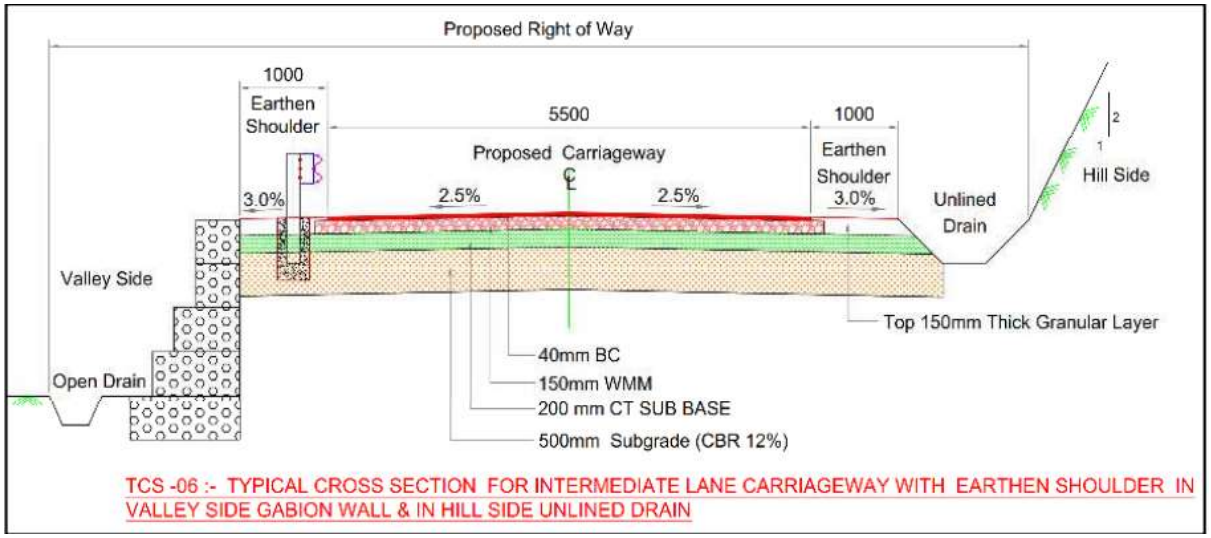
TCS -03 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE PCC DRAIN



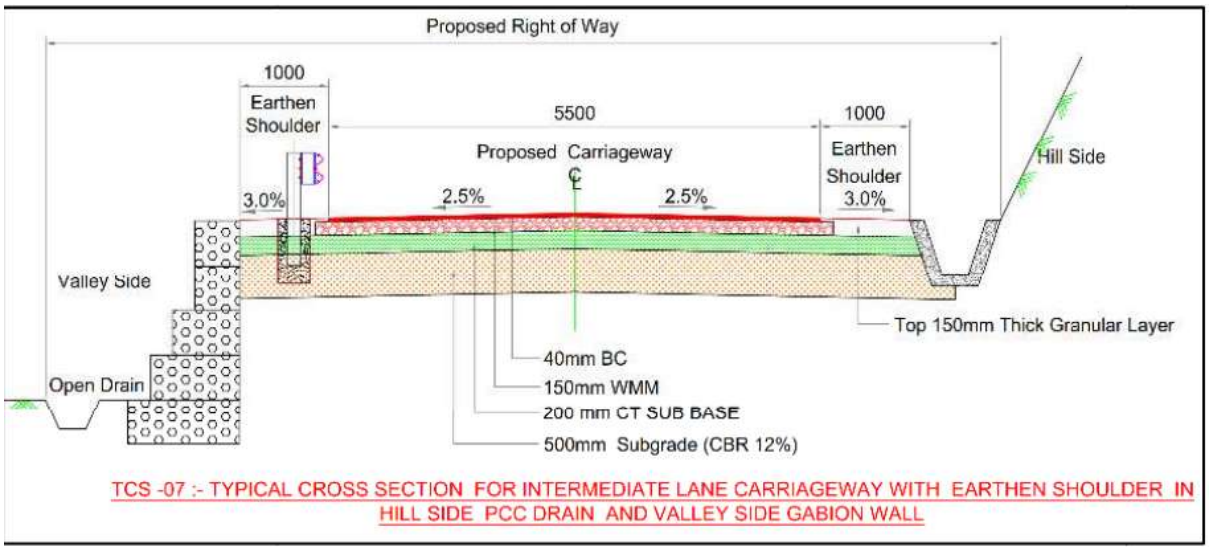
TCS -04 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN VALLEY SIDE GABION WALL



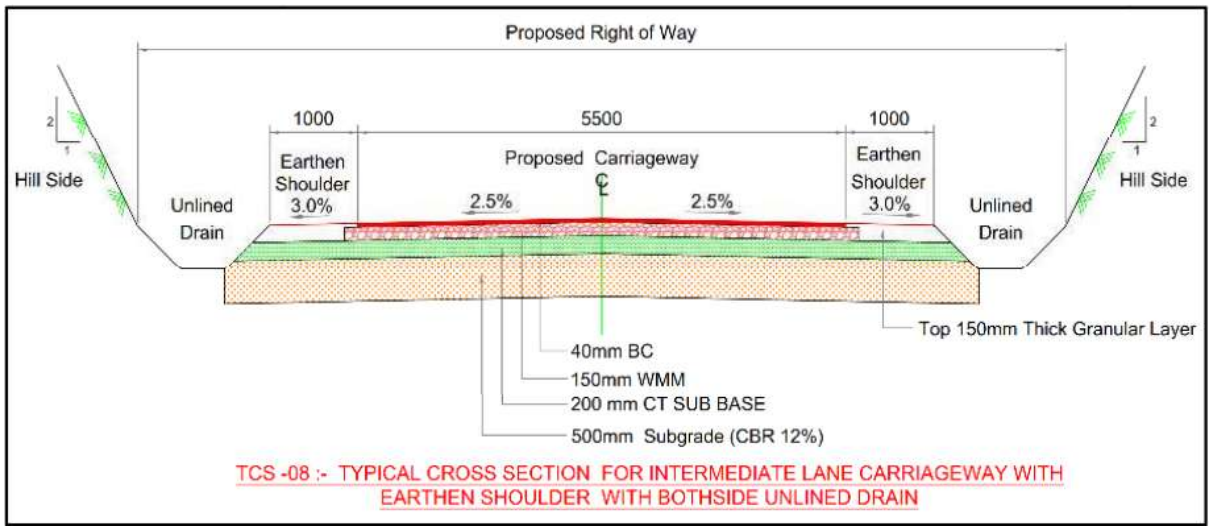
TCS -05 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN VALLEY SIDE RE WALL WITH GABION FACIA



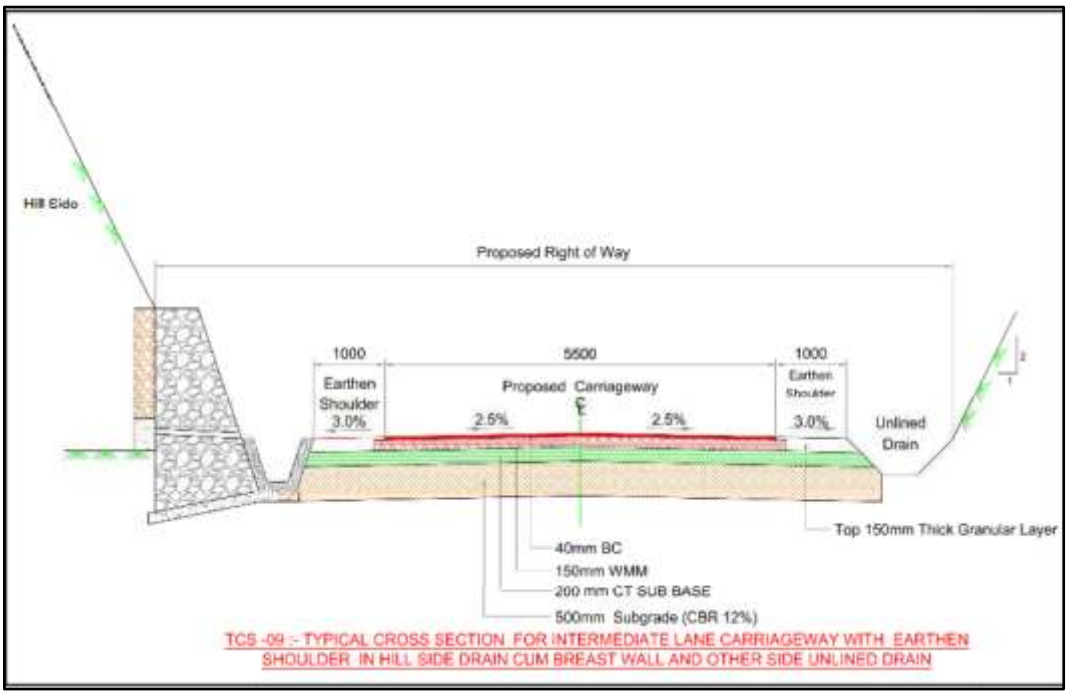
TCS -06 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN VALLEY SIDE GABION WALL & IN HILL SIDE UNLINED DRAIN



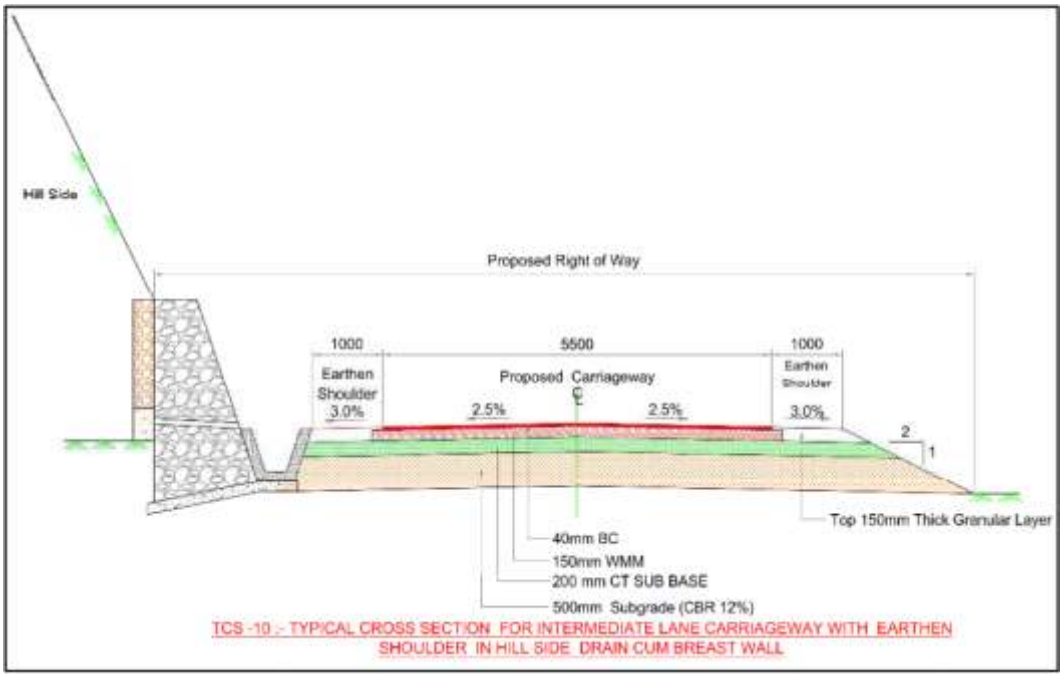
TCS -07 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE PCC DRAIN AND VALLEY SIDE GABION WALL



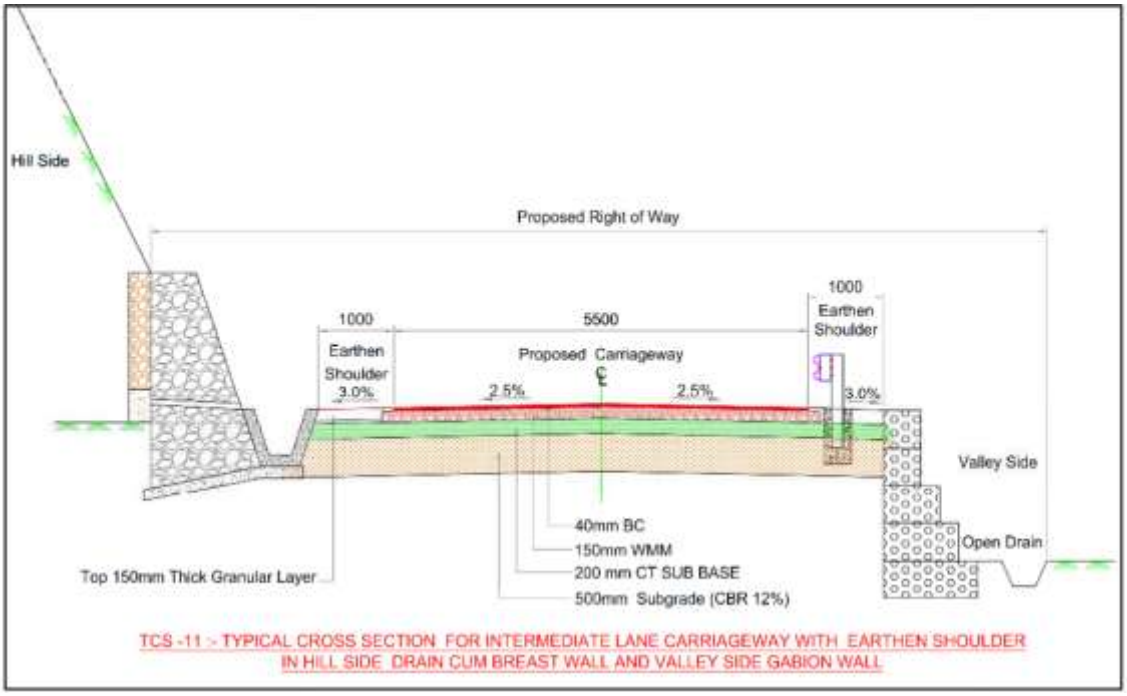
TCS -08 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER WITH BOTHSIDE UNLINED DRAIN



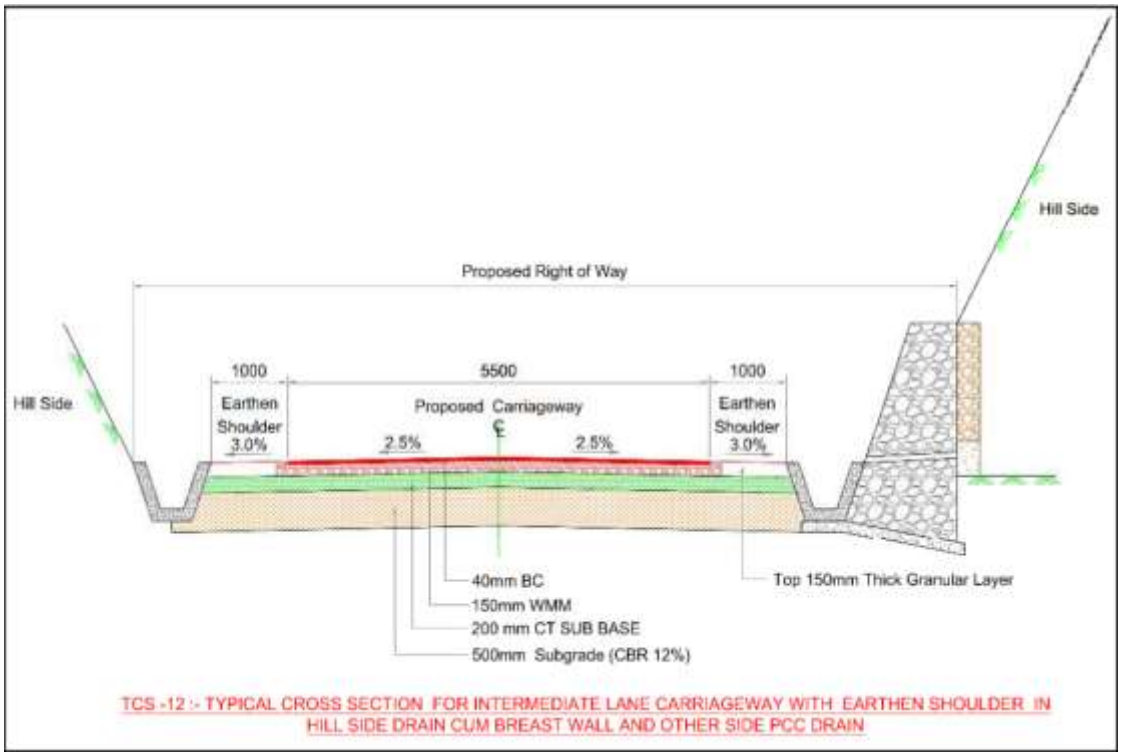
TCS -09 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE DRAIN CUM BREAST WALL AND OTHER SIDE UNLINED DRAIN



TCS -10 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE DRAIN CUM BREAST WALL



TCS -11 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE DRAIN CUM BREAST WALL AND VALLEY SIDE GABION WALL



TCS -12 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE DRAIN CUM BREAST WALL AND OTHER SIDE PCC DRAIN

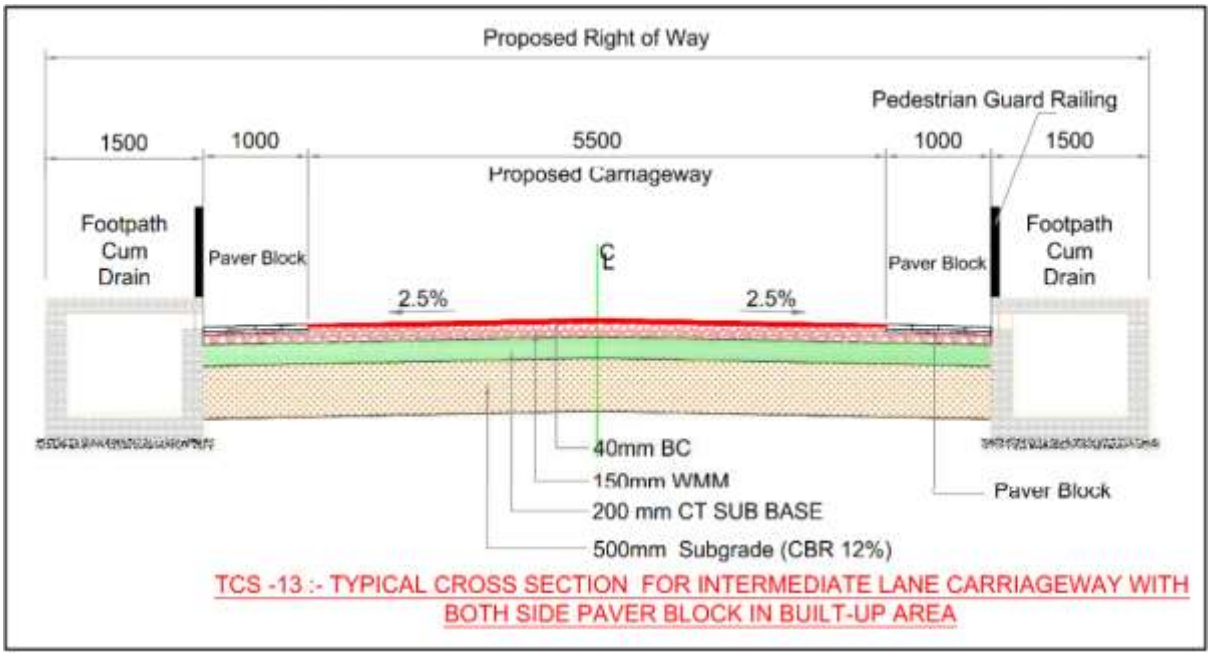


Figure 4:Typical cross sections

Current and Projected Daily Traffic

The traffic data used is taken fromthe survey conducted in April 2021 by PWD, Meghalaya at Thahkanar at km 6.000 and at Nonglyndoh at km 20.000 for 3days.

- **Average Daily Traffic**

Based on site visit observations, The AADT for 2 locations are given as follows:

Table 4: AADT at Thahkanar (6th Km)

Year	Growth Factors	AADT															TotalinNumbers	TotalinPCU
		Two Wheeler	Car/Jeep/ Van/Taxi/Auto	Mini/RTVsBus	Stand.Bus	LCV	2-Axle	3-Axle	Multi-Axle	Agri.Tract.WithTrailor	Agri.Tract. WithoutTrailor	Cycle	Cycle Rickshaw	HandCart	BullockCart	HorseCart		
2021	5.0%	5	52	2	2	40	638	106	0	8	0	0	0	0	0	0	853	2390
2022	5.0%	6	55	2	2	42	670	111	0	8	0	0	0	0	0	0	895	2509
2023	5.0%	6	57	2	2	44	703	116	0	9	0	0	0	0	0	0	940	2635
2024	5.0%	6	60	2	2	46	738	122	0	9	0	0	0	0	0	0	987	2766
2025	5.0%	6	63	2	2	49	775	128	0	10	0	0	0	0	0	0	1036	2905
2026	5.0%	7	66	3	3	51	814	135	0	10	0	0	0	0	0	0	1088	3050
2027	5.0%	7	70	3	3	54	855	142	0	11	0	0	0	0	0	0	1143	3202
2028	5.0%	8	73	3	3	56	897	149	0	11	0	0	0	0	0	0	1200	3363
2029	5.0%	8	77	3	3	59	942	156	0	12	0	0	0	0	0	0	1260	3531
2030	5.0%	8	81	3	3	62	989	164	0	12	0	0	0	0	0	0	1323	3707
2031	5.0%	9	85	3	3	65	1039	172	0	13	0	0	0	0	0	0	1389	3893
2032	5.0%	9	89	3	3	68	1091	181	0	14	0	0	0	0	0	0	1458	4087
2033	5.0%	10	93	4	4	72	1145	190	0	14	0	0	0	0	0	0	1531	4291
2034	5.0%	10	98	4	4	75	1202	199	0	15	0	0	0	0	0	0	1608	4506
2035	5.0%	11	103	4	4	79	1263	209	0	16	0	0	0	0	0	0	1688	4731
2036	5.0%	11	108	4	4	83	1326	220	0	17	0	0	0	0	0	0	1773	4968
2037	5.0%	12	114	4	4	87	1392	231	0	17	0	0	0	0	0	0	1861	5216
2038	5.0%	12	119	5	5	92	1462	242	0	18	0	0	0	0	0	0	1954	5477
2039	5.0%	13	125	5	5	96	1535	254	0	19	0	0	0	0	0	0	2052	5751
2040	5.0%	13	131	5	5	101	1611	267	0	20	0	0	0	0	0	0	2155	6039
2041	5.0%	14	138	5	5	106	1692	280	0	21	0	0	0	0	0	0	2262	6340

2042	5.0%	15	145	6	6	111	1777	294	0	22	0	0	0	0	0	0	2375	6658
2043	5.0%	16	152	6	6	117	1865	309	0	23	0	0	0	0	0	0	2494	6990
2044	5.0%	16	160	6	6	123	1959	325	0	25	0	0	0	0	0	0	2619	7340

Table 5: AADT at Nonglyndoh (20th Km)

Year	Growth Factors	AADT																
		Two Wheeler	Car/Jeep/Van/Taxi/Auto	Mini/RTVs Bus	Stand.Bus	LCV	2-Axle	3-Axle	Multi-Axle	Agri.Tract. WithTrailor	Agri.Tract. WithoutTrailor	Cycle	Cycle	HandCart	BullockCart	HorseCart	TotalinNumbers	TotalinPCU
2021	5.0%	5	42	2	2	40	637	102	0	7	0	0	0	0	0	0	838	2364
2022	5.0%	6	44	2	2	42	669	107	0	8	0	0	0	0	0	0	880	2483
2023	5.0%	6	46	2	2	44	703	112	0	8	0	0	0	0	0	0	924	2607
2024	5.0%	6	48	2	2	46	738	118	0	8	0	0	0	0	0	0	970	2737
2025	5.0%	6	51	2	2	49	775	124	0	9	0	0	0	0	0	0	1018	2874
2026	5.0%	7	53	3	3	51	813	130	0	9	0	0	0	0	0	0	1069	3018
2027	5.0%	7	56	3	3	54	854	137	0	10	0	0	0	0	0	0	1123	3168
2028	5.0%	8	59	3	3	56	897	144	0	10	0	0	0	0	0	0	1179	3327
2029	5.0%	8	62	3	3	59	942	151	0	11	0	0	0	0	0	0	1238	3493
2030	5.0%	8	65	3	3	62	989	158	0	11	0	0	0	0	0	0	1299	3668
2031	5.0%	9	68	3	3	65	1038	166	0	12	0	0	0	0	0	0	1364	3851
2032	5.0%	9	71	3	3	68	1090	174	0	13	0	0	0	0	0	0	1433	4044
2033	5.0%	10	75	4	4	72	1145	183	0	13	0	0	0	0	0	0	1504	4246
2034	5.0%	10	79	4	4	75	1202	192	0	14	0	0	0	0	0	0	1580	4458
2035	5.0%	11	82	4	4	79	1262	202	0	15	0	0	0	0	0	0	1659	4681
2036	5.0%	11	87	4	4	83	1325	212	0	15	0	0	0	0	0	0	1741	4915
2037	5.0%	12	91	4	4	87	1391	223	0	16	0	0	0	0	0	0	1829	5161
2038	5.0%	12	96	5	5	92	1461	234	0	17	0	0	0	0	0	0	1920	5419

2039	5.0%	13	100	5	5	96	1534	245	0	18	0	0	0	0	0	0	2016	5690
2040	5.0%	13	105	5	5	101	1611	258	0	19	0	0	0	0	0	0	2117	5975
2041	5.0%	14	111	5	5	106	1691	271	0	19	0	0	0	0	0	0	2223	6273
2042	5.0%	15	116	6	6	111	1776	284	0	20	0	0	0	0	0	0	2334	6587
2043	5.0%	16	122	6	6	117	1864	298	0	21	0	0	0	0	0	0	2450	6916
2044	5.0%	16	128	6	6	123	1958	313	0	23	0	0	0	0	0	0	2573	7262

Proposed Bridges and Culvert

4 Nos. of RCC bridges are found structurally sound with minimum 7.650m carriageway width and hence are proposed to be retained while the remaining 11 nos. wooden bridges need to be reconstructed.

Out of the 196 nos. of existing culverts, 45 nos. are Pipe Culvert, 1 no. is RSJ with WoodenDeck & 150 nos. are Slab culvert. All culverts present in the project road are either hydraulically inadequate or structurally unsafe & hence are proposed for reconstruction. 41 Nos.Pipe Culvert and 123 Nos. Slab Culvert are proposed to be reconstructed and remaining 32 nos. are not required due to realignment proposed at this location.

Proposed Roadside Drainage

To ensure effective drainage of water, road side drainage system has been provided throughout the project stretch. The details of the roadside drainage are shown in typical cross section and drawing volume. The summary of roadside drainage is shown in the table below:

Table 6:Summary of Proposed Drain

Sl.	Type	Length (m)
1	Unlined Drain	18251
2	PCC Drain	15159
3	RCCCoveredDraincum Footpath	5674

Trapezoidal drains have been proposed at the hill side locations. The details are as follows:

Table 7:Summary of Proposed PCC Trapezoidal Drain on road

Chainage(m)		Side	Length(m)	Length ofCD (m)	NetLength(m)
From	To				
5825	6175	Hill	350		350
6175	6410	Hill	235	2	233
6770	6875	Hill	105		105
6875	6920	Hill	45		45
6920	7025	Hill	105		105
7300	7650	Hill	350	4	346
8050	8675	Hill	625	8	617
9820	10755	Hill	935	34.24	900.76
11695	11975	Hill	280	4	276
12020	12335	Hill	315	2	313
12420	12450	Hill	30		30
12450	12495	Hill	45		45
12780	12930	Hill	150	2	148
12930	12990	Hill	60		60
12990	13110	Hill	120		120
13390	13460	Hill	70		70
13460	13560	Hill	100	2	98
13560	13620	Hill	60	2	58
14150	14180	Hill	30		30
14210	14250	Hill	40		40
14250	14350	Hill	100		100
16320	16440	Hill	120		120
16440	16925	Hill	485	15	470

Chainage(m)		Side	Length(m)	Length ofCD (m)	NetLength(m)
From	To				
17650	17975	Hill	325	4	321
17975	18075	Hill	100	2	98
18075	18750	Hill	675		675
18750	18820	Hill	70		70
19030	19175	Hill	145		145
19360	19590	Hill	230	2	228
19590	19640	Hill	50		50
19640	19760	Hill	120	2	118
20080	20290	Hill	210	2	208
20410	20460	Hill	50		50
20460	20490	Hill	30		30
20490	20530	Hill	40		40
20530	21040	Hill	510	6	504
21040	21090	Hill	50		50
21300	21400	Hill	100	2	98
21400	21475	Hill	75		75
21475	21550	Hill	75	2	73
21550	21580	Hill	30		30
21580	21630	Hill	50	2	48
21630	21910	Hill	280	2	278
21910	21980	Hill	70		70
21980	22030	Hill	50	2	48
22030	22075	Hill	45		45
22075	22380	Hill	305	2	303
22380	22420	Hill	40		40
22420	22470	Hill	50		50
22470	22530	Hill	60	2	58
22530	22575	Hill	45		45
22575	22610	Hill	35		35
22610	22660	Hill	50		50
22975	23030	Hill	55		55
23030	23100	Hill	70		70
23100	23140	Hill	40		40
23140	23200	Hill	60	2	58
23200	23260	Hill	60		60
23260	23575	Hill	315	2	313
24525	25050	Both	525	6	1038
25050	25175	Hill	125	2	123
25175	25310	Hill	135		135
26425	26725	Hill	300		300
27200	27275	Hill	75		75
27275	27630	Hill	355		355
27630	27660	Hill	30	2	28
27660	27700	Hill	40		40
27700	28125	Hill	425	2	423
28125	28190	Hill	65		65
28190	28925	Hill	735	2	733

Chainage(m)		Side	Length(m)	Length ofCD (m)	NetLength(m)
From	To				
28925	29675	Both	750	14	1472
29675	29800	Hill	125	2	123
31950	32410	Hill	460	2	458
32410	32460	Hill	50	2	48
32460	33000	Hill	540	6	534
TotalLength (m)					**15159**

Unlined drainsareprovidedon hill sideof theprojectroad as per requirement. Thedetails areasfollows:

Table:8Summary of Proposed Unlined Drain

Chainage(m)		Side	Length(m)	LengthofCD (m)	Net Length(
From	To				
330	880	One	550	6	544
880	950	One	70		70
950	1050	One	100	2	98
1050	1100	One	50		50
1100	1380	One	280	4	276
1450	1775	One	325		325
2200	2250	One	50		50
2250	2325	Both	75		150
2500	2570	Both	70		140
2570	2620	One	50		50
3300	3420	Both	120		240
3570	3640	Both	70		140
4410	4510	One	100		100
4510	4590	Both	80		160
4630	4675	One	45		45
4675	4780	Both	105		210
5080	5140	One	60		60
5190	5250	One	60		60
5250	5350	Both	100		200
5350	5410	One	60		60
5475	5510	One	35		35
5510	5600	Both	90		180
5650	5710	Both	60		120
5710	5775	One	65		65
5775	5825	Both	50		100
5825	6175	One	350		350
6410	6440	One	30		30
6440	6620	One	180		180
6650	6700	One	50		50
6700	6770	Both	70		140
6770	6875	One	105		105
6875	6920	One	45		45
7080	7300	One	220	2	218

Chainage(m)		Side	Length(m)	LengthofCD (m)	Net Length(
From	To				
7650	7905	One	255		255
8725	9400	One	675	6	669
9700	9760	One	60		60
9760	9820	Both	60		120
10755	10900	Both	145		290
10900	11125	One	225	4	221
11125	11200	Both	75		150
11275	11415	One	140		140
11415	11455	Both	40		80
11455	11625	One	170	4	166
12335	12420	Both	85		170
12495	12730	One	235		235
12730	12780	Both	50		100
13110	13210	One	100		100
13210	13350	One	140	2	138
13350	13390	One	40		40
13620	13720	One	100		100
13720	13750	One	30		30
13750	13860	One	110	2	108
13860	13890	Both	30		60
13890	14150	One	260	14.75	245.25
14180	14210	One	30		30
14350	14380	Both	30		60
14430	14470	One	40		40
14470	14570	Both	100		200
14650	14950	One	300		300
14950	15100	Both	150		300
15100	15150	One	50	2	48
15150	15200	Both	50		100
15200	15630	One	430	2	428
15630	15760	Both	130		260
15820	15960	One	140		140
15960	16020	Both	60		120
16020	16210	One	190	4	186
16210	16240	One	30		30
16240	16320	One	80	2	78
16925	17060	One	135	2	133
17060	17130	Both	70		140
17130	17650	One	520		520
18820	19030	One	210	2	208
19175	19360	One	185	4	181
19760	19850	One	90		90
19930	19980	One	50		50
20290	20360	Both	70		140

Chainage(m)		Side	Length(m)	LengthofCD (m)	Net Length(
From	To				
20360	20410	One	50		50
20410	20460	One	50		50
21090	21300	One	210		210
22660	22690	One	30		30
22690	22790	One	100		100
22790	22830	One	40		40
22830	22975	One	145		145
23575	23645	Both	70		140
23645	24330	One	685	10.7	674.3
24380	24525	Both	145	2	286
25430	25675	One	245		245
25730	25900	One	170	2	168
25900	25970	Both	70		140
25970	26020	One	50		50
26020	26240	Both	220	2	436
26240	26425	One	185		185
26725	27030	One	305	2	303
27030	27080	Both	50		100
27080	27200	One	120	2	118
29800	29875	One	75		75
29875	29940	One	65		65
29940	30000	One	60		60
30000	30310	One	310	6	304
30450	31250	One	800	10	790
31250	31310	One	60		60
31310	31340	One	30		30
31390	31750	One	360	2	358
32410	32460	One	50	2	48
33000	33630	One	630	4	626
34340	34801	One	461	2	459
TotalLength (m)					**18251**

Proposed Pedestrian and Animal Crossing

On the basis of site visit data and traffic data, no pedestrian underpass is proposed. There is no animal movement corridor along or across the project road. Therefore no animal underpass is needed.

Wayside Amenities

- **Bus Shelters**

Passenger shelters have been proposed at 20 nos. of locations near built up areas (both side). The details are given in Table9.

Table 9:Details of Proposed Bus Shelters

Sl.	Chainage(km)	Side
1	0+370	Both
2	0+990	Both
3	1+850	Both
4	2+575	Both
5	3+460	Both
6	4+430	Both
7	5+400	Both
8	7+930	Both
9	9+220	Both
10	11+000	Both
11	14+220	Both
12	17+690	Both
13	19+750	Both
14	22+310	Both
15	24+225	Both
16	25+620	Both
17	30+235	Both
18	32+800	Both
19	33+915	Both
20	34+475	Both

- **Truck Lay Bye**

No Truck Lay Byes areproposed along the project road.

- **Footpath**

Drain cum footpath facility has been provided in urban areas for the safety of pedestrians.

Table 10:Details of Footpath

Chainage(m)		Side	Length(m)	Lengthof CD(m)	Net Length(m)
From	To				
0	330	Both	330	2	656.0
1775	2200	Both	425	4	842.0
2620	3300	Both	680	6	1348.0
3700	4410	Both	710	4	1412.0
33630	34340	Both	710	2	1416.0
TotalLength					**5674.0**

- **Paver Block**

Paver blocks have been provided in urban areas as per the below table.

Table 11:Details of Paver Block

Chainage(m)		Side	Length(m)	Lengthof CD(m)	Net Length(m)
From	To				
0	330	Both	330	2	656.0
1775	2200	Both	425	4	842.0

Chainage(m)		Side	Length(m)	Lengthof CD(m)	Net Length(m)
From	To				
2620	3300	Both	680	6	1348.0
3700	4410	Both	710	4	1412.0
33630	34340	Both	710	2	1416.0
TotalLength (m)					**5674.0**

Pavement Condition

The project stretch has bitumen surface throughout. The entire bituminous surface has stripped away as a result of water accumulation for long periods. Existing road is not motorable and thus 'poor' in condition. But some parts of the road is intact and motorable and in 'good' condition. The summary of the visual pavement condition survey (carried out in September 2021) of the project roads are given below:

Table 12:Summary of Pavement Condition

Nongstoin-MaweitRoad				
Sl.	From(Km)	To (Km)	Length (Km)	PavementCondition (Good/Fair/Poor)
1	0.000	0.060	0.060	Good
2	0.060	2.780	2.720	Fair
3	2.780	2.843	0.063	Good
4	2.843	4.175	1.332	Fair
5	4.175	35.312	31.137	Poor

Construction Material Requirement

- **Quarry and Crusher Information**

Stone quarry and crusher locations are located close to each other. The Crusher is located approximately 200 metres ahead of the Quarry location. Information is provided below:

Table 13:Details of Stone Quarry

Description	Location	Lead	Coordinates	
			N	E
Stone Quarry	Porsohsat	23.2 kms from the Centre Point of the total road to the Crusher	2824936	329266

- **Sand**

Table 14:Details of Sand Quarry

Description	Location	Lead	Coordinates	
			N	E
Sand	Jaidoh village on Nongkasen to Nongkhlaw Road	33.8 kms from the Centre point of the total road to the Quarry	334477	2819531

Stone Quarry (Crusher) at Porsohsat

Fine aggregate - Sand quarry on Nongkasen Nongkhlaw Road

Figure 5: Photos of Aggregate, Borrow Area

Estimated Project Cost

The amount of each item is evaluated on the basis of relevant unit rates analyzed from Standard Data Book of Ministry of Road Transport and Highways (MoRTH). Summary of Preliminary Cost Estimate for all the improvement works is presented table below

Table 15:Summary of Project Cost

BillNo.	Description	Amount (Rs.)	Amount (Cr.)
1	SiteClearance	1,24,44,328	1.244
2	Earthwork	16,55,83,800	16.558
3	Sub BaseAndBaseCourses	46,99,73,398	46.997
4	BituminousCourses	11,75,81,632	11.758
5	Culverts		
5(a)	PipeCulvert	3,00,49,599	3.005
5(b)	Slab Culvert	15,69,86,689	15.699
6	Bridges		
6(a)	MajorBridges		
6(b)	MinorBridges	13,86,39,046	13.864
6(c)	RepairAndRehabilitation OfExistingStructures		
7	DrainageAnd ProtectiveWorks		
7A	DrainageWorks	10,96,13,899	10.961
7B	Breast Wall	7,58,68,600	7.587
7C	Gabion Wall	10,58,02,282	10.580
7D	Crash Barrier&Railing	2,96,96,026	2.970
7E	HydroSeeding With Jute Net	58,34,136	0.583
8	Traffic Signs, Markings,Safety DevicesAndRoad Appurtenances	4,16,44,742	4.164
9	Junction	2,01,06,668	2.011
10	Bus Shelter	1,40,00,000	1.400

11	Traffic Management DuringConstruction	1,01,06,368	1.011
12	Utility Shifting	1,00,00,000	1.000
A	**TOTALCONSTRUCTION COST(Without GST)**	**1,51,39,31,213**	**151.39**
B	**TOTALCONSTRUCTION COST(Including 12% GST)**	**1,69,56,02,959**	**169.56**
1	Contingencies@1% of(A)above	15139312.13	1.514
2	Agency charges@3% of (A)	45417936.39	4.542
3	Supervision Charges@3% of (A)	45417936.39	4.542
4 4	MaintenanceCharges(2.5%of A)(Firstyear-Nil, 2 nd year-0.5%, 3rd year-0.5%,4th year-0.5%&5thyear1%.)	37848280.33	3.785
5	PriceEscalation @5% perannumfor1 yearof (F)	75696560.65	7.570
	Total EMP Cost	**29,02,000**	0.30
C	**TOTALPROJECTCOST**	**1,91,80,24,958**	**191.81**
D	**TOTALPROJECTCOSTPERKm**	**5,50,30,688**	**5.503**

Implementation Schedule:

Since as a widening proposal intermediate lane has been proposed a construction period of 730 days (2022-23, 2023-24) has been envisaged with a phasing of 60% & 40%respectively.

Sub-project Benefits

The Project Benefits comprise the cost saving in operation of vehicles and maintenance of the road between Without Project and With Project options. The Project Benefits results in the form of-:

- Savings in Vehicle Operating Costs (VOC)- Vehicle Operating Cost (VOC) will be reduced when riding quality of the road is improved
- Savings in travel time costs due to reduction in congestion and higher travel speeds as a result of improved roads - both in terms of capacity as well as riding quality;
- Savings in maintenance costs- Maintenance and Operation cost such as fuel consumption, wear and tear of tyres, will be sufficiently reduced. The vehicle operating cost shall be further reduced by improving the geometrics and design. The benefits perceived by the road user are in the form of lower expenditure
- The proposed project will also contribute to economic development by encouraging attraction of businesses to sites equipped with good access and by improving the travel efficiencies of existing businesses and to start a new avenue
- Reductions in adverse environmental impacts of transportations i.e. reduced traffic emissions, decrease in respirable suspended particulate matter and suspended particulate matter, reduced Noise and other impacts are also the direct benefits of proposed upgradation of the project road

CHAPTER-III: NEED OF ENVIRONMENT & SOCIAL IMPACT ASSESSMENT

The analysis of the environmental features with respect to the project alignment and the extentof identified impacts due to project, reflect that most of the impacts are of low and medium extentand mainly related to construction activities, which are mostly temporary in nature. Based on theenvironmental screening, an environmental screening checklist is added in **Error! Reference source not found.**,the project is classified as Category-B project in accordance with WorldBank's Policy (OP 4.01 Environmental Assessment) and therefore it warrants site specificEnvironmental Impact Assessment.

Similarly, in accordance with World Bank's Operational Policy OP 4.12 (Involuntary Resettlement), this project mandates the preparation of the Social Impact Assessment (SIA) and Resettlement Action Plan (RAP). Accordingly, detailed assessments of the environmental and social impacts have been carried out following a suitable methodology.

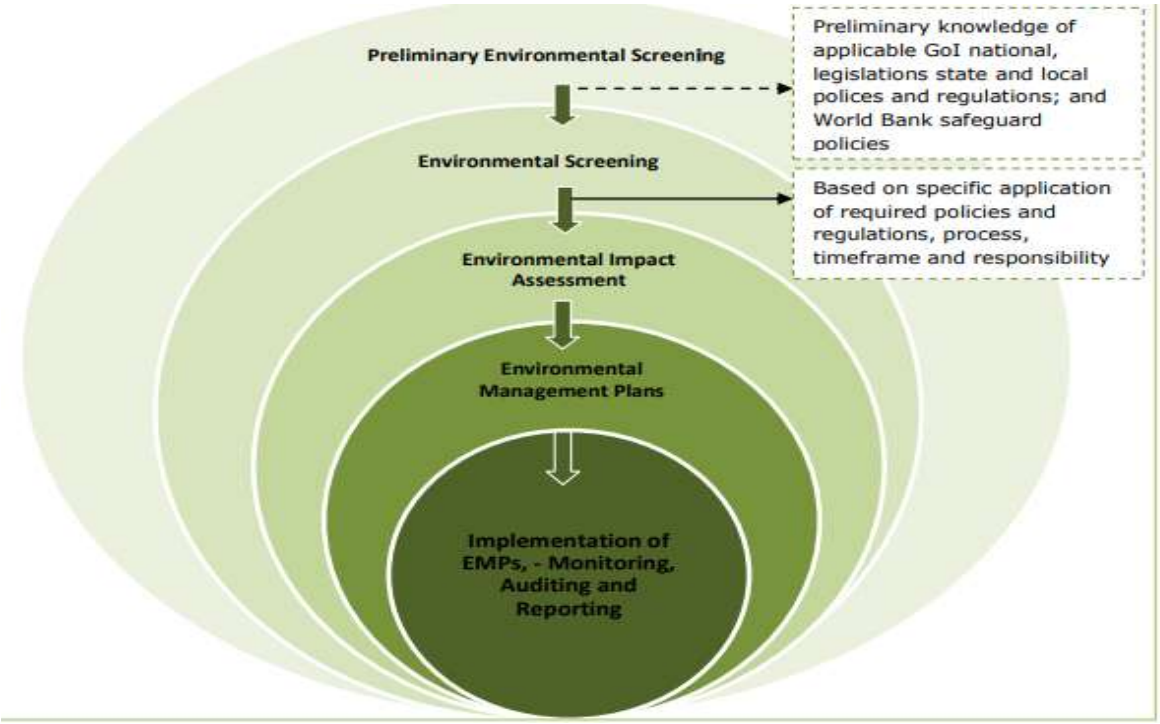
This ESIA shall cover, the environmental and social impacts due to the project, concerning construction-related environmental impacts, infringements in natural habitats and places of cultural heritage, also in the context of 'chance-find', and impacts on local population/ community. The findings of ESIA will guide the effective development of the specific ESMP and facilitate the implementation of safeguard measures appropriately.

Project Approach for Environmental Studies

The approach followed for conducting ESIA study of the Project. To identify the environmental and social issues arising out of the current practices adopted for planning, design, and construction of the project roads, the environmental and social conditions along the project roads were assessed. During these visits, consultations through group discussions with local communities, road users and village members were contacted to understand their perceptions and needs. The main approaches for the study are:

- Identification, appraisal and division between positive and negative impacts, direct and indirect impacts, and instant and long-term impacts likely to result from the project road
- Identification of unavoidable or irreversible impacts;
- Exploration towards the opportunities for environmental enhancement;
- Identification of feasible and cost effective mitigation measures to minimize negative impacts and enhance positive impacts by incorporating in the preliminary engineeringdesign.
- Preparation of Environmental Management Plan for effective implementation of environmental mitigation measures at different stages of the project.

A standard methodology was adopted for fulfilling the ESIA requirements; key features/tasks of the methodology are detailed as follows:



Task 1: Field Reconnaissance Survey and Review of Earlier Studies:
The field reconnaissance survey has been carried out along the project roads to understand salient environmental and social features that are likely to cause adverse impacts, sensitive environmental and social issues via-a-vis proposed project interventions. The salient feature includesthe topography of the land, road geometry,environmental features like trees, any forest area, water bodies like ponds, rivers, etc., social and physical features like settlement pattern, its density, typology of buildings, especially the presence of religious buildings, land use, etc.

Task 2: Review and Assessment of Applicable Environmental and Social Regulations:the various rules/regulations and guidelines applicable to the project roads vis-à-vis central(GoI), state (GoM) and World Bank statutory requirements were reviewed and referred to for assessing current environmental and social impacts that are likely to emanate.

Task 3: Delineation of Study Area for Assessment:
In road projects, the influence area may vary via-a-vis size of the road, location of the road, type of road, etc., hence, the study area was fixed based on the proposed interventions including the road sections undergoing widening and strengthening, RoW availability, structural works (culverts and bridges), presence of sensitive areas, etc. In addition to this, the project influence area (10 km buffer from the centre line on either sides) for impact assessment is also considered in those areas that are directly or indirectly influenced by the project activities during construction or operation of the proposed road work such as Hot Mix plants, sand quarries, source of raw material and material transport, etc.

Task 4: Assessment of Baseline Environmental and Social Conditions:
This task comprises a collection of baseline data for the project road locations primarily based on physical, biological and socio-economic conditions. The secondary source of information was utilised for giving a generic snapshot of socio environment features. In addition, existing environmental and social quality/features along the project roads were assessed based on a walk through surveys, public consultations, FGD's and discussions with line department officials.

Task 5: Public Consultations/ Focus Group Discussions:

To cover a wide range of stakeholders in the study area, corner meetings were conducted at selected places with women groups, men and road users to understand the people's perception about the project as well as their issues and concerns. Overall project features, social safeguards, issues related to women's safety and security, environmental safeguards, and enhancement measures that would be implemented in the project was also discussed with the public.

Task 6: Prediction of Environmental and Social Impacts:

The task identified likely impacts that would arise due to the construction of project roads, through changes in the physical, biological or socio-economic environment. Based on the baseline environmental profile of the project and analysis of the primary and secondary data collected, impacts of the proposed project on various environmental components were identified. The impacts were also analysed with respect to pre-construction, construction and operation phases and were categorised in terms of magnitude and significance.

The assessment considered both positive and negative impacts at different stages of implementation, i.e. pre-construction, construction and operation stages of the project roads.

Task 7: Preparation of Environment and Social Management Plan (ESMP):

A comprehensive Environmental and Social Management Plan (ESMP) was prepared which included mitigation measures for all the negative impacts of sub-projects and enhancement measures for the positive impacts.

Task 8: Preparation of Resettlement Action Plan (RAP):

Based on the impacts a suitable RAP shall be prepared to specify the procedures it will follow and the actions it will take to properly resettle/compensate affected people and communities. The objective of the RAP is to assist the affected people in their efforts to improve their living standards or at least regain their living standards to their pre displacement levels.

Task 9: Preparation of Environmental and Social Management Budget:

Based on the impact assessment for the environmental and social components, a suitable budget has been estimated to compensate for the temporary and permanent impacts that are likely during the project implementation. As part of the project implementation monitoring, budgetary provision has been allotted for RAP implementation and environmental monitoring. The budget also includes compensatory afforestation measures for the loss of avenue trees due to road widening.

Task 10: Environmental Safeguard Clauses in the Bid Document:

Suitable safeguard clauses have been prepared based on the ESIA, the prepared clauses shall form part of the bid document either in the General conditions or Specific conditions of the contract agreement/ bid document. The prepared ESMP shall also be part of the bid document.

Study Area

Area of Influence (AoI)

The effects of the Project activities on a particular resource or receptor will have spatial (distance)and temporal (time) dimensions. Some activities would impact a larger radius than other identifiedimpact sources. The spatial and temporal dimensions have therefore been taken into account todefine a Project's Area of Influence and given below:

Table 16:Area of Influence (AOI)

Sl.	Environmental and Social Issues	Area of Influence (AOI)	Justification
1	Air Quality	500 m	Dust emissions, fugitive dust, etc. is typically observed within 100-200m from the construction /operation area. A minimum of 500m AoI on either side of road has been

			taken to capture all sources of these emissions, including vehicular movement across access roads
2	Noise Pollution	500 m	Noise can often be detected up to 400-500m from any operation
3	Water Environment	200 m	Waterbody located in the vicinity of the project area may get impacted due to activities at project footprint and allied sites
4	Land Environment	Within proposed RoW	Impacts on soil and land are often restricted to the Project footprint area. An AoI with proposed RoW taken into account has indirect effects that usually occur due to vehicular/ heavy machinery movements and activities at allied sites
5	Socio-economic Conditions	Within proposed RoW	Within proposed RoW is considered as an AoI for socioeconomic consultations to determine perceived impacts due to the Project
6	Ecology	10 Km	An AoI of 10 km on either side of the roads are considered for the ecological study to understand the ecological settings in and around the project area

Corridor of Impact (CoI): The area of 500 m on either side of the proposed road centreline is considered as the corridor of impact. This area is more vulnerable to the project's direct impacts. .

Project Influence Area (PIA): In accordance with MoEF&CC's EIA Guideline Manual for Highways and as per guidelines of EIA Notification-2006, the Project Influence Area has been defined as 10 km on either side (Aerial distance) from boundary of road. Collection of secondary data, including likely impacts due to ancillary sites like borrow areas, quarry, material storage, disposal areas, etc. are done within this influence area.

Figure 6: Project alignment showing study area and corridor of impact

Scope of the ESIA/ESMP Study

The scopes of the ESIA/EMP study are: -

- Baseline status of environmental parameters.
- Identification of the potential impacts during pre-construction, construction and operation phases.
- Developing mitigation measures to sustain and maintain the environmental scenario.
- Providing compensatory developments wherever necessary, including plans for highway side tree plantation.
- Preparation of Environmental Management and Monitoring Plan.
- Screening, scoping and consultations with public, experts in various fields, non-government organization (NGOs) etc.
- Review of policies and legal framework.

CHAPTER: IV- LEGAL FRAMEWORK

The Ministry of Environment, Forest & Climate Change made it mandatory for introducing environment assessment into the planning process of road projects as well as environmental impact appraisal as per Environmental Protection Act, 1986. The MoEF&CC have assigned all central and State authorities to develop policies towards protection of environment for any infrastructure development activities as per the Act. The Ministry of Environment, Forest & Climate Change (MoEF&CC) has the overall authority for the administration and implementation of government policies, laws and regulations. In the present project the environment acts, policy guidelines of both State and Central Government will be applicable. As these acts/regulations have varying procedures, requirements, depending on type of project, a detailed discussion is required in this report to study the extent of applicability, procedures and requirements to be met by the implementing authorities. The following subsections summarize the legislative framework in which the present project will be addressed with respect to the environment including social issues.

Institutional Setting

The primary responsibility of administration and implementation of the Government of India's policy with respect to environmental management, conservation, ecologically sustainable development, and pollution control rests with the Ministry of Environment, Forest & Climate Change (MoEF & CC). The MoEF & CC has a number of agencies and institutions to implement the environmental policies. Such as: Central Pollution Control Board (CPCB), MoEF & CC Regional Offices, State Pollution Control Board (SPCB) & State Department of Environment & Forests.

The Government of India, through specific legislations, regulates the environmental management system in India. The Ministries / Statutory Bodies responsible for ensuring environmental compliance by project proponents include:

- The Ministry of Environment & Forests and Climate Change (MoEFCC)
- Central Pollution Control Board (CPCB)
- Meghalaya Pollution Control Boards (MPCB)
- Ministry / Department of Environment in the States

Acts & Regulation

The Government of India has laid down various policy guidelines, regulations, acts and legislations pertaining to sustenance of environment. The following table shows the relevant environmental legislations and implementing agencies.

Table 17:Applicable Acts & Regulations

Sl.	Act/Regulations	Main Objective	Applicability to this Project	Implementation Agency
1.	Air (Prevention and Control of Pollution) Act, 1981	To control and monitor air quality as per prescribed limits	Yes, For establishment and operation of Hot Mix/ Stone crusher/ WMM/ Batching Plants during construction, etc. (Construction Stage)	State Pollution Control Board.
2.	The Water (Prevention and	To control and monitor water pollution as per	Yes, For establishment and operation of Hot Mix/	State Pollution Control Board.

Sl.	Act/Regulations	Main Objective	Applicability to this Project	Implementation Agency
	Control of Pollution) Act, 1974	prescribed limits	Stone crusher/ WMM/ Batching Plants during construction, etc. (Construction Stage)	
3.	Indian Motor Vehicles Act, 1988	To check vehicles for air and noise pollution	Yes, For construction vehicles (Construction Stage) Pollution Under Control Certificate	Motor Vehicles Department, Govt. of Meghalaya.
4.	The Forest Conservation Act, 1980	To check deforestation	No. No forest land is required	Forest Department GOI and Government of Meghalaya & MoEF & CC
5.	National Forest Policy, 1988	To preserve and restore biological diversity	No	Forest Department.
6.	Wild Life (Protection) Act, 1972	To protect and improve the overall wild life	No. No Wildlife Sanctuary or National Park/Tiger reserves lies within 10 km.of project boundary	Chief Conservator wild life, Forest Department, Meghalaya.
7.	Environment Protection Act, 1986	To protect and improve the overall environment	Yes, discharge Standards, Hazardous material management and handling Rules & Regulations (Construction Stage)	Dept. of Environment and Forest, Meghalaya.
8.	Ancient Monuments and Archaeological Sites and Remains Act, 1958	Preservation of culture and historical remains	No. There is no cultural and historical place along the project road.	Indian Heritage Society, and Indian National Trust for Art and Culture Heritage
9.	EIA Notification, September 14, 2006	For all Development Projects	The Project does not require Environmental Clearance.	Ministry of Environment, Forest & Climate Change (MoEF & CC)
10.	National Environmental Appellate Authority Act, 1997	For Grievance Redress	No.	Ministry of Environment, Forest & Climate Change (MoEF & CC)
11.	Integrated Waste Management	Waste management and control.	Yes, it is applicable as domestic solid waste is generated from the canteens, residences located within the Construction camp.	Ministry of Environment, Forest & Climate Change (MoEF & CC) and State Pollution Control Board

Sl.	Act/Regulations	Main Objective	Applicability to this Project	Implementation Agency
12	Fly Ash Notification, 2011 and 2016	Mandate use of fly ash in road construction within a radius of 300km	Yes. Because as per the notification every construction agency engaged in construction of roads within a radius of 300 kilometers from a coal or lignite based thermal power plant would be bound to use fly ash in accordance with the guidelines or specifications issued by the Indian Road Congress. The NTPC Thermal Power Project in Dolaigaon, Assam, Bongaigaon Thermal Power Project r lie within 300km radius of the project road.	MoEF & CC
13	Noise Pollution (Regulation and Control) Rules The Noise Pollution (Regulation and Control) Amendment Rules 2006	To regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise	Yes	State Pollution Control Board
14	The Explosives Act (& Rules) Explosives Rules, 2008	An Act to regulate the manufacture, possession, use, sale, transport, import and export of Explosives (For transporting and storingdiesel, bitumen etc.)	Yes, if the storage quantityof Diesel and Bitumenexceeds the allowablelimit.	Petroleum & Explosives Safety Organization (PESO)
15	Ground Water (Management &Regulation) Act, 2019	For regulating ground waterabstraction and maintainingground water table.	Yes, NOC for establishing bore wells for abstraction of ground water for use of construction as well as domestic use.	State Ground Water Board
16	The Petroleum Rules,2002	Delivery, dispatch or storage of petroleum products by authorized persons/organization	Yes	A person recognized by the Chief Controller

Clearance Requirement

During the construction stage, some of the key statutory requirements that need to be obtained by the Contractor as part of mobilization have been listed in the table given below:

Table 18:Applicable Acts & Regulations (Construction Phase)

Sl.	Clearance Required for	Statute under which clearance is required	Statutory Authority
1	Hot mix plants, Crushers, Batch Mix Plants & DG Sets.	Air (Prevention and Control of Pollution) Act, 1981 and Noise Pollution (Regulation and Control) Rules, 2000	State Pollution Control Board
2	Storage, handling and transport of hazardous materials.	Hazardous Waste (Management and Handling) Rules, 1989 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989.	State Pollution Control Board
3	Location/ layout of workers camp, equipment and storage yards	Environment Protection Act, 1986 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	State Pollution Control Board
4	Quarries (Aggregates, Sand & Earth)	Environment Protection Act, 1986	MoEF&CC
5	Permission for withdrawal of groundwater and for construction purpose.	Environment Protection Act, 1986	CGWB
6	Disposal of bituminous wastes	Hazardous Waste (Management and Handling) Rules, 1989	As per state norm/ Local Civic Body
7	Pollution Under Control Certificate	Central Motor and Vehicle Act 1988	Department of Transport, State Government.
8	Storage of fuel oil, lubricants, explosives, diesel etc. at construction camp.	Manufacture, storage and Import of Hazardous Chemical Rules 1989	State Pollution Control Board & PESO.

MoRTH & IRC Specifications

All road works in India are to be in accordance with the MoRTH specifications for Road and Bridge works and guidelines of Indian Roads Congress (IRC). The MoRTH specifications have special provisions towards protection of environment under Clause 501, Annexure A and the contractor has to satisfy the provisions. Apart from the Annexure A to clause 501, there are provisions for control of erosion, drainage, dust suppression, borrow area and haul road management under relevant sections. Provisions of clause 501 Annexure A, cover the environmental aspects.

Environmental Standards and Code of Practices

All the construction work will be carried out as per the Environment standards and guidelines of MoEFCC, CPCB & code of practices of IRC. Some of the codes used during the construction phase are listed below.

- Guidelines for use of Fly Ash in Road Embankments (IRC: SP: 58-2001)
- Guidelines for Environmental Impact Assessment of Highway Projects (IRC: 104-1988)
- Guidelines on Preparation and Implementation of Environment Management Plan (IRC SP 108-2015)
- Guidelines on Landscaping and Tree Plantation (IRC:SP-21-2009)
- Report containing recommendations of the IRC regional workshops on Highway Safety (IRC: SP: 27-1984)

- Recommended practice for Borrow pits for Road Embankments constructed by Manual operation IRC: 10-1961
- Road accident Forms (IRC: 53-1982)
- Guidelines for Use of Construction and Demolition Waste in Road Sector (IRC 121-2017)
- Proceedings of International Seminar on sustainable development in 8.10.2001
- Road Transport Highway Safety Code (IRC: SP: 44-1996)
- Guidelines on Safety in Road Construction Zones (IRC: SP: 55:2001)
- Guidelines on Skill Development of Workmen in Road Sector (IRC 127-2018)
- Guidelines of WB& ADB.

Other Applicable Policies (Social Security & Labor Welfare)

Environmental and labour welfare issues during the construction stage generally involve equity, safety and public health issues. The different applicable policies are:

Table 19:Applicable Policies

Applicable Codes	Concerns	Remarks
The Code on Social Security, 2020	It consolidated The Employees' Compensation Act, 1923, The Employees' State Insurance Act, 1948, The Employees' Provident Funds and Miscellaneous Provisions Act, 1952, The Employment Exchanges (Compulsory Notification of Vacancies) Act, 1959, The Maternity Benefit Act, 1961, The Payment of Gratuity Act, 1972, The Cine Workers Welfare Fund Act, 1981, The Building and Other Construction Workers Welfare Cess Act, 1996, Unorganised Workers' Social Security Act 2008.	Ministry of labour and Employment
The Occupational Safety, Health And Working Conditions Code, 2020	It amalgamated The Factories Act, 1948, The Plantations Labour Act, 1951, The Mines Act, 1952, The Working Journalists and other Newspaper Employees (Conditions of Service and Miscellaneous Provisions) Act, 1955, The Working Journalists (Fixation of Rates of Wages) Act, 1958, The Motor Transport Workers Act, 1961, The Beedi and Cigar Workers (Conditions of Employment) Act, 1966, The Contract Labour (Regulation and Abolition) Act, 1970, The Sales Promotion Employees (Condition of Service) Act, 1976, The Inter-State Migrant workmen (Regulation of Employment and Conditions of Service) Act, 1979, The Cine Workers and Cinema Theatre Workers Act, 1981, The Dock Workers (Safety, Health and Welfare) Act, 1986 and The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.	Ministry of labour and Employment
The Code on Wages, 2019	It consolidated the provisions of four labour laws concerning wage and bonus payments and makes universal the provisions for minimum wages and timely payment of wages for all workers in India. The Code repeals and replaces the Payment of Wages Act, 1936, the Minimum Wages Act, 1948, the Payment of Bonus	Ministry of labour and Employment

Applicable Codes	Concerns	Remarks
	Act, 1965, and the Equal Remuneration Act, 1976.	

World Bank safeguard/ Operational policies

The World Bank policies and directives on environmental and social safeguards have adhered to the project roads. The applicability of the relevant policies of the project roads that are undergoing up-gradation (strengthening and widening) are summarized in the following table:

Table 20:Applicable World Bank Operational policies

OP 4.01 Environmental Assessment	The objective of this policy is to ensure that Bank financed projects are environmentally sound and sustainable. Help to ensure the environmental and social soundness and sustainability of investment projects. Support integration of environmental and social aspects of projects in the decision-making process. Yes, this operational policy is applicable in this project. The project is Classified as Category-B project and EIA study is required.
OP 4.04 Natural Habitats	The policy recognizes that the conservation of natural habitats is essential for long-term sustainable development.Promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions. This policy may be triggered to improvement activity of road requiring forest/ wildlife lands, locating close to the natural habitats with the potential to cause significant adverse impact or degradation of natural habitats whether directly (through construction) or indirectly (through human activities induced by the project). The project does not pass through reserved forest or natural habitat of wild animals therefore this operational policy is not applicable in this project.
OP 4.36 Forestry	Aims to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively for sustainable economic development and protect vital local and global environmental services and values of forests. The widening of project road section will require felling of 166 numbers of trees within the existing ROW, although these trees will be transplanted along the project stretch to restore the green cover. Hence this operational policy is not applicable in this project.
OP 4.09 Pest Management	The objective of this policy is to promote the use of biological or environmental control methods and to reduce reliance on chemical pesticides. This policy is not applicable in this project.
OP 4.12 Involuntary Resettlement	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing before the beginning of project implementation, whichever is higher. About 42 families will be impacted due to the project thus there is applicability of OP 4.12 of World Bank Guidelines.
OP 4.10 Indigenous People	Design and implement projects in a way that fosters full respect for indigenous peoples' dignity, human rights, and cultural uniqueness so that they receive culturally compatible social and economic benefits, and Do not suffer adverse effects during the development process. About 41 families of ST will be impacted due to the project, however these families mostly reside in the urban areas and are not attached to the land for their live and livelihood. Thus OP 4.10 is applicable.
Physical Cultural Resources (PCR)	OP 4.11 Assist in preserving PCR and in avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites), aesthetic, or other cultural significance. There is only one boundary wall of a

	school structure will be impacted due to the project.

The World Bank has classified the type of projects into following categories depending on the extent of the impact on environment:

Category A: A proposed project is classified as Category A, if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. Such project requires full EIA study.

Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas— including wetlands, forests, grasslands, and other natural habitats—are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts

As per World Bank has categorization the project comes under Category-B project, so for this project covered under this scheme would require EIA study and preparation of EIA reports including EMP.

Resettlement Policy Framework (RPF): Resettlement Policy Framework (RPF) consisting of national/state policies and the World Bank's operational policy on involuntary resettlement is being implemented in MITP. The frameworks provide an overview of screening of the road-projects for social impacts, the process for social impact assessment, preparation of land plan schedules, entitlements for different impact categories, institutional arrangements, information disclosure and consultations and the preparation and implementation of Resettlement Plan (RP). Land will be acquired following provisions of Meghalaya PWD Rules, Meghalaya RFCTLARR Rules, 2017 and RFCTLARR Act, 2013. For the compensation for land, the competent authority will be guided by the provisions of Sec 26, Sec 27, Sec 28, Sec 29 and Sec 30 of RFCTLARR Act, 2013. The replacement value of houses, buildings and other immovable properties will be determined based on the latest PWD Standard Schedule of Rates (SSOR) as on date without depreciation. Compensation for trees will be based on their market value. Disputes relating to ownership rights, apportionment issues, amount of compensation awarded will be referred by the Special DRO to the jurisdictional LARR Authority, to be constituted following Section 51(1) of the RFCTLARR Act, 2013 and Meghalaya RFCTLARR Rules, 2017. However the project does not envisaged any new Land Acquisition.

Applicable Legal Framework for Social

The legal framework and principles adopted for addressing resettlement issues in the Project have been guided by the proposed legislation and policies of the GOI, the state Government of Meghalaya, PWRD Meghalaya in accordance to World Bank's OP 4.12 for Involuntary Resettlement and OP 4.10 for Indigenous People. Prior to the preparation of the Resettlement Plan, a detailed analysis of the proposed national and state policies is to be undertaken and an entitlement matrix has to be prepared for the entire program. The section below provides details of the various national and state level legislations and their applicability. A summary of applicable acts and policies is presented in the following paragraphs

Objectives of the Policy

The objectives of the Policy are as follows: -
To minimize displacement and to identify non-displacing or least-displacing alternatives;
To plan the resettlement and rehabilitation of Project Affected Families, (PAFs) including special needs of Tribal and vulnerable sections;
To provide better standard of living to Aps.

Policy Framework for this Project

Based on the above analysis of applicable legal and policy frameworks of the country and in consistent with World Bank's policy requirements the broad resettlement principle for this project shall be the following:
The livelihoods of all Affected Persons were improved or at least restored through (i) land-based resettlement strategies when affected livelihoods are land based where possible or cash compensation at replacement value for land when the loss of land does not undermine livelihoods, (ii) prompt replacement of assets with access to assets of equal or higher value, (iii) prompt compensation at full replacement cost for assets that cannot be restored, and (iv) additional revenues and services through benefit sharing schemes where possible.
Affected Persons without titles to land or any recognizable legal rights to land are ensured that they are eligible for resettlement assistance and compensation for loss of non-land assets.
Aabbreviated resettlement plan was prepared elaborating on Affected Persons' entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget and time-bound implementation schedule.
All compensation to be paid and other resettlement entitlements are to be provided before physical or economic displacement. The resettlement plan is to implemented under close supervision throughout project implementation.
Resettlement outcomes, their impacts on the standards of living of Affected Persons are monitored, it were accessed whether the objectives of the resettlement plan have been achieved by taking into account the baseline conditions and the results of resettlement monitoring. Monitoring reports are disclosed to DPs.
All Common Property Resources (CPR) lost due to the project are replaced or compensated by the project.Cash compensation for properties belonging to the community if opted by the community, were provided to enable construction of the same at new places through the community/ local self-governing bodies / appropriate authority in accordance with the modalities determined by such bodies / authority to ensure correct use of the amount of compensation.
Compensation for trees is based on their market value. Loss of timber trees were compensated at their replacement cost while the compensation for the loss of fruit bearing trees were calculated as annual produce value for at next 15 years depending on the nature of crops/trees.

Table 21Applicable Legal Framework for the entire Project

Sl.	Name of Act/ Rules	Purpose	Applicable/Not Applicable	Description	Responsible Agency
2.	The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act	Grants Legal recognition to the rights of traditional forest dwelling communities.	Applicable	This Act is Applicableas it protects the rights of the forest dwelling schedule tribes & other traditional forest dwelling communities.	Tribal Affairs, Department of Tribal Welfare of State Government

Sl.	Name of Act/ Rules	Purpose	Applicable/Not Applicable	Description	Responsible Agency
3.	The Minimum Wage Act,1948	Payment of minimum rate of wages as fixed and periodically revised by the State Government	Applicable	Construction/ daily wageworkers are involved and was involved in the project	District Labour Commissioner.
4.	Workmen Compensation Act, 1923	It provides for payment of compensation by Employers to their Employees for injury by accident i.e., personal injury or occupational disease.	Applicable	The Insurance Policy covers the compensation, hospitalization and transportation of workers /employees	District Labour Commissioner
5.	Inter-state Migrant Workers Act, 1979	It protects workers whose services are requisitioned outside their native states in India. Contractor who employs or who employed five or more Inter-State migrant workmen need to obtain registration under this act	Applicable	Construction workers involved in the project may or may not be from the neighboring state. Presently the construction workers are from within the state of Meghalaya.	District Labour Commissioner/ Govt. Of Meghalaya
6.	The Child Labour (Prohibition & Regulation) Amendment Act, 2016	It prohibits employment of children in certain specified hazardous occupations and processes and regulates the working conditions in others.	Applicable	No Child worker should be involved in the project. it may be noted that no child labour is engaged in the project	District Labour Commissioner
7.	Building and Other Construction Workers Welfare Cess Act, 1996	An Act to provide for the levy and collection of a Cess on the cost of construction incurred by employers.	Applicable	Project involves employment of construction workers	District Labour Commissioner
8	The Sexual Harassment of Women at Workplace (Prevention, Prohibition, and Redressal) Act, 2013	Vishakha Guidelines are to be followed	Applicable	This act specially protects the rights of the women workers against any kinds of sexual harassment at the project, both at office and sites.	

Sl.	Name of Act/ Rules	Purpose	Applicable/Not Applicable	Description	Responsible Agency
9	The Equal Remuneration Rules, 1976	Equal Remuneration for identical works	Applicable	Project will not discriminate between sex, race, caste or creed in payments to the employees	District Labour Commissioner
10	The Trade Union Act, 1926	Right to form Trade Union at the Workplace	Applicable	No trade union formed within the organization	District Labour Commissioner
11	Public Liability Insurance Act 1991	Provides immediate relief to the persons affected by accidents, occurring while handling any hazardous substance	Applicable	Project has been adhering to all the relevant provisions made under the act	District Labour Commissioner
12	World Bank OP/BP 4.12 – Involuntary Resettlement	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing before the beginning of project implementation, whichever is higher	Applicable	The project does not envisaged land acquisition as there is a very low scale widening, realignments, junction improvementsetc however might adversely affect non-titleholders structures used for various purposes, livelihood of people (mainly earning their livelihood by means of petty shops and providing various services).	PIU/Implementing Agency
13	Indigenous Peoples OP/BP 4.10	In the context of India Indigenous Peoples may be referred to "scheduled tribes". As per the Census of India, 2011 about 86% of the Meghalaya state belongs the Schedule Tribe. The population is distributed across 11 districts of Meghalaya.	Not Applicable	The majority of the population of the state is tribal however, largely impacted ST population mostly live in the urban areas and become the mainstream population. Thus the policy on Indigenous People is triggered. as the presence of tribal groups with close attachment to land in the project area is not established. Further, this policy is not triggered in terms of “collective attachment to geographically distinct	PIU/Implementing Agency

Sl.	Name of Act/ Rules	Purpose	Applicable/Not Applicable	Description	Responsible Agency
				habitats" and "institutions".	
14	Bank Policy – Access to Information	The policy governs the public accessibility of information in the Bank's possession.	Applicable	Documents such as RPF, all ESIA and ARAPs was disclosed both by the borrower and Bank and uploaded in the website.	PIU/Implementing Agency

Social Categorization:

There are 8 identified sub-projects 4 are urban and 4 are rural. All activities under these sub-projects are limited to the available RoW, thus no land acquisition and resettlement and rehabilitation are envisioned for these activities. As there is impact on ST population due to the project thus, the World Bank OP 4.10 does trigger for these projects. Again, impacts on the livelihood of vendors, petty shopkeepers and likes cannot be fully avoided and thus need to be mitigated in accordance with the policies of the World Bank (OP 4.12).

As per World Bank's guidelines of Categorization for Involuntary Resettlement, this sub-project is categorized as Category S2 as the total permanently impacted population is less than 200 PAPs in all the sub-projects. Thus, an Abbreviated Resettlement Action Plan (ARAP) is prepared on the possible impacts identified and measured in SIA and mitigation measures as provisioned in the Entitlement Matrix of the Resettlement Framework and is as per the Guideline and Template of ESMF. The ARAP will be disclosed and will be implemented in the project and the compensation and R&R assistances will be released to the displaced families before the Civil Construction starts.

All the activities in the urban or rural projects will impact the tribal population though it is limited to the existing land area already available. However, "collective attachment to geographically distinct habitats" and "institutions that are separate from those of the dominant society and culture is not present in the project impact area. As per World Bank's guidelines of Categorization for Indigenous People Impact this sub-project is categorized as Category S3. As per the guidelines no specific action is required, still the mitigation methods are reflected in the related plans such as an Abbreviated Resettlement Plan, ESMP and Gender Action Plan.

CHAPTER: V- DESCRIPTION OF ENVIRONMENT

The present chapter describes the baseline environmental conditions of the project road. It comprises both secondary information as well as primary information collected through baseline studies, data collection and field surveys.

Details of the baseline environmental parameters are required for decision making for the project design, implementation and operation from the environmental point of views. The data has been collected from the primary surveys and secondary sources. It is essential to establish the base line environmental status of the physical, natural and socio-cultural environmental parameters along the project roads and within the project influence area of 10 Kms.

The baseline condition describes the state of the existing environment before the onset of the proposed development work. The collection of baseline information on biophysical, social and economic aspects of the project area is the most important reference for conducting Environmental Screening and Preliminary Environmental and Social Impact Assessment study. The description of existing environment includes the characteristic of area in which the activity of the project road would occur and cover area affected by all impacts. The existing baseline conditions have been analyzed based on secondary information/data collection with regard to air quality, water quality, noise, soil, ecology & biodiversity and socio- economic aspects and secondary data/information collection from published authentic sources and various government agencies. Efforts have been made to collect the latest information both at regional as well as local level especially along the project roads alignment. The existing baseline data and analysis around the project road covering both districts are presented in the following sections.

Topography:

Meghalaya: Meghalaya state is also known as Meghalaya plateau. The highest point in the state is the Shillong Peak with an altitude of 1961 meters. The state can, broadly, be divided into three physiographic zones, namely:

a. Central Plateau Region comprising the Khasi Hills and has the highest elevations between 900-2000m
b. Sub-montane region in continuation with the Central Plateau below 900m which gradually merges with the plains in the West and North, namely the Jaintia Hills, and
c. Border region which stretches south-wards abruptly from the Central Plateau to the plains in Bangladesh, mainly the Garo Hills region, and is nearly plain.

West Khasi Hills:

West Khasi Hills District of Meghalaya, was carved out of the erstwhile Khasi Hills District on the 28th October 1976. The District lies in the central part of the State of Meghalaya and is situated between 10‘ and 25 degrees 51‘ N Latitude, and between 90 degrees 44‘ and 91 degrees 49‘E longitude. The District is divided into four broad geographical units. The western parts bordering Garo Hills, at an elevation between 600 to 900 meters from the mean sea level are traditionally the homes of dense forest. The southern sector is rich in mineral resources. The central plateau divides the district into the northern slope and the southern slope is between 1400 to 1700 meters above the MSL. The district headquarters is Nongstoin which covers an area of 76 sq. km. Mairang, Mawshynrut and Mawkyrwat are the three civil Subdivisions of the district.

The project road passes mostly through hilly terrain and few stretches pass through rolling terrain. The existing road level varies from 1325 meter above sea level at start point to 720

meter above sea level at end point of the project road. Digital elevation map of project road is attached in Figure below

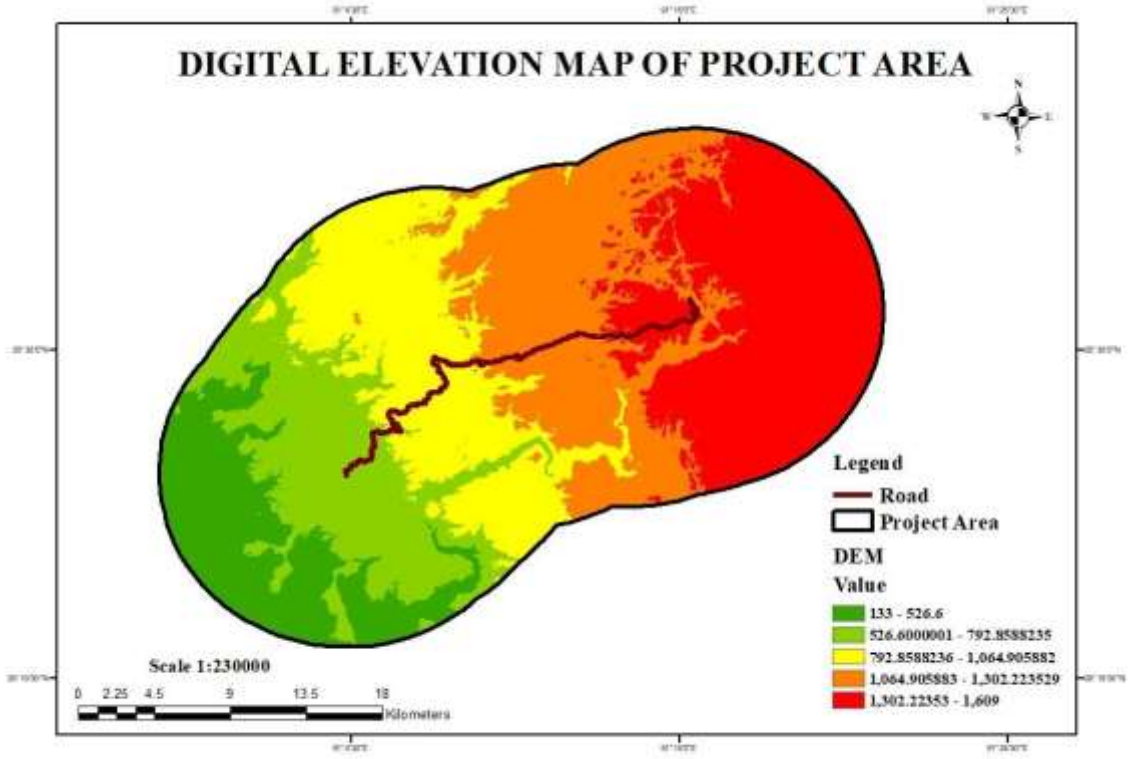


Figure 7:Digital Elevation Map of Project Road

Soil & Geology:

The climate, vegetation, relief and parent material constituting the ecosystem influence significantly the paedogenesis resulting in the development of different kinds of soils. The State is covered by the warm per-humid agro-ecoregion. However, it can be divided into two distinct sub eco-region (Zone) with thermic and hyper thermic temperature regimes.

The area form a part of Meghalaya plateau comprising Archaean Basement Complex and younger sediments. The Archaean Basement Complex and the overlying Proterozoic metasediments of Shillong Group form NE-SW trending strike redges with prominent Valleys. Quartzite and conglomerate form high hills whereas phyllites, slate and quaternary valley fills form the low lying valleys. The Shillong Group of rocks were deposited in a shallow marine environment. Gneisses and schistose rocks of the Archaean age are the oldest rock of the area forming the basement complex of Assam Meghalaya Gneissic Complex. The other rocks present in the area are quartz-biotite-sillimanite schist and migmatites. The regional strike of the foliation is more or less NE-SW with southerly dips. Veins of quartz and pegmatites mostly follow the foliation trend. The Shillong Group of rock includes conglomerate, quartzite, phyllites and quartz mica schist. The above group of rocks is intruded by grey/pink Alluvium comprising dark brown to brown oxidized sand, silt clay of Chapar and sorbhog formation is found towards northern part of the district. A NESW trending shear zone traverses through the eastern part of the district.

The district shows different types of soil as the provenance differs widely. Red Gravelly and Red Loamy Soil are the common soil types. The soils are acidic in nature and comparatively rich in organic matter and nitrogen but poor in phosphorous.

Various types of soil are observed along the project road. At the beginning of the road typic Udorthents, typic kanhapludult soils are found. Major portion of the project road passes through the region where typic kanhapludult soils and typic dystrochrepts are present. Typic kanhapludult soils have a low cation-exchange capacity[1] and these soils are having less than 5 percent plinthite. Typic Udorthents soils comprise of moderately coarse textured soil material and a few small areas of medium textured material[2]. In the same line, pH of the dystrochrepts soils is acidic in nature[3] and it is also loamy – skeletal[4] soil.

The soils along the project road are clayey silt with rock pieces or rock dust. Soil profile of the project location is drawn below:

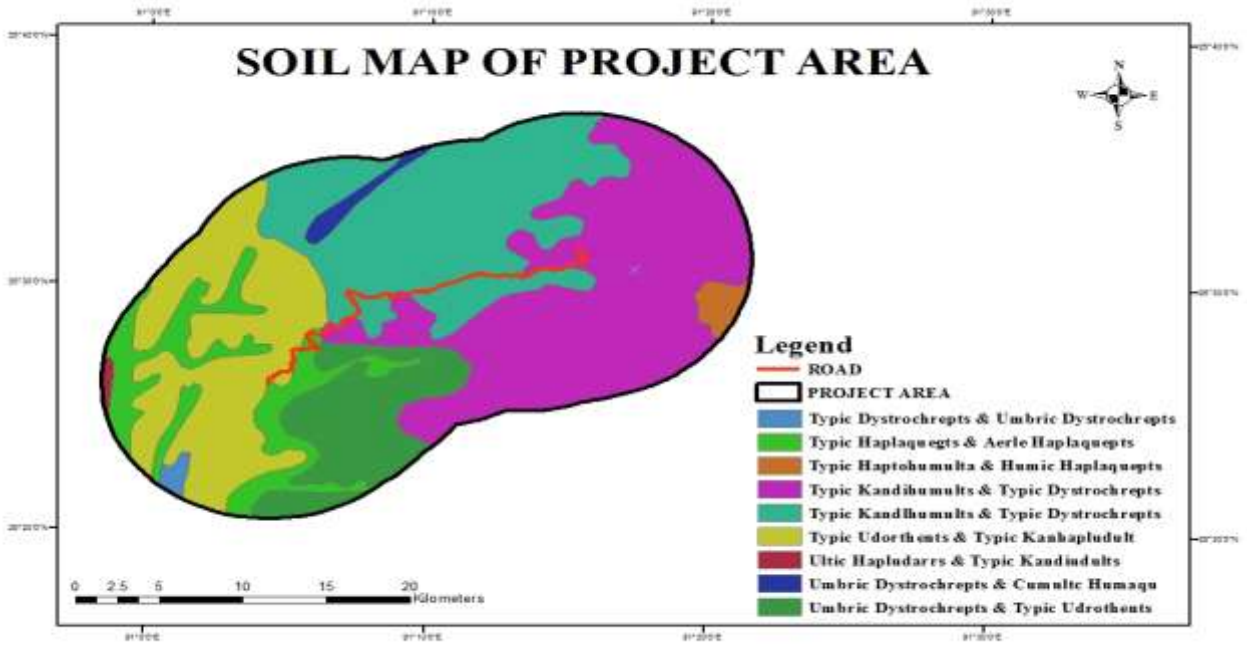


Figure 8:Soil Map of Project Area

Soil Quality Monitoring

Soil is an important non-renewable resource to human life and terrestrial ecosystems. The key aim of soil monitoring is to understand the condition of soil in the project districts. The sampling was taken by a NABL Accredited Laboratory in the month of January. The concerned parameters are Nitrogen, Phosphorus, Potassium, pH, Nitrate etc. The sample collection, preservation, storage, transportation, and analysis were carried out as per the standard methods. Soil sampling locations are given in Table below

Table 22:Soil sampling locations along the project road

[1] https://sites.google.com/site/dinpuithai/Home/taxonomy/h-ultisols/hc/hcd/hcdn

[2] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/office/ssr12/?cid=nrcs144p2_016612

[3] http://isslup.in/wp-content/uploads/2018/09/Influence-of-plantation-crops-on-characteristics-of-soils-Typic-Dystrochrepts.pdf

[4] http://cgwb.gov.in/AQM/Meghalaya.pdf

Sampling Location	Date of Sampling	Name of place	Distance	Coordinates	
				Latitude	Longitude
1	07/01/2022	Nongstoin	150 m	26.704350 N	94.440923 E
2	07/01/2022	Miangkain	150 m	26.704350 N	94.440923 E

Source: Environmental Baseline Monitoring

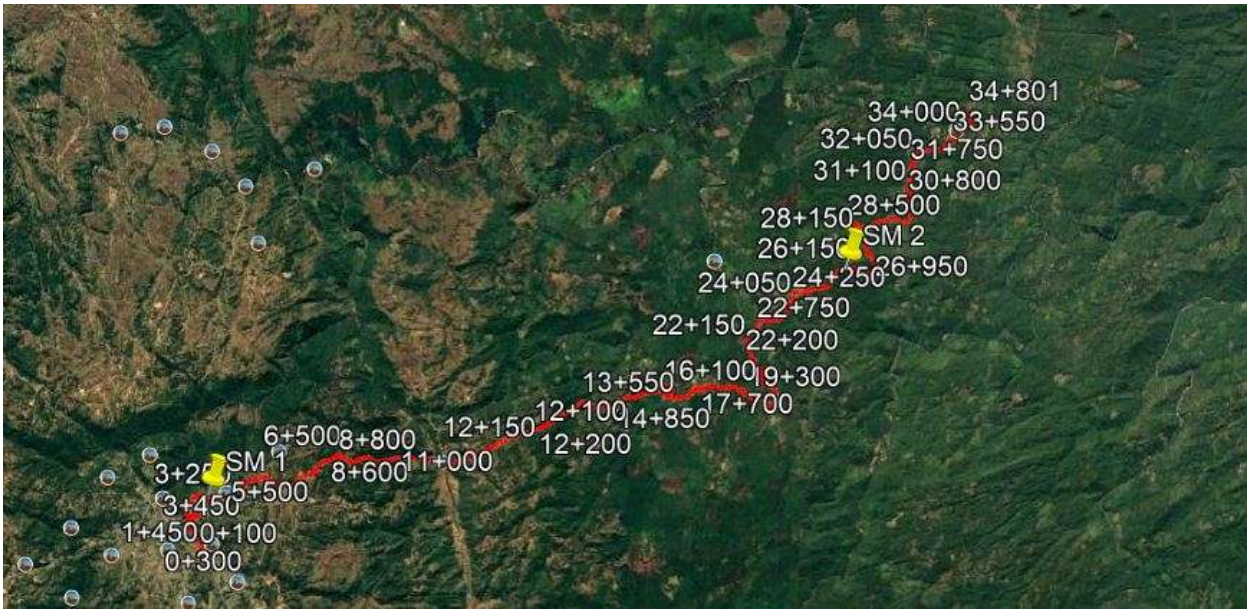


Figure 9 : Soil sampling locations along the project road

The soil quality along the project road is given in below

Table 23:Soil Quality along the Project Road

Sl.	Parameters	Test Method	Unit	Nongstoin	Miangkain	Standards/ Permissible (Limits Hand Book of Agriculture, ICAR, New Delhi)
1.	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	8.15	7.88	<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.	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µmhos/cm	677	714	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 Harmful to

Sl.	Parameters	Test Method	Unit	Nongstoin	Miangkain	Standards/ Permissible (Limits Hand Book of Agriculture, ICAR, New Delhi)
						crops (sensitive to salts)
4.	Soil Texture	ITL/SOP/ENV/Soil/07	-	Silty Clay Soil	Silty Clay Soil	-
5.	Sand	ITL/SOP/ENV/Soil/06	% by mass	23.4	18.2	-
6.	Clay	ITL/SOP/ENV/Soil/06	% by mass	42.5	42.6	-
7.	Silt	ITL/SOP/ENV/Soil/06	% by mass	34.1	39.2	-
8.	Nitrogen	ITL/SOP/ENV/Soil/09	mg/kg	25.1	22.8	Upto 50 Very less 51-100 Less 101-150 Good 151-300 Better >300 Sufficient
9.	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/kg	73.1	68.4	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	ITL/SOP/ENV/Soil/10	mg/kg	4.21	3.99	0 -120 Very less 120-180 Less 181-240 Medium 241-300 Average 301-360 Better >360 More than sufficient
11.	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	6.5	6.2	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	ITL/SOP/ENV/Soil/05	Inches/foot	1.22	1.17	-
14.	Sulphates	ITL/SOP/ENV/Soil/14	mg/kg	13.4	14.2	-
17.	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.30	1.29	-

The important physical characteristics of soil are bulk density, porosity and texture. Ph of soil in the proposed study area were found in the range of 7.88 to 8.15.The soil samples are, therefore, moderately alkaline. Conductivity of soils sample is found in the range of 677 to 714 Mhos/cm. Available phosphorous of soil samples along the proposed study area ranges from 3.99 to 4.21 mg/kg which is very less. Potassium content as K in soil samples along the proposed study area is found in the range of 68.4 to 73.1 mg/kg. Total organic matter in soil samples along the proposed study area is found in the range of 6.2– 6.5 %, therefore the soil is fertile in terms of productivity.

Climate:

Meteorology:

As per the Kalita et.al.(2020), the state of Meghalaya has four distrinct season viz.

Winter season- It includes the months of January and February.

Pre Monsoon season consists of March, April, and May.

Monsoon season is being from June to September

Post-Monsoon includes the rest of the months: October, November, and December

In some places in Meghalaya, annual average rainfall crosses 12 000 mm (470 in) and the maximum temperature is around 28 °C. Because of high elevation, Shillong area has experienced low temperatures and on the other hand, Garo Hills region with lower elevations has experienced low temperatures.

West Khasi Hills District:

The Climate of the district varies in latitudinal and longitudinal directions and is influenced mainly by physiography. There are four seasons in the district namely summer, monsoon or rainy, autumn and winter. The summer season extends from the end of March to mid-May, which is characterized by relatively high temperature, occasional thunderstorm with high wind velocities. The rainy season commences with the onset of southwest monsoon in April and lasts up to October. This is followed by short autumn from mid-October to November. This season indicates the slow retreating of monsoon with clear and sunny sky. The winter season extends from December to the end of March. This is the coldest season of the year with sharp decline in the temperature. During winter, some high altitude areas of the state experiences very cold nights. Winter is basically dry with lower diurnal range of temperature.

In general, the district has a mildly tropical climate in the northern and southern foothills, whereas central upland portion experiences temperate climate and the places of medium altitude of the northern, southern and western parts of the district experience sub-tropical climate.[5]

Nongstoin:

In Nongstoin, the wet season is comfortable, muggy, and mostly cloudy and the dry season is cool and mostly clear.

Rainfall:

In terms of precipitation received, Augustreceives the most amount of rainfall, with an average of 27.6 days with at least 706 mm of precipitation. Driest month of Nongstoin district is January withan average of 5.9 days with at least 23mmof precipitation.The study area is surrounded by hills and is subjected to a wet weather. The area experiences a lot of rainfall every year.

[5] Ground Water Information Booklet West Khasi Hills District, Meghalaya

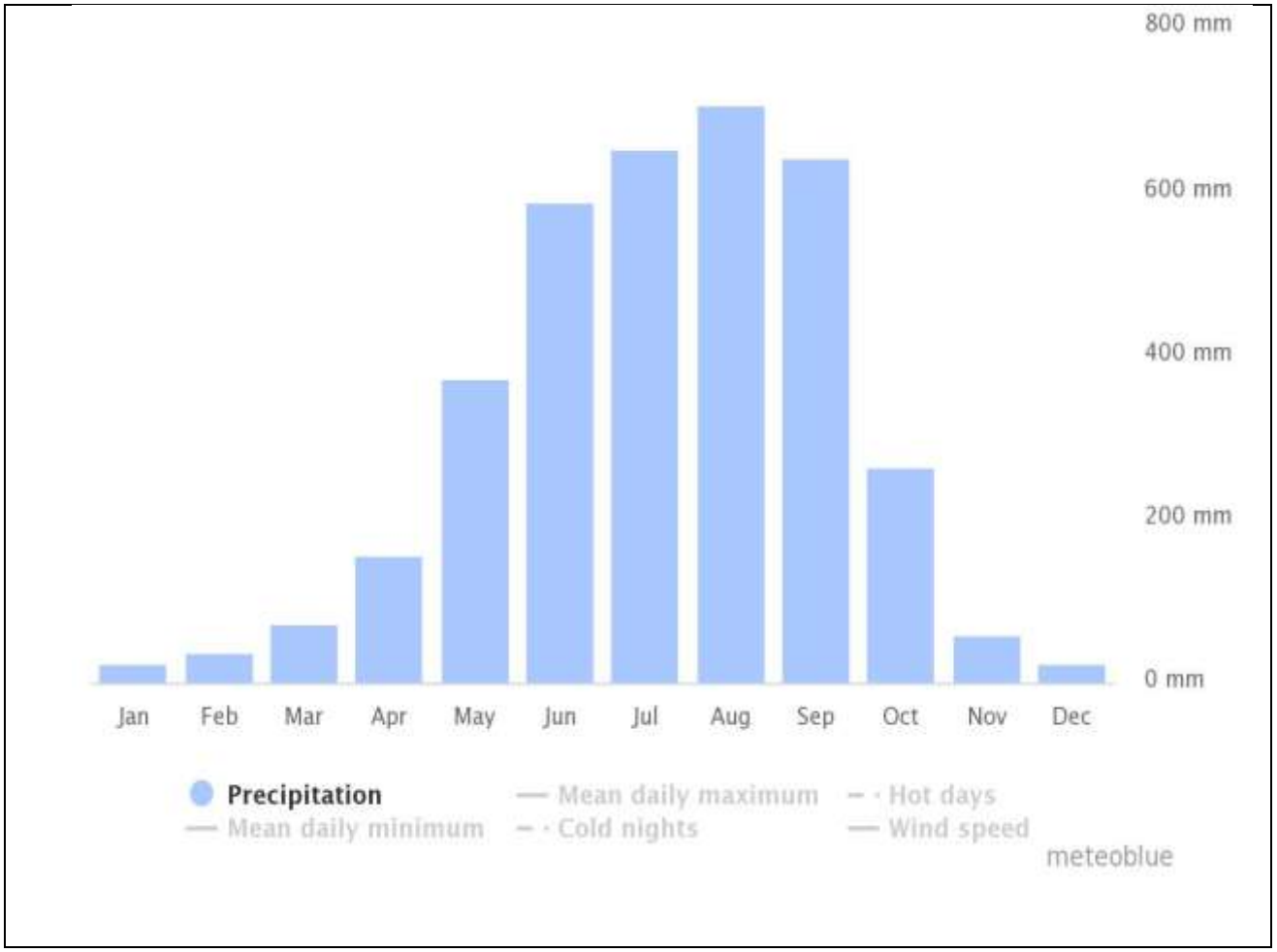


Figure 10: Precipitation in Nongstoin (Source-meteoblue)

Temperature:

The warm season lasts for 5.3 months, from May 20 to October 30, with an average temperature above 70°F. The hottest month of the year in Nongstoin is August, with anaverage of 23°C. The cool season lasts for 1.7 months, from December 17 to February 8, with an average temperature below 19°C. The coldest month of the year in Nongstoin is January, with an average of 17°F.

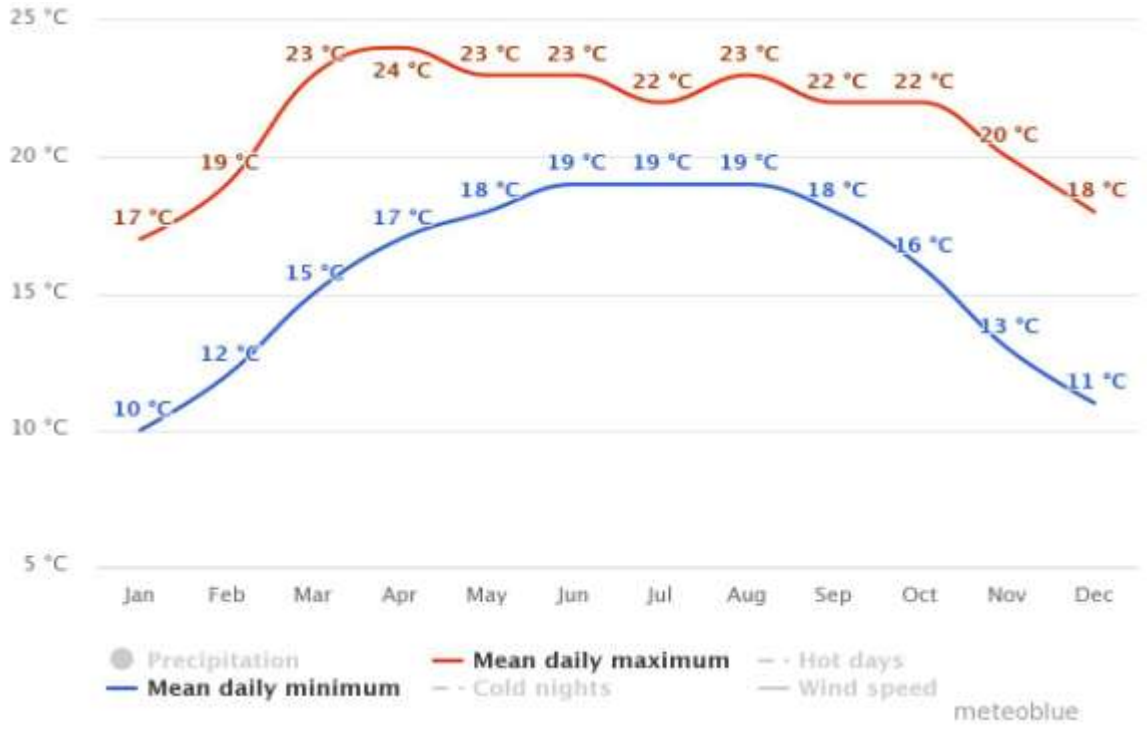


Figure 11: Average Temperature in Nongstoin

Wind Speed/Direction:

The average hourly wind speed in Nongstoin experiences significant seasonal variation over the course of the year. The windier part of the year lasts for 5.3 months, from March 25 to September 3, with average wind speeds of more than 6.4 miles per hour. The windiest month of the year in Nongstoin is July, with an average hourly wind speed of 8.4 miles per hourand so in these months there is a chance of soil erosion in this area. Potholes can also be created due to continuous soil erosion and water may get logged into the potholes during heavy rainfall which can ultimately led to the destruction of roads. The calmer time of year lasts for 6.7 months, from September 3 to March 25 and these months are the suitable for construction.

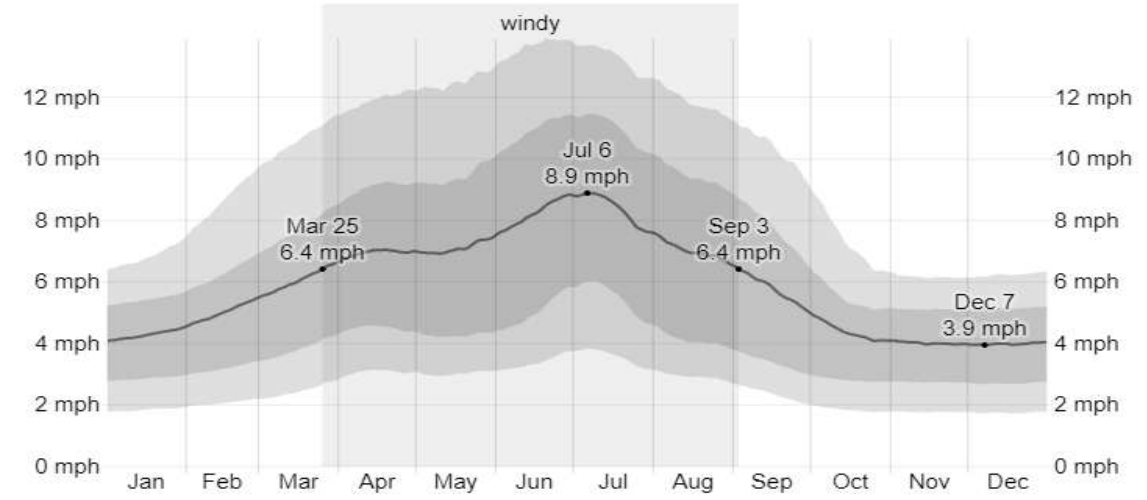


Figure 12: Average Wind Speed in Nongstoin

Source:https://weatherspark.com/y/111986/Average-Weather-in-Nongstoin-India-Year-Round

The wind is most often from the west for 2.5 months, from January 7 to March 23, with a peak percentage of 52% on March 2. The wind is most often from the south for 6.6 months, from March 23 to October 10, with a peak percentage of 87% on July 8. The wind is most often from the east for 2.9 months, from October 10 to January 7, with a peak percentage of 37% on January 1.Depending on the maximum flow direction of wind the setup of hot mix plant will be decided because the construction of roads should not affect the air quality of residential areas in the down wind direction.

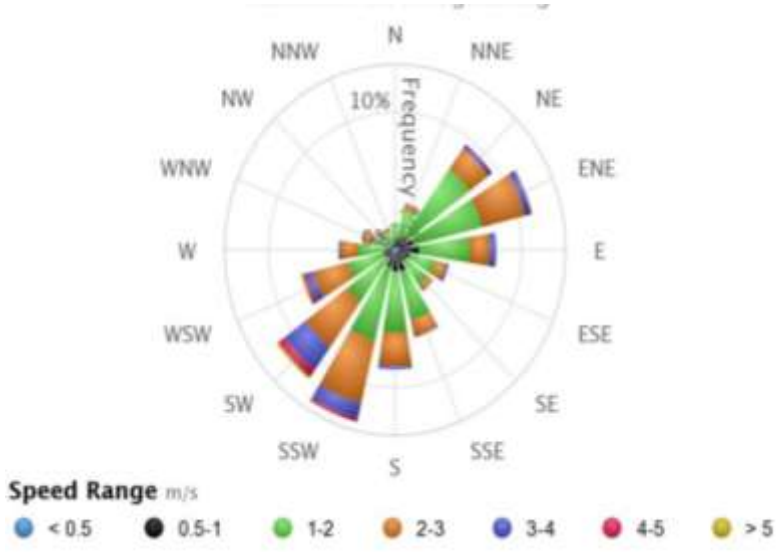


Figure 13: Wind Rose Diagram For Nongstoin

(Source:https://www.indianclimate.com/)

Relative Humidity:

The air is generally humid in this region during the monsoon reason when the maximum relative humidity was observed to be 95%. Similarly, the minimum relative humidity was observed to be 68%. Generally, the weather during other seasons was observed to be dry. The Relative Humidity is often associated with the working capacity of the labour force and shares an inversely proportional relationship. The higher the humidity, the less is the working capacity as the body gets tired and fatigued easily. Hence, construction work will be done more comfortably during the months when the humidity is lower.

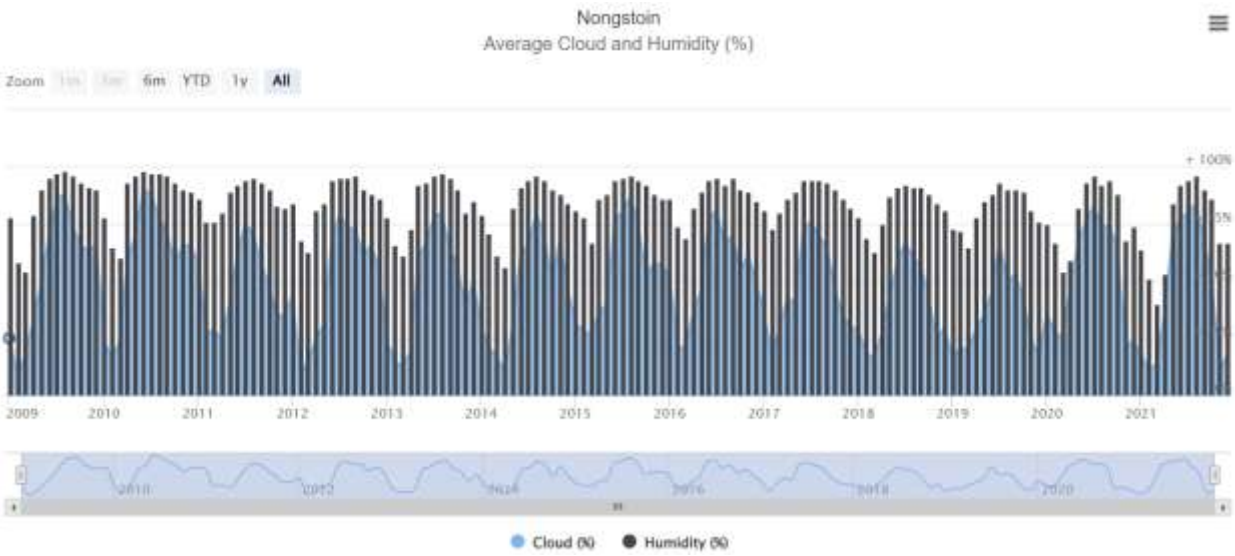


Figure 14: Average Humidity of previous 10 years

(Source: https://www.worldweatheronline.com/nongstoin-weather-averages/meghalaya/in.aspx)

Natural Hazards:

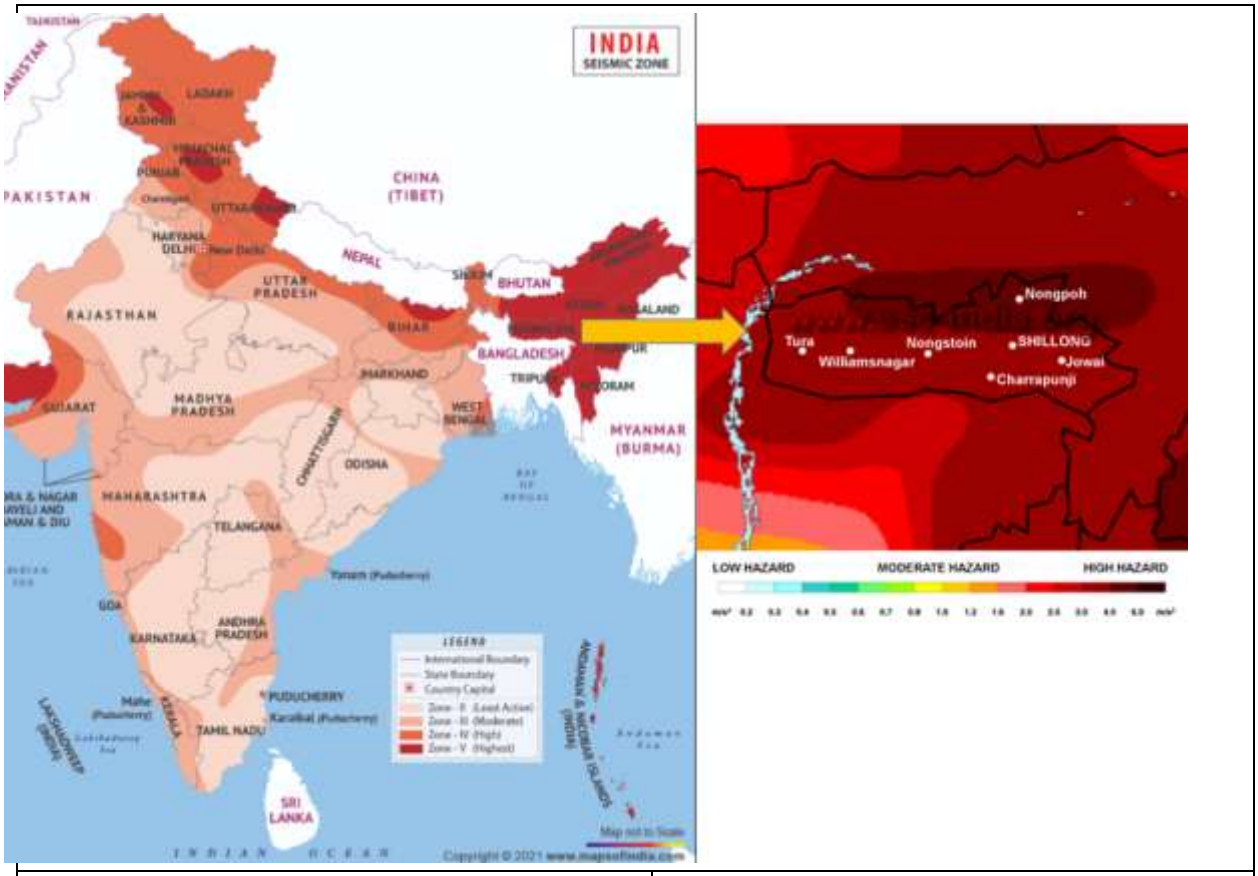
As the State lies in the seismically active zone, special emphasis should be given to reduce the impacts of earthquake. Moreover, it is also affected by hazards such as floods, flash floods, epidemics, fire, hailstorm, lightening, road accidents, etc.

The State of Meghalaya has witnessed seismic events of '8.7 magnitude in 1897'. This region has been identified as a potential site of a future catastrophic earthquake. With the growth of population and infrastructure, seismic vulnerability has increased and previous earthquakes have provided a glimpse of the devastating potential of seismic tremors

Seismicity:

Earthquake is a natural disaster so necessary safety measures may be adopted considering the vulnerability to avoid enhanced risk. As per the 2002 Bureau of Indian Standards (BIS) map, the state of Meghalaya falls in a region of high to very high seismic hazard.All districts of the state of Meghalaya lie in Zone V. This state also falls in Zone V.Considering high hazard seismic zone of the project road section area, design standards for structures stipulated in the clause under IRC: 6-2014 has been taken into account.

Both the project district and project arealie over high damage risk zone V. The project area falls in a high earthquake prone zonebut no such earthquake was recorded in Nongstoin-Maweti road. The seismic map of Meghalaya indicating the location of project stretch is shown inFigure below



Seismic Zone Map of India	Seismic Zone Map of Meghalaya

Source: http://asc-india.org/seismi/seis-meghalaya.htm

Figure 15: Seismic zone map of India & Meghalaya

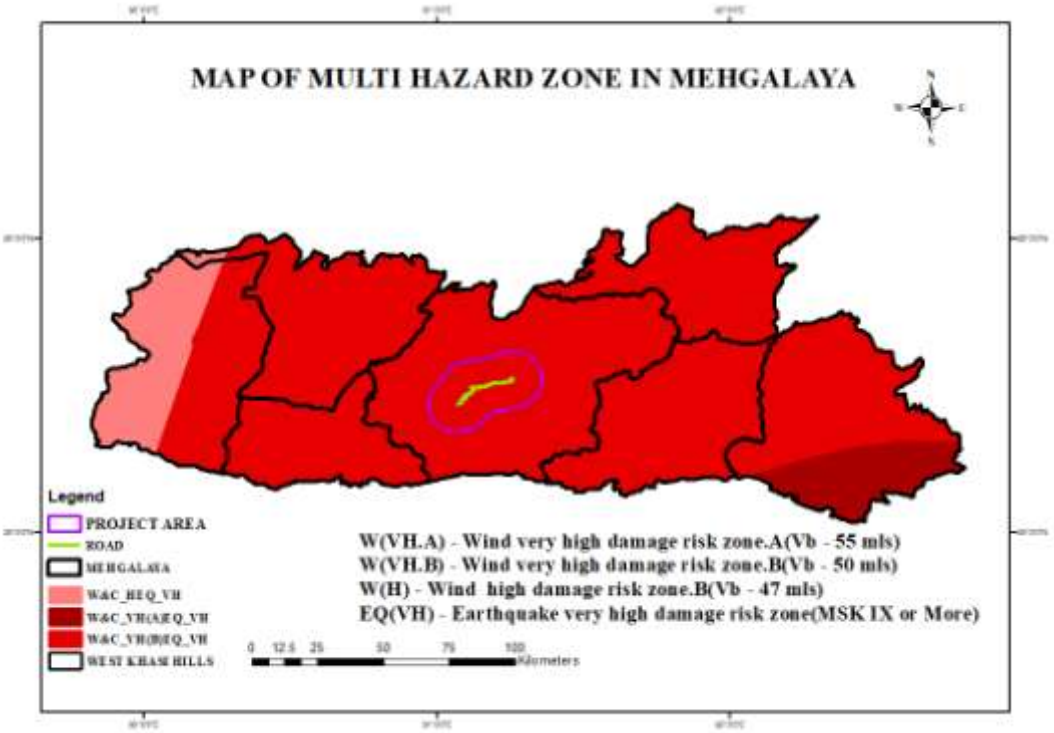


Figure 16: Map of Multi hazard Zone in Meghalaya showing the project road

Flood Hazard:

In Meghalaya, floods occur in river valleys when the flow exceeds the capacity of the river channel, particularly at bends or meanders. The plain areas of Meghalaya adjoining Assam are affected by flood due to the back flow of water from the River Brahmaputra during the flood season between June and October. The tributaries like Krishnai, Jinari, Jingjiram, Rongai, Dudhnoi, Ringgi, Gohai, Dilni etc cause flood in the plain areas of the State.

The Flood Prone Areas of Meghalaya:

- Western part of Meghalaya like Tikrikilla, Phulbari, Rajabala, Garobadha, Hallidaygunj, Bhaitbari, Fersakandi, Magurmari, Silkata, Mahendraganj etc.
- Plain areas near Bangladesh like Baghmara, Balat, Shella, Dawki etc.
- Urban Flooding in localized areas of Shillong, Williamnagar, Tura etc.
- Localised areas of West Khasi Hills, South West Khasi Hills, East Khasi Hills Jaintia Hills and in Ri-Bhoi Districts.
- Project district also fall under flood prone area. Flood prone area of Meghalaya is shown in the Figure below

The project area is not known to face significant impacts from monsoon floods. However, it does witness flash floods in certain low-lying areas. The patterns of floods cannot be forecasted.

Figure 17 :Flood Prone Zones of Meghalaya

Source: http://www.mati.gov.in/docs/Academic%20Module%20-%202/PDF%20(3rd%20November%202021)/vulnerability%20profile%20of%20meghalaya%2018th%20October,2013-SDMA.pdf

- **Landslide Hazard:**

Meghalaya being a hilly terrain is prone to landslides. Every year a number of landslides have been reported from various localities. These cause a lot of miseries to public, resulting in the loss of lives and properties, disruption of communication network, besides causing economic burden on the society. Landslide is primarily attributed to high slope, immature geology, neo-tectonic activity, heavy rainfall, unplanned and improper land use practice in the State. Landslides generally occur during heavy rains, that is during the months of June to October, in Meghalaya. The existing road section comes under high landslide zones.

Nongstoin-Maweit project road has been passing through mountainous terrain with steep and unstable slopes. Much of areas in this section are geologically young, resulting in soft/fragile substrates. These factors mean that project area conditions are amongst the most difficult in the region for road construction. Landslide prone and geologically weak zone along the project road are given below.

Chainage (KM)		Length(KM)
From	To	
5.825	6.920	1.095
12.450	12.990	0.540
14.150	14.250	0.100
17.975	19.590	1.615
20.410	23.260	2.850
24.525	25.175	0.650
27.200	27.700	0.500

Chainage (KM)		Length(KM)
From	To	
28.925	29.675	0.750
Total		8.100

Figure 18: Landslide Prone Location along the project road

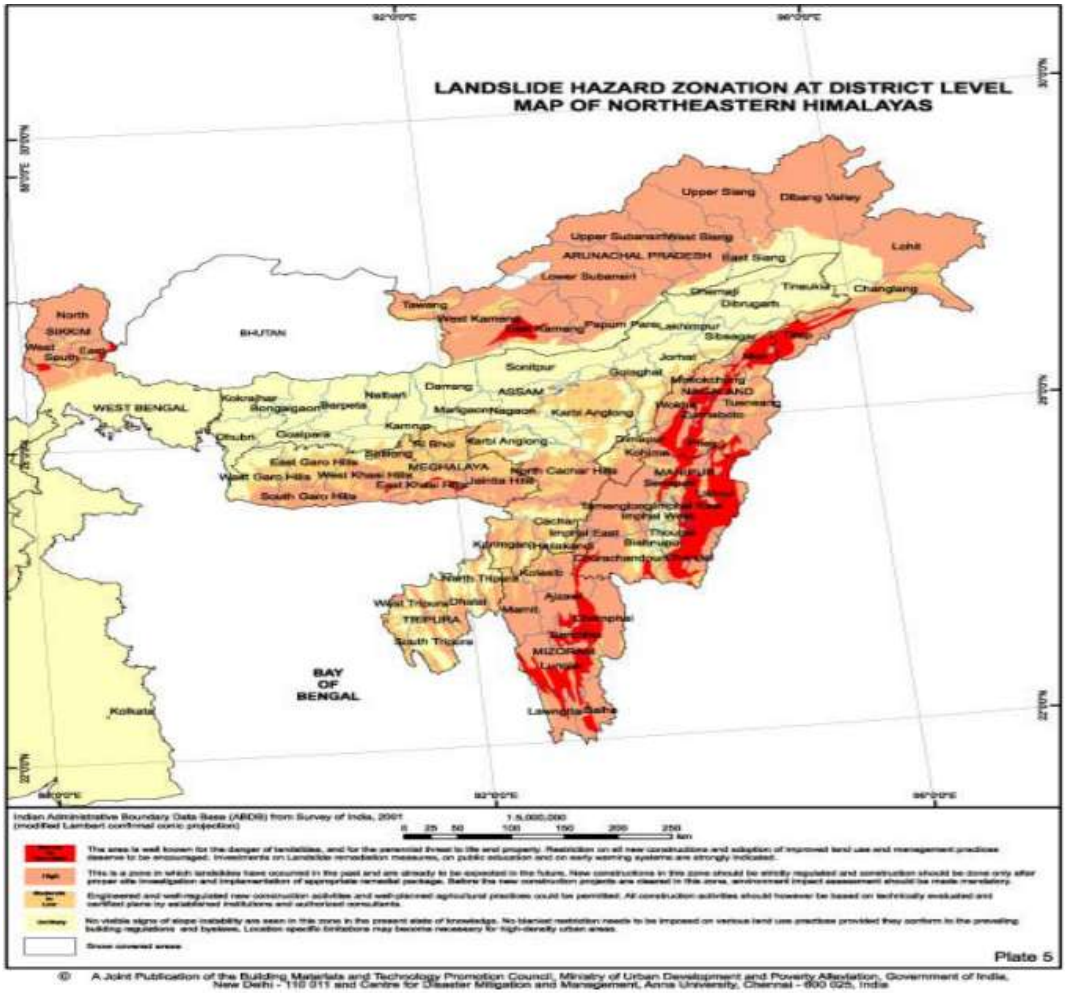


Figure 19: Landslide Map of North-Eastern Himalayas

Source: https://megrevenuedm.gov.in/reports/Meghalaya_State_Disaster_Management_Plan_Volume1.pdf

- **Cyclone**

Meghalaya is situated in the north eastern direction of Bangladesh which is highly prone to cyclone. Yearly, approx. 60% percent of the state is affected by cyclone in Bangladesh. The Districts close to Bangladesh like South West Garo Hills, South Garo Hills, South West Khasi Hills, West Khasi Hills, fall in very high cyclonic zone due to close proximity to Bay of Bengal (which is a cyclone basin). During April – May, various parts of Meghalaya observe cyclone. It has detrimental impacts on society and environment.
West Khasi Hill district and project road section also comes under high cyclonic zone. The Cyclone Zone map of Meghalaya indicating the location of the project stretch is shown inthe figure below

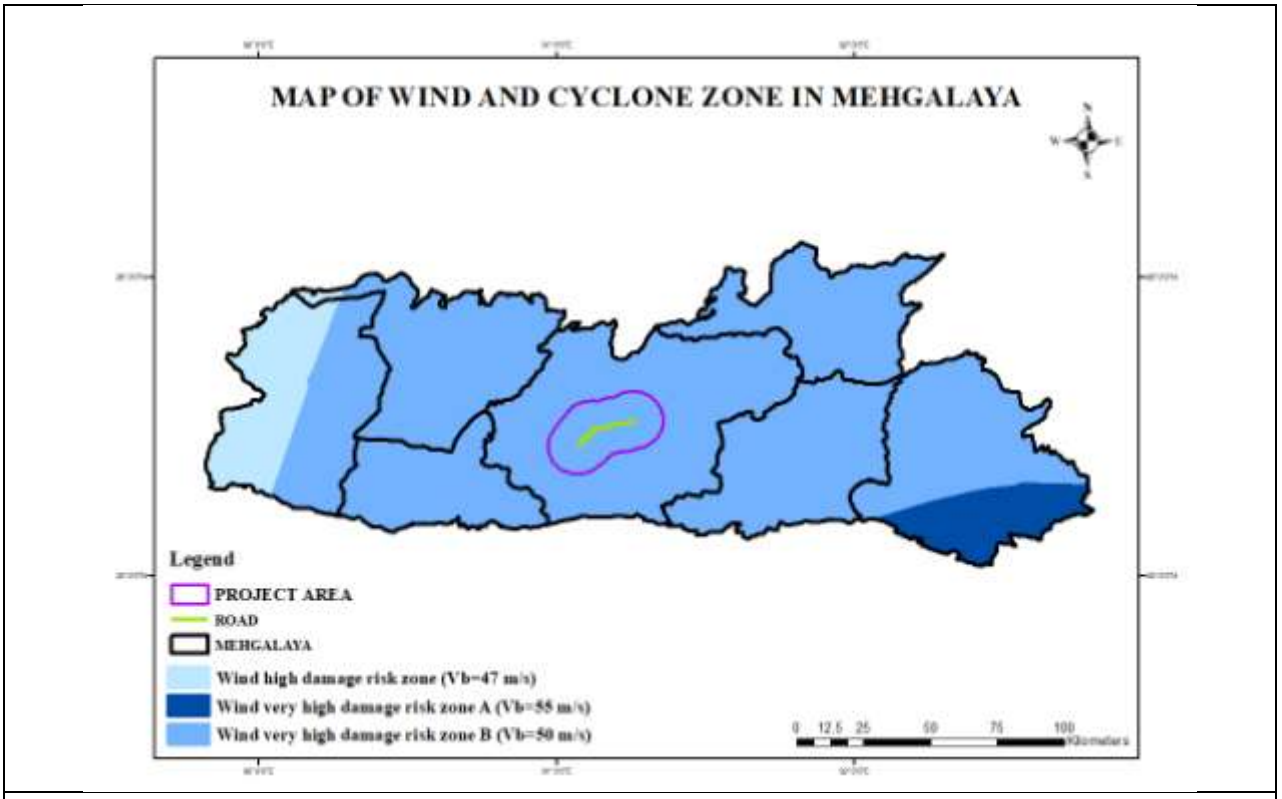


Figure 20: **Map of Wind and Cyclone Zone in Meghalaya showing the project road**

Land Use Pattern:

The project road passes mostly through hilly terrain and few stretches pass through rolling terrain. The adjoining land is generally hilly with vegetation. A combination of conversion of land use to agriculture and plantations, deforestation and periods of intense rainfall render several tracts of land abutting the road to be erosion prone.The land use pattern of the project area is presented in **Error! Reference source not found.** below.The project corridor has scattered built up area named as Nongpyndeng, Mawlait, Nongthraw, Miangshiang, Nongsba, Nongpathar, Maweit Etc.

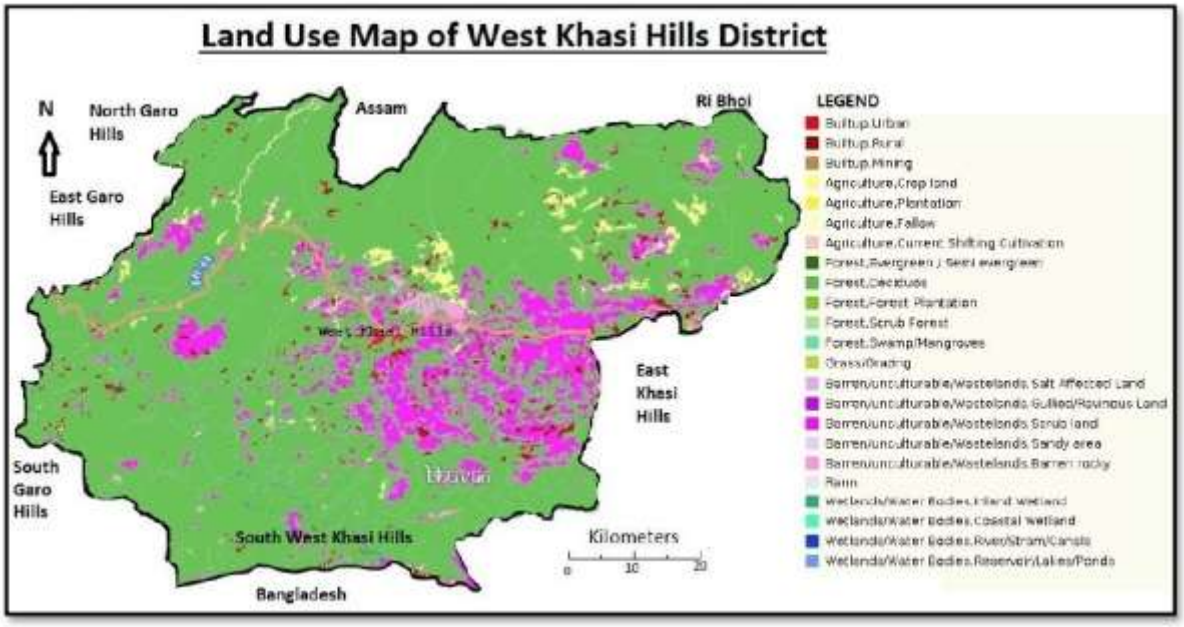


Figure 21: Land use map of West Khasi Hills

Water Environment:

The Project area is rich in water sources. There are several major river/streams in the vicinity of the project corridor. All of these rivers are perennial. Ground water resources are used for drinking purpose by open wells, Bore wells, tube wells or installing hand pumps.
The project corridor is dotted with a number of ponds along theProject road. Few of them are located in close to the RoW. The details of surface waterresources along the project road section are given in table below.

Table 24:Water Bodies along the Project Road

Sl.No	Water Body	Chainage	Distance from the road (m)
1.	Pond	Ch. 1.400 km,RHS	2.18
2.	Pond	Ch. 5.000 Km ,RHS	5.60
3.	Pond	Ch. 9.500 Km,LHS	12.16
4.	Pond	Ch. 19.900 km,RHS	4.65
5.	Pond	Ch. 25.750km,LHS	7.19
6.	Pond	Ch. 27.100 km,RHS	916.39
7.	Pond	Ch. 32.000km,RHS	6.36
8.	Risiang River	Ch.11.250km	
9.	Wahlyngdoh River	Ch. 20.100 km	
10.	Umiang River	Ch.30.380km	

Some photographs of road side ponds and rivers are shown in figure below

Roadside Pond

Roadside Pond

Roadside Pond

Roadside Pond

Roadside Pond

Roadside Stream

Figure 22 Photographs of few surface water bodies along the project road

Water Quality Monitoring

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 January2022 (winter period). The water samples, after collection, were immediately subjected to the analysis of various parameters in the NABL Accredited laboratory. The parameters analysed, include pH, Electrical Conductivity (EC), Total Alkalinity (TA), Total Hardness (TH), Nitrate (NO_3), 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 ground water samples were collected for winter season (January 2022) to assess the ground water quality along the project road. These samples were taken as grab samples and were analyzed for various parameters to compare with the standards. The details of monitoring locations for assessing the groundwater quality are indicated in Table 25. The ground and surface water quality result of the project road is given in the Table 26.

Table 25:Groundwater sampling locations along the project road

Sampling Location	Date of Sampling	Name of place	Source	Distance (m)	Coordinates	
					Latitude	Longitude
1	08/01/2022	Nongstoin	Tube well	100	26.694302	94.413154
2	08/01/2022	Nonglyer	Hand pump	100	26.694302	94.413154

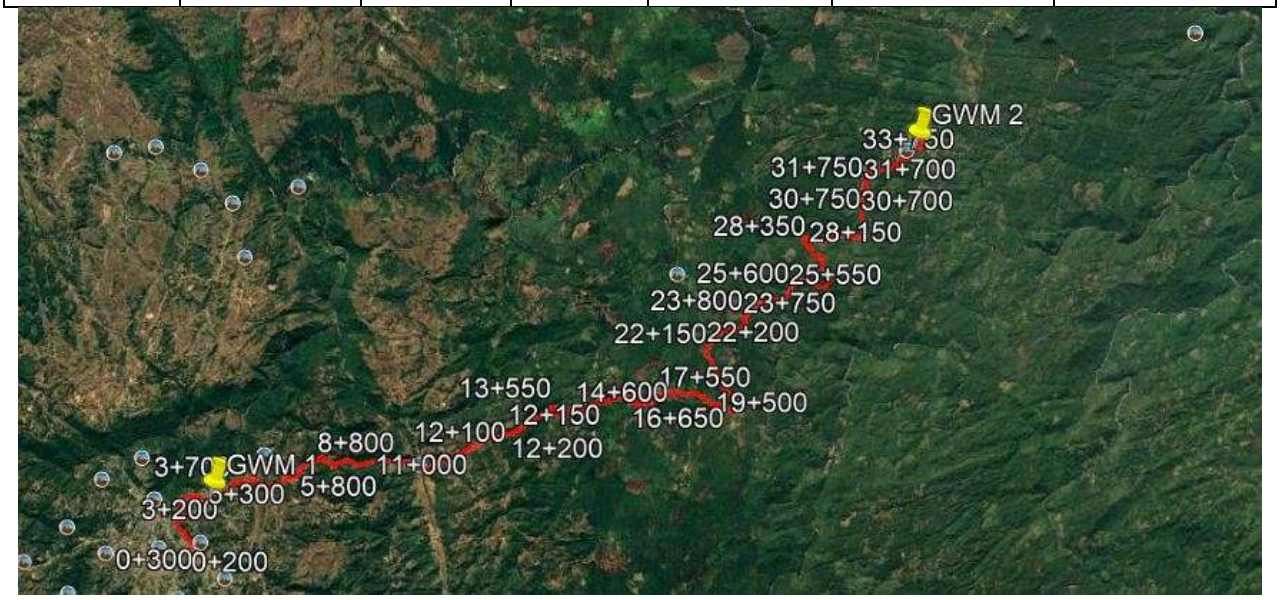


Figure 23: Groundwater sampling locations along the project road

Table 26:Ground Water quality result of the project road

Sl.	Parameters	Unit	Limit (as per IS:10500-2012)		Result		WHO Drinking Water Standard (Fourth Edition 2011)
			Desirable Limit	Permissible Limit	Nongstoin	Nonglyer	
1	pH	-	6.5-8.5	No Relaxation	6.67	6.64	8.2-8.8
2	Colour	Hazen	5	25	<1	<1	Not Exceeding 5 hazen Unit
3	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Unobjectionable
4	Total Hardness (as $CaCO_3$)	mg/l	200	600	111	85	-
5	Chloride (as Cl)	mg/l	250	1000	21.4	18.4	-
6	Fluoride (as F)	mg/l	1	1.5	BDL	BDL	1.5
7	Calcium (as	mg/l	75	200	22.4	16.8	-

Sl.	Parameters	Unit	Limit (as per IS:10500-2012)		Result		WHO Drinking Water Standard (Fourth Edition 2011)
			Desirable Limit	Permissible Limit	Nongstoin	Nonglyer	
	$CaCO_3$)						
8	Magnesium (as $CaCO_3$)	mg/l	30	100	13.5	10.5	-
9	Sulphate (as SO_4)	mg/l	200	400	36	32	-
10	Nitrate (as NO_3)	mg/l	45	No Relaxation	0.06	0.05	50
11	Alkalinity as ($CaCO_3$)	mg/l	200	600	109	92	-
12	TDS	mg/l	500	2000	232	185	-
13	Electrical Conductivity	Micromhos/cm	-	-	357	284	-
14	Sodium (as Na)	mg/l	-	-	24.1	20.9	40
15	Potassium (as K)	mg/l	-	-	11.2	8.4	-
16	Total Coliform	mg/l	Nil	Nil	Absent	Absent	Absent
17	Fecal Coliform	mg/l	Nil	Nil	Absent	Absent	Absent

Source: Environmental Baseline Monitoring

It can be seen from **Error! Reference source not found.**that the pH of the drinking water varies from 6.64 to 6.67. Total hardness as $CaCO_3$ varies from85 to 111 mg/l. Other parameters analyzed like chloride, sulphate, fluorides are found well within standards. It can be seen from the results that the ground water quality meets the standards of IS:10500-2012 standards for drinking water and CPCB standards for ground water at all sampling locations. The chemical constituents present in the ground water of the district (Table -26) is within the desirable limit set for drinking and irrigation water standards.

Samples from different waterbodies were taken in the month of January 2022 in order to assess the surface water quality within the project area. The water samples from the following water sources were collected for assessing the physico-chemical characteristic of water.The analysis result of various quality parameters has been presented intable below.

Table 27:Surface water sampling locations along the project road

Sampling Location	Date of Sampling	Name of place	Source	Distance (m)	Coordinates	
					Latitude	Longitude
1	07/01/2022	Nongstoin	Road side pond	100	26.700120	94.437104
2	07/01/2022	Maweit	Road side Pond	100	26.700120	94.437104

Source: Environmental Baseline Monitoring

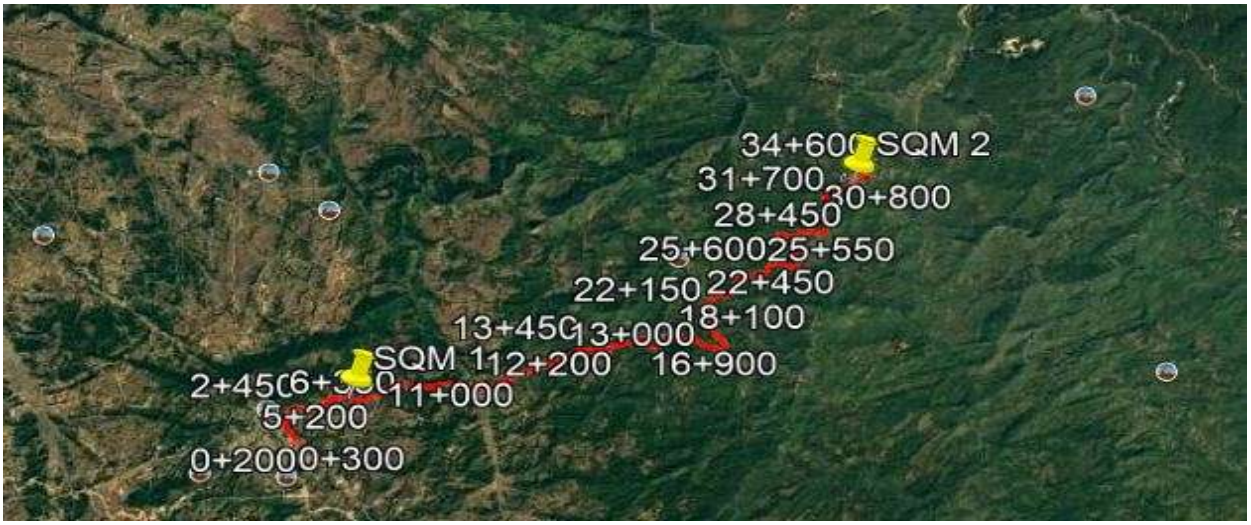


Figure 24: Surface water sampling locations along the project road

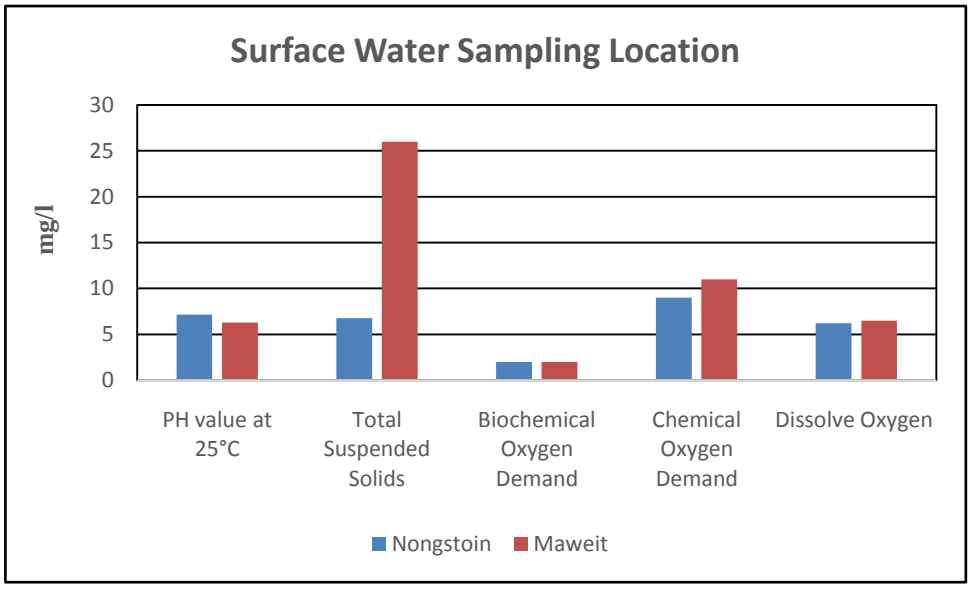
Table 28:Surface Water quality result of the project road

Organoleptic & Physical Parameters

Sl.	Parameter	Test method	Unit	Result		Standards/ Permissible Limits	CPCB Surface Water Standard	
				Nongstoin	Maweit	WHO	Inland Surface water Tolerance Limits for Class -B	Inland Surface water Tolerance Limits for class -D
1	Colour	IS-3025 (P-04)	Hazen Unit	<1	<1	-	-	-
2	Odour	IS-3025 (P-04)	-	Agreeable	Agreeable	-	-	-
3	pH value	IS-3025 (P-04)	-	7.14	6.78	6-9	6.5 – 8.5	6.5 – 8.5
4	Total Dissolved Solid (TDS)	IS-3025 (P-04)	mg/l	156	133	-	-	-
5	Electrical Conductivity	IS-3025 (P-04)	µs/cm	240	204	-	-	1000
6	Total Suspended Solid	IS-3025 (P-04)	mg/l	4	6	-	-	-
7	Total Dissolve Oxygen	IS-3025 (P-04)	mg/l	6.2	6.5	-	5	4
8	Biological Oxygen Demand	IS-3025 (P-04)	mg/l	02	02	30	3	-
9	Chemical Oxygen Demand	IS 3025 (Part-I)	Mg/l	09	11			
10	Phosphate Content	IS-3025 (P-04)	mg/l	0.4	0.7	-	-	2

Concerning Substances Undesirable in Excessive Amounts

Sl.	Parameter	Test method	Unit	Result		Standards/ Permissible Limits	CPCB Surface Water Standard	
				Nongstoin	Maweit	WHO	Inland Surface water Tolerance Limits for Class -B	Inland Surface water Tolerance Limits for class -D
11	Total Ammonia	IS: 3025 (P- 34)	mg/l	0.28	0.24	-	-	-
12	Calcium (as Ca)	IS: 3025 (P- 40)	mg/l	15.2	14.4	-	-	-
13	Chloride (as Cl)	IS: 3025 (P- 32)	mg/l	16.2	12.4	-	-	-
14	Copper (as Cu)	IS: 3025 (P-42)	mg/l	BDL	BDL	-	-	-
15	Iron (as Fe)	IS: 3025(P-53)	mg/l	0.04	0.08	-	-	-
16	Magnesium (as mg)	IS: 3025 (P-46)	mg/l	8.4	6.1	-	-	-
17	Nitrate (as NO_3)	IS: 3025 (P- 34)	mg/l	1.2	1.5	-	-	-
18	Sulphate (as SO_4)	IS: 3025 (P- 24)	mg/l	34	28	-	-	-
19	Alkalinity (as Ca CO_3)	IS: 3025 (P- 23)	mg/l	71	64	-	-	-
20	Total hardness (as $CaCO_3$)	IS: 3025 (P- 21)	mg/l	72.4	61	-	-	-
21	Zinc (as Zn)	IS: 3025 (P- 49)	mg/l	0.6	0.8	-	-	-
22	Sodium (as Na)	IS-3025(P-45)	mg/l	16.5	15.2	-	-	-
23	Potassium (as K)	IS-3025(P-45)	mg/l	6.4	5.4	-	-	-



In the above graph it is clear that at MaweitDO, COD and TSS value is higher than Nongstoin. BOD is same in all the sampling locations .

CPCB and MOEF&CC has categorized the surface water into 5 different categories namely A, B, C, D and E (Ref: http://cpcb.nic.in/water-quality-criteria/). From **Error! Reference source not found.**it can be inferredthat in both thesurface water monitoring locations the pH values are between 6.5 – 8.5, dissolved oxygen level is above 4 mg/l and free ammonia is less than 1.2mg/l. Hence the surface water along the project road can be classified as Category A.

Table 29CategorisationofsurfacewaterbyCPCBandMOEF&CC

Designated-Best-Use	Class ofwater	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 orless, pH between 6.5 and 8.5, DissolvedOxygen 6mg/lormore Biochemical Oxygen Demand 5 days 20C 2mg/l orless
Outdoor bathing (Organized)	B	Total Coliforms Organism MPN/100ml shall be 500 orless, pH between 6.5 and 8.5, Dissolved Oxygen 5mg/lormore Biochemical Oxygen Demand 5days 20C3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000or less, pH between 6 to 9, Dissolved Oxygen 4mg/l ormore, Biochemical Oxygen Demand 5 days 20C 3mg/l orless
Propagation of Wild life and Fisheries	D	pH between 6.5to 8.5, Dissolved Oxygen 4mg/l or more, Free Ammonia (asN)1.2mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0to 8.5, Electrical Conductivity at 25C micro mhos/cmMax.2250, Sodium absorption Ratio Max. 26, Boron Max.2mg/l

As seen from the results, the pH of the drinking water in the region is well within permissible limits (6.64-6.67). The total dissolved solids in the samples collected vary from 133 mg/l to 156 mg/l which is well within the permissible standards. Total hardness as CaCO3 in the water sample varies from 85mg/l to 111mg/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 to be good by visual identifications. There are no reports of any water-borne diseasesin the region. People are using this water for various domestic purposes.

Air Environment:

Air pollution is caused due to both natural and manmade processes. The main source of air pollution is human induced/manmade, which includes industrialization and its by products, burning of timber, heat and light, rapid urbanization, vehicular pollution, plastics, burning of polymers and processing of various materials emitting obnoxious gasses, generation of smoke, dust and fine respirable particles due to construction activity and rapid burning etc. Vehicular emission is the major source of air pollution now-a-day. Presently some patches of the study area are in the locality of heavy traffic movement particularly at congested places i.e. at major market areas, which may impact the ambient air quality of the area. During construction stage of the project, temporary air pollution arises due to movement of construction vehicles, operation of plants & machineries, dust emission due to excavation and demolition etc.

Monitoring Parameters and Standards

The Environmental monitoring of the parameters involved and the threshold limits specified are discussed below: -

Ambient Air Quality Monitoring

The air quality parameters viz. Sulphur di-oxide (SO_2), Oxides of Nitrogen (NO_X), Carbon Monoxide (CO) and Particulate Matter ($PM_{2.5}$& PM_{10}) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards.
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 2022.

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. Selection of Air quality monitoring station was done as per MoEF guidelines for conducting EIA study. 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.

Frequency and Parameters for Sampling

High volume samplers were used to collect/measure the air pollutant concentration data at 24 hours averaging periods for all stations. Thebaseline data of air environment was monitored for parameters mentioned below:

1. Particulate Matter (PM2.5);
2. Particulate Matter (PM10);

3. Sulphur dioxide (SO_2);
4. Oxides of Nitrogen (NO_x);
5. Carbon Monoxide (CO)

The AAQ sampling is carried out on the basis ofthe 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 2 locations as shown in**Error! Reference source not found.** belowalong the project road for particulate matter ($PM_{2.5}$ and PM_{10}), sulphur dioxide (SO_2), oxides of nitrogen (NO_X); and carbon monoxides (CO) using standard analysis technique is shown in table below

Table 30:Techniques Used for Ambient Air Quality Monitoring

Sl.	Parameter	Technique	Minimum DetectableLimit ($\mu g/m^3$)
1.	Particulate Matter ($PM_{2.5}$)	Gravimetric Method	10.0
2.	Particulate Matter (PM_{10})	Gravimetric Method	25.0
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 mg/m^3)

To study the baseline ambient air quality scenario within the project corridor the ambient airquality, air sampling was carried out in the month of January 2022.To generate post-monsoon airquality of the project area, samples of ambient air was collected from two (2) locations for twicea week for two weeks.

Table 31:Air Quality Monitoring locations along the project road

Sl.	Date of Sampling	Name of place	Distance (m)	Coordinates		Type of Area
				Latitude	Longitude	
1	03/01/2022 to 04/01/2022 07/01/2022 to 08/01/2022	**Nongstoin**	50	32°45'40.68"	28°23'188.13"	Residential cumcommercial area
2	03/01/2022 to 04/01/2022 07/01/2022 to08/01/2022	**Miangkain**	50	32°45'40.68"	28°23'188.13"	Residential Area

Source: Environmental Baseline Monitoring

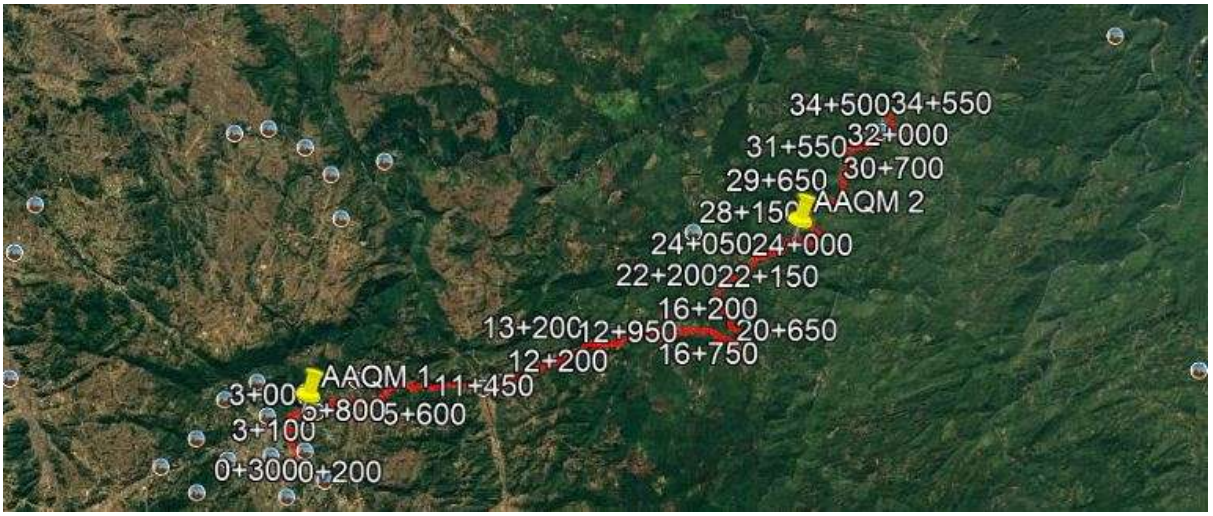
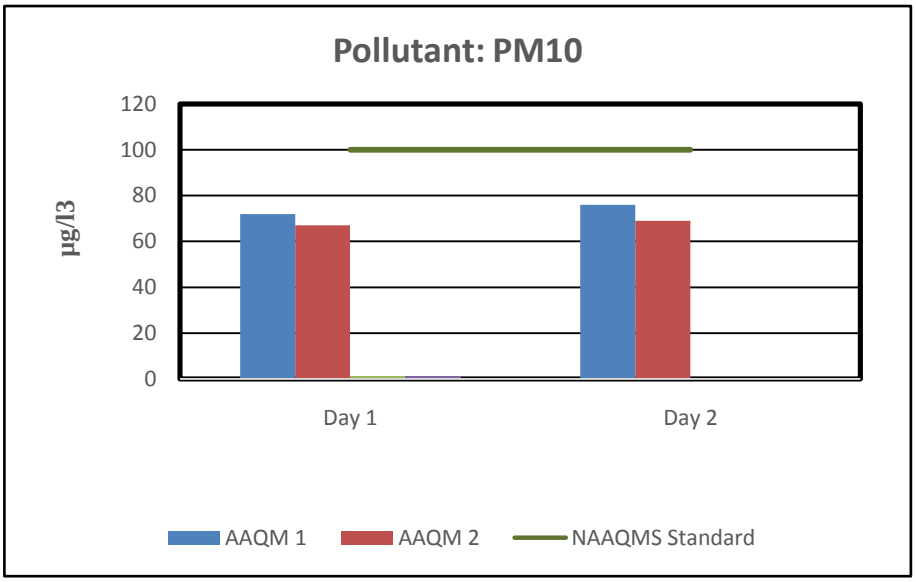


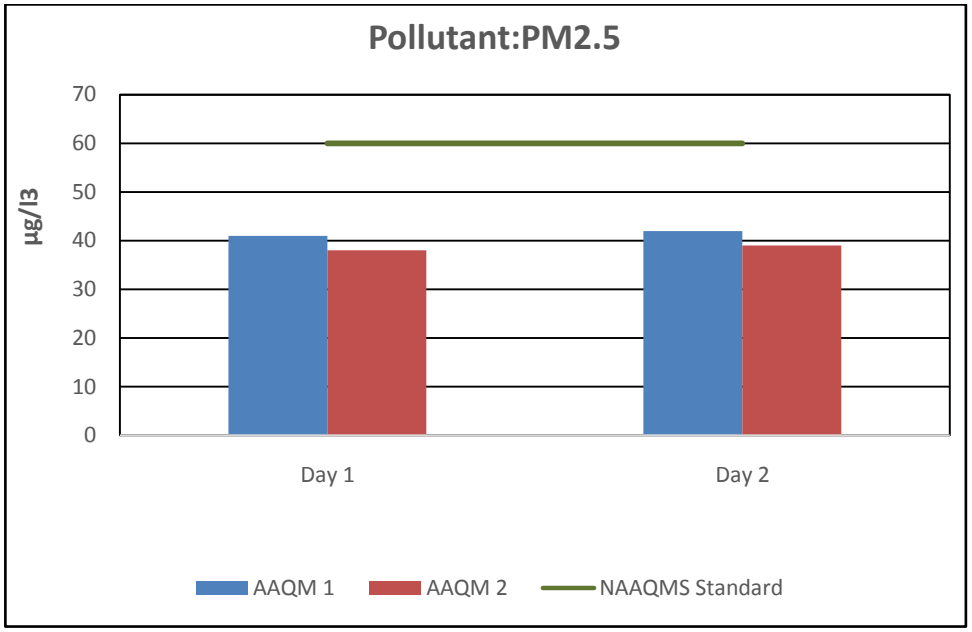
Figure 25: Air Quality Monitoring locations along the project road

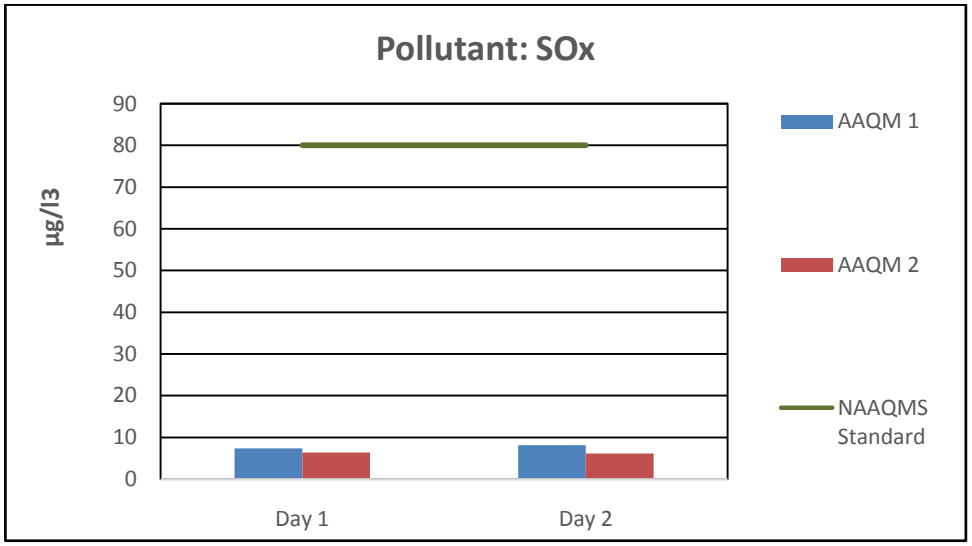
Ambient air quality monitoring results for $PM_{2.5}$, PM_{10}, SO_2, NO_X, and CO concentrations are given in Table 32 and summarized below. The monitored values are compared with National Ambient Air Quality Standards prescribed by Central Pollution Control Board (CPCB) and WHO Ambient Air Quality Guidelines (IFC EHS) for residential, rural, and other areas.

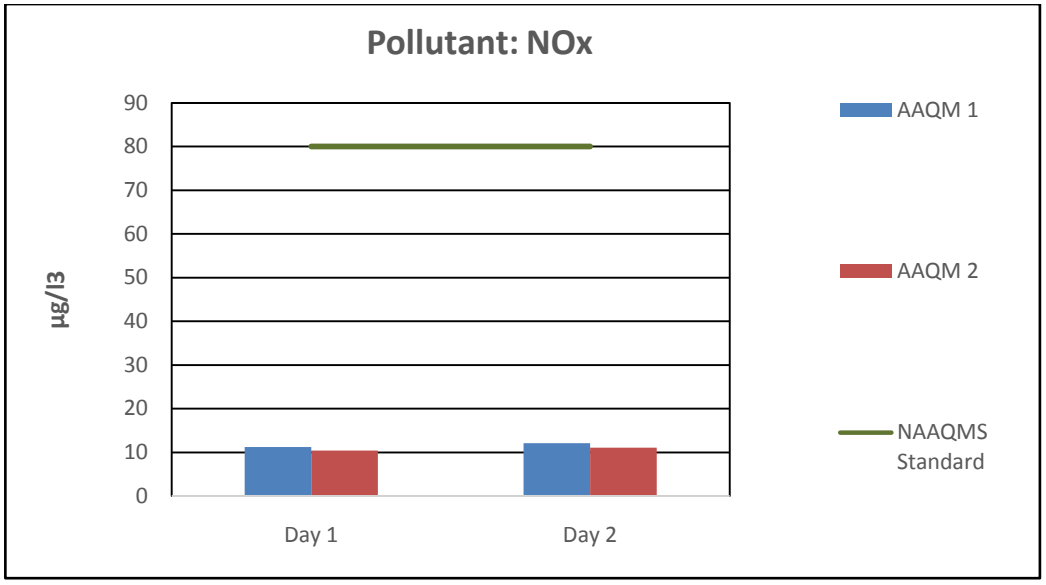
Table 32:Ambient Air Quality along the Project Road

	S. N.	Particulate Matter (PM_{10})	Particulate Matter ($PM_{2.5}$)	Sulphur Dioxide	Nitrogen Dioxide	Carbon Monoxide	Hydrocarbon (HC), µg/m³	Lead (Pb), µg/m³
National Ambient Air Quality Standard (CPCB) - Permissible limit		100	60	80	80	2	-	1
AAQM 1: Nongstoin								
Week 1	1	72	41	7.4	11.2	BDL	BDL	BDL
Week 2	2	76	42	8.1	12.1	BDL	BDL	BDL
AAQM 2: Miangkain								
Week 1	5	67	38	6.4	10.4	BDL	BDL	BDL
Week 2	6	69	39	6.1	11.1	BDL	BDL	BDL


Pollutant: PM10
µg/l3
120
100
80
60
40
20
0
Day 1
Day 2
AAQM 1
AAQM 2
NAAQMS Standard


Pollutant:PM2.5
µg/l3
70
60
50
40
30
20
10
0
Day 1
Day 2
AAQM 1
AAQM 2
NAAQMS Standard


Pollutant: SOx
µg/l3
90
80
70
60
50
40
30
20
10
0
Day 1
Day 2
AAQM 1
AAQM 2
NAAQMS Standard



The Ambient air quality levels meet the National air quality standards for the rural, residential area all along the project road. Concentrations of all the parameters at twolocations are within the National Ambient Air Quality Standard (CPCB) - Permissible limit.

$PM_{2.5}$: The mean $PM_{2.5}$ concentration at ambient air quality monitoring locations varies from38 µg/m^3 to 42 µg/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 67 to 76 µg/m^3. The values are within the permissible limit at all the stations as per the NAAQS.

SO_2: The mean concentrations of SO_2 at all ambient air quality monitoring locations vary from 6.1 µg/m^3 to 8.1 µg/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 10.4 to 12.1 µg/m^3. The values are within the permissible limit at all the stations.

CO: The CO level was measured below detection limitat all the locations.

Noise Environment:

Noise can be defined as any sound that is undesirable because it interferes with speech and hearing, and is intense enough to damage hearing or is otherwise annoying. Noise impacts can be of concern during construction and operational phases of the project.

Noise quality is an issue particularly at congested locations due to heavy traffic jams, horns and slow moving traffic. The educational institutions, health care facilities, Court etc along the project corridor comprise sensitive receptors with respect to noise pollution.

The Ambient Noise Quality Standards with respect to noise have been stipulated by Govt. of India vide Gazette Notification dt.14.02.2000.

Table 33:Ambient Noise Standards

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

* Silence zone is defined as an area up to 100 meters around such premises as hospitals, educational institutions and courts. The silence zones are to be declared by the competent authority;

A separate Environment Management and Monitoring Plan for the safeguard of noise environment have been prepared to mitigate the different impacts caused due to construction activities, which is provided in the subsequent chapters.

Noise Quality Monitoring

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 along the proposed alignment. 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 from7 AM to 10 PM and night levels from 10 P.M. to 7 AM at 2locations. The Details of the monitoring locations are given in Table 34. Day and night-time Leq have been calculated from hourly Leq values and compared with the stipulated standards.

The monitored values are compared with CPCB Ambient Air Quality Standards in respect of Noise and Guidelines for Community Noise, World Health Organization for residential areas. The monitored levels meet the National as well as WHO standards for the residential area all along the project road.

The main objective of noise monitoring in the study area is to establish the baseline noise levels, which was used to assess the impact of total noise generated by the proposed project activities. Noise level monitoring was carried out continuously for 24 – hours with one-hour interval at each location using Sound level meter capable of measuring the Sound Pressure Level (SPL) in Db (A). Hourly Leq values were computed by the noise

integrating sound level meter and statistical analysis was done for measured noise levels in the study area.

Table 34;Noise Monitoring locations along the project road

Sampling Location	Date of Sampling	Name of place	Coordinates		Land use
			Latitude	Longitude	
1	03.01.2022-07.01.2022	**Nongstoin**	32°45'40.68''	28°23'188.13''	Residential cum Commercial area
2	03.01.2022-07.01.2022	**Miangkain**	32°45'40.68''	28°23'188.13''	Residential Area

Source: Environmental Baseline Monitoring

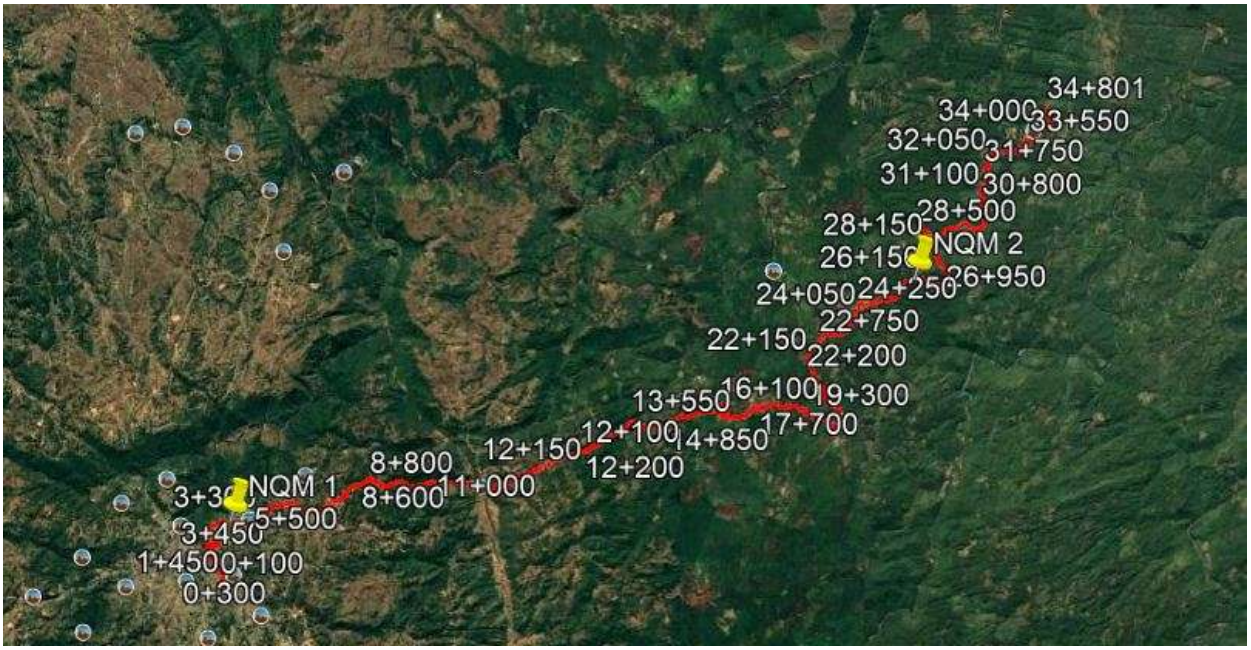
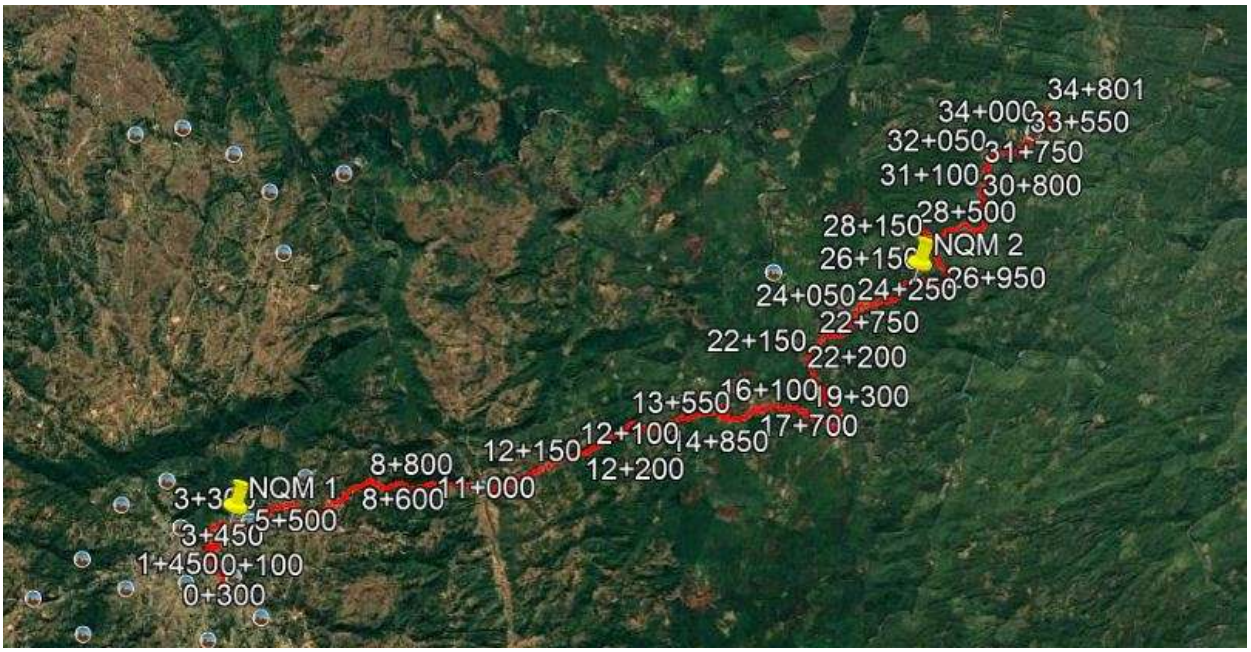


Figure 26:Noise Monitoring locations along the project road

Table 35;Day and Night Time Leq in the Project Area

	Noise location1: Nongstoin		Noise location 2Miangkain	
Date	**03.01.2022**	**07.01.202**	**03.01.2022**	**07.01.2022**
Maximum	52.3	52.1	52.1	51.2
Minimum	35.2	36.4	37.9	38.2
Leqday	48.6	47.7	48.2	47.7
Leqnight	36.4	36.5	39.4	38.3
Leq	48	47.4	48.6	47.9
STANDARD	**Day–65**	**Night-55**	**Day–55**	**Night - 45**

It can be seen from



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 48.6 dB(A) and night time noise level is 39.4dB(A) at Nongstoin and Miangkain respectively. Average day time noise level along the subproject roads varies from 47.7 dB(A) to 48.6 dB(A) whereas average night time noise levels vary from 36.4 dB(A) to 39.4dB(A).

Biological Environment:

Ecological resources are among the most important resources impacted by the road/infrastructure projects. The detailed baseline study of the ecological resources is essential to estimate the magnitude of potential impacts and to avoid or mitigate any loss caused by the proposed project. In this section baseline details of the flora and fauna are presented.

The three geographical sub-regions of Meghalaya, viz., Khasi, Garo and Jaintia hills are among the wettest regions of the world, with clouds persisting in various areas nearly throughout the year. Meghalaya falls under the Indo-Myanmar Bioddiversity Hotspot zone. Meghalaya, is one of the biodiversity rich states of India in terms of diversity of both flora and fauna due to its unique geographical position at the meeting point of Indo-Malayan and Eastern Himalayan bio-geographical regions. Thus, it shares biodiversity elements including flora and fauna from both the regions. Meghalaya also shares rich species diversity containing species from Indo-China and rest of India. The diverse landscape of the state also supports a large array of forest types and species. The flora of Meghalaya comprises about 3,128 species of flowering plants of which a large number of species are endemic. Meghalaya harbours a rich diversity of orchids (Family: Orchidaceae), of which nearly 110 genera and 439 taxa are reported from the state. However, many authors believe that Meghalaya may have more species of orchids and many are still to be discovered (Kakati 1986). Meghalaya is also considered as centre of origin for a number of crop plants like rice, and Citrus based on the large number of wild relatives found in the state. True to its name, 'Meghalaya' is an abode of clouds and thus increased moisture conditions prevails. The hills rise abruptly in south, while it is gradual in north. The altitudinal variation ranges from 50 meters to 1950 meters with the Shillong plateau at the crest. The hills are dissected and drained by numerous rivers and rivulets draining to north and south. The climate is monsoonal with distinct warm-wet and cold-dry periods. The towns of Sohra

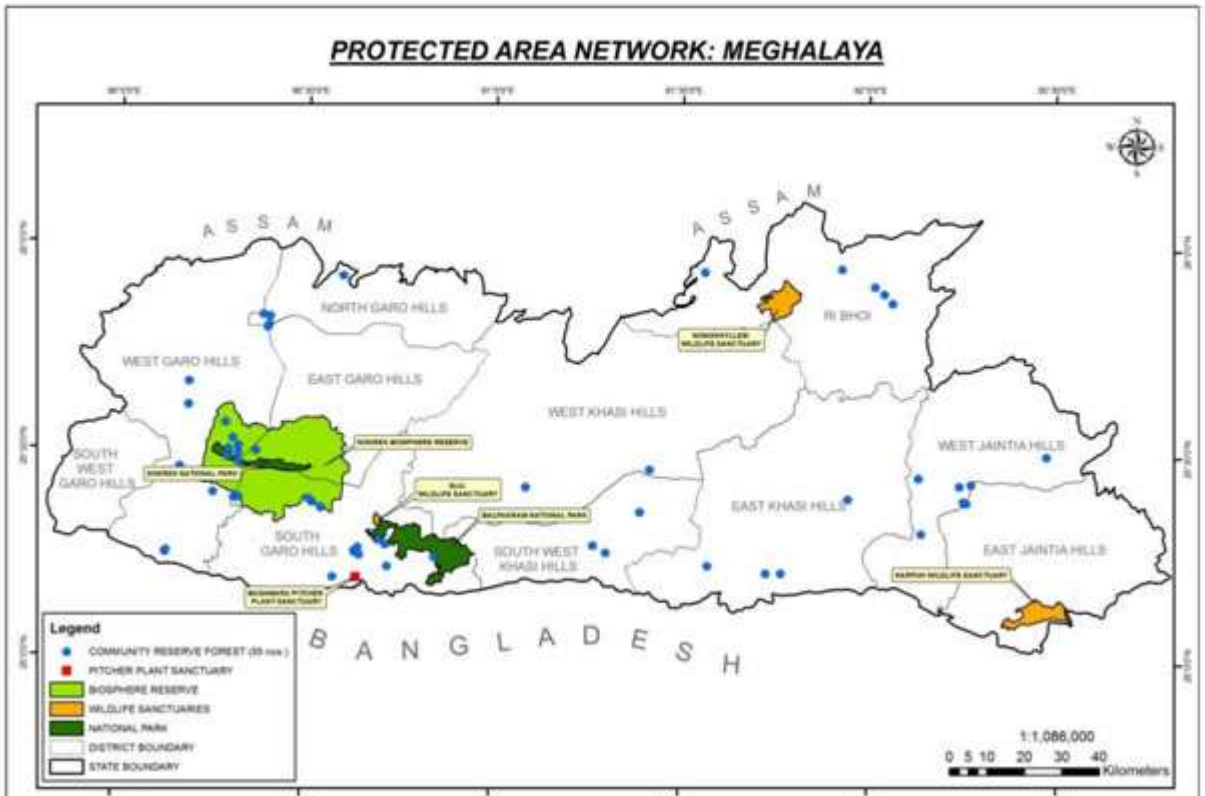
(Cherrapunjee) and Mawsynram, which are located on the Southern part of the State, receive very heavy rainfall and are amongst the wettest spots in the world.
The faunal diversity of Meghalaya constitutes a total of 5538 species recorded so far, of a total 89,451 species known from India. Nearly 35 % of Indian Mammals and 50 % of the birds are represented in the state. Invertebrates are represented by 2114 genera and 4580 species, of which 3624 species are insects. Among invertebrates, the porifera is the smallest group represented by only one genus and one species. Meghalaya has 139 species of Mammals, 659 species of Birds, 107 species of Reptiles, 55 species of Amphibia and 152 species of Fishes. Of these, 35 species of Mammals are endangered, vulnerable or insufficiently known. Similarly, 10 species of birds and 9 species of reptiles are either endangered or vulnerable. Along with the species diversity, the State has a significant percentage of endemic elements.
West Khasi Hills District was carved out of the state of Meghalaya in the year 1976 on the 28 day of October which in fact is the largest of all the eleven districts in the state of Meghalaya and since its existence, it has been bifurcated into two Civil Sub-divisions and a new district in South West Khasi Hills. It spreads through the heart of the state running high with plateau ranges and low with rich plain lands.

Protected Areas of Meghalaya:

The protected area network in Meghalaya occupies 1133.9 Sq. Km area which constitute about 5.06 % of the State's Geographical Area. The Protected Area Network includes 2 national Parks, 4 wildlife Sanctuaries and 1 Biosphere Reserve playing an important role in in-situ conservation of Biodiversity.
As per the website of Meghalaya Forest Department, the project district does not have any Protected area within its boundary. The nearest Protected area is Balpakram National Park, which is about 22km away from the project site and falls outside of the both Direct and Indirect impact zone.

Table 36:Protected area in Meghalaya

Sl.	Protected Area	Area (sq kms)	District
1	Balpakram National Park	352.00	South Garo Hills
2	Nokrek National Park	47.48	East Garo Hills
3	Nongkhyllem Wildlife Sanctuary	29.00	Ri-Bhoi District
4	Siju Wildlife Sanctuary	5.18	South Garo Hills
5	Baghmara Pitcher Plant Sanctuary	0.02	South Garo Hills
6	Narpuh Wildlife Sanctuary	59.9	East Jainti
7	Nokrek Biosphere Reserve	820	East, West and South Garo Hills



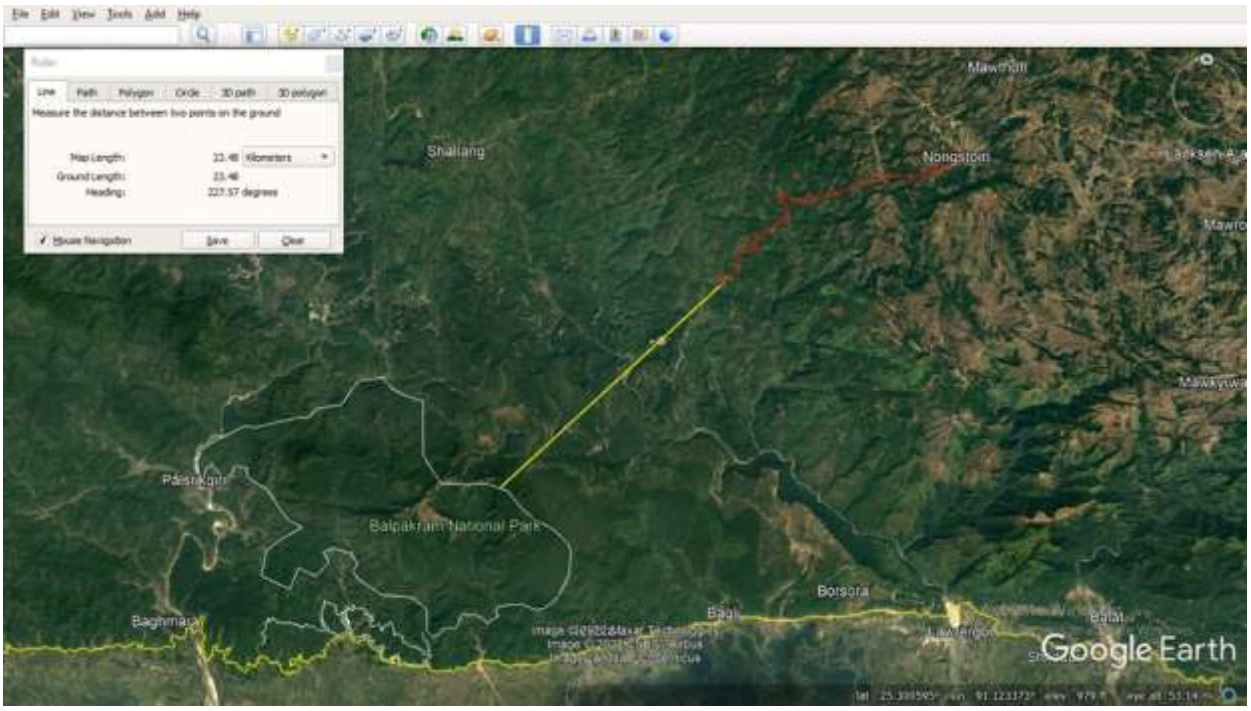


Figure 27; Distance between Balpakram National Park and project area

Elephant Reserves

The state has a substantial population of Asian elephant and due to this high density of elephants in the state, \, state has developed various policies for their conservation. For protection and conservation of elephants in Garo Hills area, Meghalaya government has notified (vide- No.132/2000/97 dated 31st October 2001) a 3500 km^2 area as Garo Hills Elephant Reserve under Project Elephant, MoEFCC, Govt of India. Nokrek and Balpakram National Park forms the core area (400 Km^2) of the Elephant Reserve and majority of the part of the Elephant Reserve is situated in East Garo and South Garo Hill Districts. West Khasi Hills district is not a part of any Elephant Reserve.

Figure 28 :Vegetation cover along the project road

Reserved Forests of Meghalaya State:

There are 24 Reserved Forests (RFs) in the state with area varying from 0.44 km^2 to 150 km^2 covering a total of 712.74 km^2 area. There is no Reserve Forest in the West Khasi Hills district.

Table 37:Reserve forest list in Meghalaya State

District	Name of Reserved Forests	Area (in sq. km.)
Jaintia Hills District	Saipung R.F.	150.35
	Narpuh Bl. I	62.42
	Narpuh Bl. II	98.68
East Khasi Hills District	Riatkhwan R.F.	3.91
	Shyrwat R.F.	0.44
	Riat Laban R.F.	2.05
Ri – Bhoi District	Nongkhyllem R.F.	125.91
	Umsaw R.F.	0.44
East Garo Hills District	Chimabongshi R.F.	23.28
	Dhima R.F.	20.72
	Dilma R.F.	2.59
	Rajasimla R.F.	18.13
	Ildek R.F.	2.59
	Darugiri R.F.	10.36
	Rongrenggiri R.F.	36.26
	Dambu R.F.	18.13
	Songsak R.F.	23.31
West Garo Hills District	Dibru Hills R.F.	15.02
	Tura peak R.F.	4.19
South Garo Hills District	Baghmara R.F.	43.91
	Angratoli R.F.	30.11
	Rewak R.F.	6.47
	Emangiri R.F.	8.29
	Siju R.F.	5.18

Animal crossings & Migratory Routes

The project corridor is devoid of any reserved forest within the study area and there is no wildlifehabitat around the project. So there is no designated migratory route or animal crossing in theproject area.

Community Reserves:

Community Reserves or Conservation Reserves are special category of protected areas and it recognizes that local communities can participate in protection of threatened species and natural resources. Meghalaya has a large number of Community Reserves, the largest for any Indian state. The Govt. of Meghalaya has declared 73 private and community lands/forests into Community Reserves, to increase the area under protected networks for protecting flora, fauna and traditional or cultural conservation values and practices. There are two Community Reserves in West Khasi Hills. Both are situated away from the ROW.

Table 38: Details of Community Reserve

Sl.	District	Name of Community Reserve	Area (Ha)
1	West Khasi Hills	Kpoh Eijah	17
2		Miewsyiar	87
Grand Total			6293.382

Sensitive Ecological and cultural attributes:

The table below gives the ecological profile of the project area indicating the critical ecological, Historical and cultural features –

Table 39: Details of Ecological and cultural attributes

Ecologically/Culturally significant feature	Availability within project area
Wildlife Sanctuary	No
National Park	No(The nearest is Balpakram National Park, which is outside of direct influence zone of the ROW, No impact)
Ramsar Site	No(As on Dec 2020, there is no declared Ramsar site in Meghalaya)
Biodiversity Heritage Site	No
Biosphere Reserve	No
Important Bird Area	No (The nearest is Balpakram National Park, which is outside of direct influence zone of the ROW, No impact)
Key Biodiversity Area	No (The nearest is Balpakram National Park, which is outside of direct influence zone of the ROW, No impact)
Wildlife Corridor	No
Elephant Corridor	No (The nearest is Bagmara – Balpakram , which is outside of direct influence zone of the ROW, No impact)
Tiger Reserve	No
Reserve Forest	No
Elephant Reserve	No
Community Forests	No
Sacred Groove	No
Archeological Sites	No

Ecologically/Culturally significant feature	Availability within project area
Unprotected / Non Classified Forest	Yes
Major River	No
Fish Sanctuary	No
Surface water bodies	Yes. Small ponds mostly used for fishery.

Biodiversity Profile of the Study area:

The whole of Garo Hills region forms a sort of undulating plateau with plenty of flat lands and valleys with altitudes varying from 100-1400 m above sea level, highest point being Lum Shyllong which is 1,968 metres .The district has a rich and unique flora and it is supposed to be the original home of the Citrus. Based on altitude, the vegetation of Garo Hills can be broadly classified into the flora of tropical and sub-tropical zones. During the survey,the team has also given emphasis to thepresence of different species within the 10 km and 15 km Buffer area of the project site through interview, field visit and literature review.

Vegetation:

Vegetation around 10 km and 15 km buffer of the study area mostly comprises of large/ medium/ small trees bushy shrubs and annuals perennial or biennials herbs. No scheduled species as per Wildlife ProtectionAct ,1972 had been described from the project site nor any species listed under Endangered or Vulnerable as per IUCN status had been described from the project site. It embraces evergreen, semi-evergreen and deciduous forests, bamboo thickets and grasslands including riparian forests and swamps. These forests mainly consist of *Shorearobusta*, and in certain area *Tectona grandis* has also been introduced.

Table 40: Details of Agro-biodiversity in the Study Area

ScientificName	Family	Crop Type	Local/EnglishName
Allium cepa	Amaryllidaceae	Vegetable	Piyaj
Allium sativum	Amaryllidaceae	Spice	Lahsun
Amaranthus sp.	Amaranthaceae	Vegetable	Lalsag
Anacardium occidentalis	Anacardiaceae	Plantation Crop	Kaju
Ananas comosus	Bromeliaceae	Fruit	Pineapple
Areca catechu	Arecaceae	Plantation Crop	Tambul
Artocarpus hetrophyllus	Moraceae	Vegetable	Kathal
Brassica spp.	Brassicaceae	Oilseed	Sarson
Capsicum annuum	Solanaceae	Vegetable	Mirch
Carica papaya	Caricaceae	Fruit	Papita
Cier aeriatinum	Fabaceae	Pulse	Chana
Citrus media	Rutaceae	Fruit	Nimbu
Cocos nucifera	Arecaceae	Fruit	Narikol
Colocasia antiquoram	Aracea	Vegetable	Kachchu
Corchorus capsularis	Malvaceae	Fibre	Jute
Coriandrum sativum	Apiaceae	Condiment & Spice	Dhania
Cucumis sativa	Cucurbitaceae	Fruit	Kheera
Cucurbita pepo	Cucurbitaceae	Vegetable	Kaddu
Daucus carrota	Apiaceae	Vegetable	Gajar
Hevia brasiliensis	Euphorbiaceae	Plantation Crop	Ruber
Lens esculenta	Fabaceae	Pulse	Masur
Luffa spp.	Cucurbitaceae	Vegetable	Lauki
Lycopersicon esculentum	Solanaceae	Vegetable	Tamatar

ScientificName	Family	Crop Type	Local/EnglishName
Momordica charantia	Cucurbitaceae	Vegetable	Karela
Musa indica	Musaceae	Fruit	Kela
Oryza sativa	Poaceae	Cereal	Dhan
Phaseolus mungo	Fabaceae	Pulse	Urd
Psidum guajava	Myrtaceae	Fruit	Amrud
Raphanus sativa	Brassicaceae	Vegetable	Muli
Sesamum indicum	Pedaliaceae	Oilseed	Til
Solanum melongena	Solanaceae	Vegetable	Began
Solanum tuberosum	Solanaceae	Vegetable	Aalu
Spinach oleracea	Amaranthaceae	Vegetable	Palak
Trigonella foenium graecum	Fabaceae	Vegetable	Methi
Triticum aestivum	Poaceae	Cereal	Gehu
Zea mays	Poaceae	Cereal	Makka
Zingiber officinalis	Zingiberaceae	Rhizome	Adrakh

Table 41: Details of PlantBiodiversityintheStudyArea

ScientificName	Family	Habit	LocalAvailability	IUCN * Status
(A) ANGIOSPERMS				
Acacia pennata	Mimosaceae	Herb	Common	LC
Ageratum conyzoides	Asteraceae	Herb	Very Common	NA
Albizzia procera	Mimosaceae	Tree	Rare	NA
Anthocephalus chinensis	Rubiaceae	Tree	Common	NA
Artocarpus integrifolia	Moraceae	Small Tree	Common	NA
Arundinella nepalensis	Poaceae	Herb	Common	NA
Arundo donax	Poaceae	Herb	Common	LC
Asparagus racemosus	Liliaceae	Herb	Rare	NA
Bauhinia acuminata	Caesalpiniaceae	Small Tree	Common	LC
Bombax ceiba	Bambacaceae	Tree	Very Common	NA
Cardamine impatiens	Brassicaceae	Herb	Common	NA
Cassia fistula	Caesalpiniaceae	Small Tree	Common	NA
Cassia tora	Caesalpiniaceae	Shrub	Common	NA
Chrysopogon fulvus	Poaceae	Herb	Common	NA
Cissampelos pariera	Manispermaceae	Herb	Rare	NANIC
Commelina bengalensis	Commelinaceae	Herb	Very Common	NANIC
Cyperus rotundus	Cyperaceae	Herb	Abundant	NANIC
Dendrocalamus hamiltonii	Poaceae	Herb	Common	NA
Dioscorea bulbifera	Dioscoreaceae	Climber	Common	NA
Erythrina variegata	Papilionaceae	Small Tree	Rare	NA
*Eucalyptus tereticornis***	Myrtaceae	Tree	Rare	NA
Euphorbia emodi	Euphorbiaceae	Herb	Common	LC
E. hirta	Euphorbiaceae	Herb	Common	NA
Ficus hispida	Moraceae	Tree	Common	NA
Galium sp.	Rubiaceae	Herb	Common	NA
Gmelina arborea	Verbenaceae	Tree	Common	NA
Imperata cylindrica	Poaceae	Herb	Common	LC
Ipomoea aquatica	Convolvulaceae	Herb	Common	NA
I. cairica	Convolvulaceae	Creeper	Very common	NA
Justicia adhatoda	Acanthaceae	Shrub	Common	NA
Lagerstroemia sp	Lytharaceae	Tree	Rare	NA

ScientificName	Family	Habit	LocalAvailability	IUCN * Status
Lathyrus aphaca	Fabaceae	Herb	Common	NA
Lemna minor	Lemnaceae	Herb	Common	LC
Lepidium virginicum	Brassicaceae	Herb	Common	NA
Litsea glutinosa	Lauraceae	Tree	Rare	NA
Mallotus philippensis	Euphorbiaceae	Small Tree	Common	NA
Mimosa pudica	Mimosaceae	Herb	Rare	NA
Phragmites karka	Poaceae	Herb	Common	LC
Phyllanthus emblica	Euphorbiaceae	Tree	Common	NA
Poa annua	Poaceae	Herb	Common	LC
Potamogeton pectinatus	Potomogetonaceae	Herb	Common	LC
Pycrius spp.	Cyperaceae	Herb	Abundant	NA
Ranunculus arvensis	Ranunculaceae	Herb	Common	NA
Saccharum spontaneum	Poaceae	Herb	Abundant	LC
Sapium baccatum	Euphorbiaceae	Tree	Common	NA
Scripus spp.	Cyperaceae	Herb	Common	NA
Shorea robusta	Dipterocarpaceae	tree	Rare	NA
Smilex zylanica	Smilaceae	Climber	Rare	LR
Solanum erianthum	Solanaceae	Herb	Common	NANIC
Sonchus spp.	Asteraceae	Herb	Common	NA
Stellaria media	Caryophylaceae	Herb	Common	NA
Syzygium cumini	Myrtaceae	Tree	Common	NA
*Tectona grandis***	Verbenaceae	Tree	Common	NA
Thysanolaena maxima	Poaceae	Herb	Common	NA
Tinospora cordifolia	Manispermaceae	Climber	Rare	NA
Toona ciliata	Meliaceae	Tree	Common	NA
Trewia nudiflora	Euphorbiaceae	Tree	Rare	LR
Vitex peduncularis	Verbenaceae	Tree	Rare	NA
Zizyphus mauritiana	Rhamnaceae	Tall Shrub	Abundant	NANIC
(B) FERNS AND FERN ALLIES				
Adiantum caudatum	Adiantaceae	Herb	Common	NA
Equisetum diffusum	Equisetaceae	Herb	Common	NA
Marselia minuta	Marseliaceae	Herb	Common	NANIC
Pteris biaurita	Pterideae	Herb	Rare	NA
Seleginella helferi	Selaginellaceae	Herb	Common	NANIC

Abbreviations:VU=Vulnerable,NA=NotassessedbutpresentinthecatalogueofLife,NANIC=Notassessedandnotpresentinthecatalogueof Life, LC =Least concern, LR =Lowrisk

Table 42: Details of Invasive Alien Plants in the Study Area

Species	Family	Habit	Nativity
Aervajavanica	Amaranthaceae	Herb	TropicalAmerica
Ageratumconyzoides	Asteraceae	Herb	Brazil
Amaranthusspinosus	Amaranthaceae	Herb	TropicalAmerica
Anagallisarvensis	Primulaceae	Herb	Europe
Argemone mexicana	Papaveraceae	Herb	Tropical South America
Calotropisprocera	Asclapiadaceae	Shrub	TropicalAmerica
Cannabissativa	Cannabaceae	Herb	TropicalAmerica
Chenopodiumalbum	Chenopodiaceae	Herb	TropicalAmerica
Species	Family	Habit	Nativity
Cleome viscosa	Capparaceae	Herb	Tropical America
Cuscuta reflexa	Cuscutaceae	Climber	Mediterranean region

Datura metal	Solanaceae	Shrub	Tropical America
Eichhornia crassipes	Pontederiaceae	Herb	Tropical America
Euphobia hirta	Euphorbiaceae	Herb	Tropical America
E. thymifolia	Euphorbiaceae	Hurb	Tropical America
Galinsoga paviflora	Asteraceae	Herb	Tropical America
Lantana camara	Verbenaceae	Shrub	Tropical America
Oxalis corniculata	Oxalidaceae	Herb	Europe
Parthenium hysterophorus	Asteraceae	Herb	Tropical America
Physalis minima	Solanaceae	Herb	Tropical America
Portulaca oleracea	Portulacaceae	Herb	Tropical South America
Prosopis juliflora	Mimosaceae	Small Tree	Mexico
Saccharum spontaneum	Poaceae	Herb	Tropical America
Side acuta	Malvaceae	Herb	Tropical America
Solanum nigrum	Solanaceae	Herb	Tropical America
Tridex procumbens	Asteraceae	Herb	Tropical America
Typha angustifolia	Typhaceae	Herb	Tropical America
Xanthium strumarium	Asteraceae	Herb	Tropical America

Medicinal Plant Species:

There are many medicinal plants, which have been classified as endemic and/or threatened in the state depending on their distribution pattern and population size. Eight medicinal plant species such as *Camellia caduca* Cl ex Brandis, *Citrus latipes* Tanaka, *Nepenthes khasiana* Hk. f, *Osbeckia capitata* Benth are reported to be endemic to Meghalaya only. Thirty-seven medicinal plants, like *Schima khasiana* Dyer, *Boehmeria macrophylla* D.Don, Citrus *medica* L, Ilex *khasiana* Purk, *Piper griffithii* C.DC, *Acanthus leucostachys* Roxb. etc. which has been classified as endemic to Eastern Himalayas, Western Ghats, Indo-Burma region and Peninsular India, are also found in Meghalaya. Seventeen medicinal plant species found in Meghalaya have been classified under threatened category some of these are *Taxus wallichiana var. baccata*, *Dendrobium nobile*, *Panax pseudo-ginseng, Nepenthes khasiana* etc.

But dependency on traditional medicines had drastically reduced to increased demand for modern medicine. During consultation, it is been informed due to lack of traditional knowledge, over harvesting, rapid mining activity, collection of medicinal plants had reduced and availability of medicinal plants on the ROW is nil due to existing road network.

Natural Vegetation

Natural Vegetation of the project area is fairly poor due to tremendous biotic factors such as recurring fire hazards, overgrazing and browsing. Over exploitation of timber and fuel wood and charcoal burning etc. have destroyed the economical species and left scrub vegetation in most of the area. The area consists mostly of degraded and open forest with scattered pockets of the clad trees. The following species area available in the Project area:

Table 43: Details ofavailablespecies in the Study Area

Pinus kesiya(Diengkseh)	*Betula alnoides (dieng lienglieh)*
Schima wallichi(Diengngan)	Bamboo
Quercus spp. (dieng sning, diengsai)	*Castanapsis spp (Diengstap, diengsohot)*
Toona ciliate (dieng Tanglung)	*Morus alba(Sohlungdkhur)*
Bucklandia populnea (DiengDoh)	*Myrica nagii(sohphie))*
Alnus nepalensis (Dieng lingIong)	

Fauna in Study Area:

On the basis field observations, there is no major wildlife as there are no forest areas in and around the project road alignment. Primary field surveys are conducted through random observation in the study area and also information collected from elderly persons of the area, forest officials. This area hosts jackal, foxes and other animals. There are no endangered animals in project influence area.

Mammal of study area:

Though the state of Meghalaya recorded presence of about 139 different species of mammals, but mammalian Diversity is not high in the project site as the area doesn't have any dense forest cover. Only minor mammals are seen.

Table 44;Details of Mammals in the Study Area

Order	Common Name	Scientific Name	Local Availability	IUCNStatus	WPAStatus
Primates	Rhesus macaque	*Macaca mulatta*	Common	LC	II
Pholidota	Chinese pangolin	*Manis pentadactyla*	Very Rare	CR	I
Artiodactyla	Wild Boar	*Sus scrofa*	Common	LC	III
Artiodactyla	Barking Deer	*Muntiacus muntjak*	Common	LC	II
Carnivora	Jackal	*Canis aureus*	Rare	LC	II
Carnivora	Jungle Cat	*Felis chaus*	Rare	LC	II
Carnivora	Common Palm Civet	*Paradoxurus hermaphroditus*	Common	LC	II
Carnivora	Indian Grey mongoose	*Herpestes edwarsdii*	Common	LC	IV
Chiroptera	Flying Fox	*Pteropus giganteus*	Common	LC	V
Eulipotyphla	The Asian House Shrew	*Suncus murinus*	Common	LC	V
Rodentia	Porcupine	*Hystrix* sp	Common	LC	II

Rodentia	Hoary-Bellied Squirrel	*Callosciurus pygerythrus*	Common	LC	V
Rodentia	The House Mouse	*Mus musculus*	Common	LC	V
Rodentia	Bandicoot Rat	*Bandicota bengalensis*	Common	LC	IV

Herpetofauna of study area:

Herpetofauna includes Reptiles and amphibian animals of a particular area.

Table 45: Details of Herpetofauna in the Study Area

Order	***Common Name***	***Scientific Name***	***Local availability***	***IUCNStatus***	***WPAStatus***
Agamidae	Garden Lizard	*Calotes versicolor*	Common	LC	IV
Gekkonidae	Indian House Gecko	*Hemidactylus sp*	Common	LC	IV
Scincidae	Common Skink	*Eutropis carinata*	Common	LC	IV
Varanidae	Common Indian Monitor	*Varanus bengalensis*	Rare	LC	I
Pythonidae	Burmese Python	*Python bivittatus*	Rare	VU	I
Typhlopidae	Brahminy blind snake	*Indotyphlops braminus*	Common	LC	IV
Colubridae	Common Wolf Snake	*Lycodon aulicus*	Common	LC	IV
Colubridae	Indian Rat Snake	*Ptyas mucosa*	Common	LC	IV
Colubridae	Checkered Keelback	*Fowlea piscator*	Common	LC	IV
Colubridae	Indo-Chinese Rat snake	*Ptyas korros*	Common	LC	IV
Elapidae	King cobra	*Ophiophagus hannah*	Very Rare	VU	I
Elapidae	Northeastern hill krait	*Bungarus bungaroides*	rare	LC	IV
Viperidae	Mountain Pit Viper	*Ovophis monticola*	Rare	LC	IV
Colubridae	Painted Bronzeback Tree Snake	*Dedrelaphis pictus*	Common	LC	IV

Order	***Common Name***	***Scientific Name***	***Local availability***	***IUCNStatus***	***WPAStatus***
Turtles and Tortoises					
Testudines	Tricarinate Turtle	*Melanochelys tricarinata*	Very Rare	EN	I
Testudines	Yellow Tortoise	*Indotestudo elongata*	Rare	EN	IV
Amphibians					
Bufonidae	Common Asian Toad	*Duttaphrynus melanostictus*	Common	LC	~
Rhacophoridae	Terai Tree Frog	*Polypedates teraiensis*	Common	LC	~
Rhacophoridae	Common Tree Frog	*Polypedates leucomystax*	Common	LC	~
Rhacophoridae	Assam Tree Frog	*Polypedates assamensis*	Common	LC	~
Dicroglossidae	Indian Bull Frog	*Hoplobatrachus tigerinus*	Common	LC	IV
Dicroglossidae	Indian Skipping Frog	*Euphylctis cyanophlyctis*	Common	LC	IV
LC= Least Concern, EN= Endangered,NT= Near Threatened, VU= Vulnerable					

Common Fishes of study area:

Fish diversity of the West Khasi hills is good due to presence of numerous water bodies, smalls streams etc. As commercial fishery is an important livelihood option in West Garo hills, many different species of fishes are farmed in the region. The project site does not have any major river system and fish sanctuary within its limits.

Table 46: Details of Common Fishes in the Study Area

Species	IUCN Status	Remarks
Brachydanio rerio	Least Concern	
Heteropneustes fossilis	Least Concern	
Mastacembelus armatus	Least Concern	
Glyptothorax striatus	Least Concern	
Heteropneustes fossilis	Least Concern	
Mastacembelus armatus	Least Concern	
Garra nasuta	Least Concern	
Neolissocheilus hexagonolepis	Near Threatened	Very rare
Puntius. shalynius	Least Concern	
Brachydanio rerio	Least Concern	

Species	IUCN Status	Remarks
Heteropneustes fossilis	Least Concern	
Mastacembelus armatus	Least Concern	
Glyptothorax striatus	Least Concern	
Heteropneustes fossilis	Least Concern	
Chana stewartii	Least Concern	
Tor putitora	Endangered	Very Rare
Labeo rohita	Least Concern	
Catla catla	Least Concern	
Labeo gonius	Least Concern	
Cyprinus carpio	Vulnerable	Farm fish, locally common
Mystus sp	Least Concern	
Sperata sp	Least Concern	
Heteropneustes fossilis	Least Concern	
Wallago attu	Near Threatened	Farm fish, locally common
Bagarius sp	Near Threatened	Rare

Common Birds of study area:

Avian Diversity is quite low due to large scale mining, Jhum cultivation. The common birds of the study area are listed below.

Table 47: Details of Common Birds in the Study Area

Order	Common Name	Scientific name	IUCN Status	WPA Status
COLUMBIFORMES	Rock Dove	*Columba livia*	LC	IV
COLUMBIFORMES	Oriental Turtle Dove	*Streptopelia orientalis*	LC	IV
COLUMBIFORMES	Yellow-Footed Green-Pigeon	*Treron phoenicoptera*	LC	IV
COLUMBIFORMES	Spotted Dove	*Streptopelia chinensis*	LC	IV
COLUMBIFORMES	Red Collared Dove	*Streptopelia tranquebarica*	LC	IV
COLUMBIFORMES	Emerald Dove	*Chalcophaps indica*	LC	IV
CUCULIFORMES	Indian Cuckoo	*Cuculus micropterus*	LC	IV
CUCULIFORMES	Asian Koel	*Eudynamys scolopaceus*	LC	IV
GALLIFORMES	Red Jungle Fowl	*Gallus gallus*	LC	IV
GALLIFORMES	Kalij Pheasant	*Lophura leucomelanos*	LC	IV
PELECANIFORMES	Indian Pond Heron	*Ardeola grayii*	LC	IV
PELECANIFORMES	Cattle Egret	*Bubulcus ibis*	LC	IV
PELECANIFORMES	Little Cormorant	*Microcarbo niger*	LC	IV
CHARADRIIFORMES	River Lapwing	*Vanellus duvaucelii*	LC	IV
ACCIPITRIFORMES	Crested Serpent-Eagle	*Spilornis cheela*	LC	IV
STRIGIFORMES	Barn Owl	*Tyto alba*	LC	IV
STRIGIFORMES	Jungle Owlet	*Glaucidium radiatum*	LC	IV
BUCEROTIFORMES	Oriental Pied-Hornbill	*Anthracoceros albirostris*	LC	IV
BUCEROTIFORMES	Common Hoopoe	*Upupa epops*	LC	IV

Order	Common Name	Scientific name	IUCN Status	WPA Status
CORACIIFORMES	Common Kingfisher	*Alcedo atthis*	LC	IV
CORACIIFORMES	White-Throated Kingfisher	*Halcyon smyrnensis*	LC	IV
CORACIIFORMES	Green Bee-Eater	*Merops orientalis*	LC	IV
CORACIIFORMES	Indian Roller	*Coracias benghalensis*	LC	IV
PICIFORMES	Coppersmith Barbet	*Psilopogon haemacephalus*	LC	IV
PICIFORMES	Blue-Eared Barbet	*Psilopogon duvaucelii*	LC	IV
PICIFORMES	Lineated Barbet	*Psilopogon lineatus*	LC	IV
PICIFORMES	Blue-Throated Barbet	*Psilopogon asiaticus*	LC	IV
PICIFORMES	Common Flame-Backed Woodpecker	*Dinopium javanense*	LC	IV
PICIFORMES	Black-Rumped Flameback	*Dinopium benghalense*	LC	IV
PICIFORMES	Greater Flameback	*Chrysocolaptes guttacristatus*	LC	IV
PASSERIFORMES	Scarlet Minivet	*Pericrocotus speciosus*	LC	IV
PASSERIFORMES	Black-Hooded Oriole	*Oriolus xanthornus*	LC	IV
PASSERIFORMES	Indian Golden Oriole	*Oriolus kundoo*	LC	IV
PASSERIFORMES	Black-Naped Oriole	*Oriolus chinensis*	LC	IV
PASSERIFORMES	Common Iora	*Aegithina tiphia*	LC	IV
PASSERIFORMES	Black Drongo	*Dicrurus macrocercus*	LC	IV
PASSERIFORMES	Bronzed Drongo	*Dicrurus aneus*	LC	IV
PASSERIFORMES	Ashy Drongo	*Dicrurus leucophaeus*	LC	IV
PASSERIFORMES	Long-Tailed Shrike	*Lanius schach*	LC	IV
PASSERIFORMES	Rufous Treepie	*Dendrocitta vagabunda*	LC	IV
PASSERIFORMES	Common Tailorbird	*Orthotomus sutorius*	LC	IV
PASSERIFORMES	Red-vented Bulbul	*Pycnonotus cafer*	LC	IV
PASSERIFORMES	Ashy Bulbul	*Hemixos flavala*	LC	IV
PASSERIFORMES	Red-whiskered Bulbul	*Pycnonotus jocosus*	LC	IV
PASSERIFORMES	Jungle Babbler	*Turdoides striata*	LC	IV
PASSERIFORMES	Indian White-eye	*Zosterops palpebrosus*	LC	IV
PASSERIFORMES	Asian Pied Starling	*Gracupica contra*	LC	IV
PASSERIFORMES	Common Myna	*Acridotheres tristis*	LC	IV
PASSERIFORMES	Bank Myna	*Acridotheres ginginianus*	LC	IV
PASSERIFORMES	Jungle Myna	*Acridotheres fuscus*	LC	IV
PASSERIFORMES	Great Myna	*Acridotheres grandis*	LC	IV
PASSERIFORMES	Common Hill Myna	*Gracula religiosa*	LC	IV
PASSERIFORMES	House Sparrow	*Passer domesticus*	LC	IV
PASSERIFORMES	Oriental Magpie-Robin	*Copsychus saularis*	LC	IV
PASSERIFORMES	Baya Weaver	*Ploceus philippinus*	LC	IV
PASSERIFORMES	Citrine Wagtail	*Motacilla citreola*	LC	IV
PASSERIFORMES	White Wagtail	*Motacilla alba*	LC	IV

Order	Common Name	Scientific name	IUCN Status	WPA Status
PASSERIFORMES	Scally Breasted Munia	*Lonchura punctulata*	LC	IV
PASSERIFORMES	Purple Sunbird	*Cinnyris asiaticus*	LC	IV
PASSERIFORMES	Crimson Sunbird	*Aethopyga siparaja*	LC	IV

Plankton Diversity:

Plankton are the microscopic organisms that drift on the water currents. Phytoplankton forms the sole base of food chain in aquatic system as they act as energy transducers and convert the solar energy into chemical energy of food. Zooplankton passes this food energy to the higher trophic levels and thus provides a link between energy producers and the consumers. These organisms are important biological indicator of water quality and trophic status of aquatic ecosystem as they respond quickly to the environmental changes. A rapid survey of the different water bodies were carried out to determine the species diversity in project site.

Table 48: Details of Plankton in the Study Area

PHYTOPLANKTON	
Class: Bacillariophyceae	**Class: Chlorophyceae**
Frustulia sp.	*Staurastrum rotundum*
Gyrosigma sp.	*Staurastrum leptocladium*
Navicula sp.	*Cosmarium decoratum*
Tabellaria sp.	*Cosmarium reniforne*
Gomphonema sp.	*Cosmarium leibleinii*
Fragilaria sp.	Draparnaldiopsis sp.
Diatoma sp	*Hyalotheca* sp.
Synedra sp.	*Spirogyra* sp.
Pinnularia sp.	*Gonatozygon* sp.
Class: Cyaenophyceae	*Ulothrix* sp.
Anabaena sp.	*Eudorina* sp.
Oscillatoria sp.	**Class: Desmidiacae**
Microcystis aeruginosa	*Closterium*sp.
Spirulina sp.	**Class: Chrysophyceae**
Nostoc sp.	*Dinobryon sociale*
Class: Dinophyceae	**Class: Dinophyceae**
Ceratium sp.	*Ceratium hirudinella*
Glenodinium sp.	
ZOOPLANKTON	
Kindom: Animalia; Phylum: CRUSTACEA	**Order : Rotifera**
Nauplii sp. larvea	*Anuraeopsis fissa*
Order : Copepoda	*Pleosoma hudsoni*
Cyclops sp.	*Polyarthra vulgaris*
Diaptomus sp.	*Ascomorpha* sp
Mesocyclops sp.	*Conochilus unicornis*
Tropocyclops sp.	*Trichocerca* sp
Order : Cladocera	*Pompholyx sulcata*
Moina sp.	*Asplanchna priodonta*
Bosminopsis deitersi	*Monostyla* sp.
Diaphanosoma	*Brachionus* sp.

Chydorus sphaericus	*Keratella* sp.
Bosmina sp.	*Lepadella* sp.
Ceriodaphnia sp.	*Nauplius* sp.
Daphnia sp.	*Euchlanis* sp.
Class: Rhizopoda	**Kingdom: PROTISTA**
Difflugia lebes	*Paramoecium* sp.
Arcella vulgaris	*Euglena* sp.
Acanthocystis chaetophora	
Polymyxa sp.	

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, No such Heritage trees of cultural significance have been identified along the road.

Sericulture

No Sericulture activities were identified in the project region.

Rare or Endangered Species

The local forest department was consulted to know the presence of any endangered and protected species of flora and fauna 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.

Educational Institutions / Hospitals

The educational institutions and hospital/health centres constitute the sensitive environmentalreceptors. The list of such features along the ROW along the project roads is presented intable 49. A total number of 11 educational institutions are located along the ROW. No health care centre was found within the project core zone which is 500m either side of the road.

Table 49:Sensitive receptors along the project road

Sl.	Receptor	Side	Chainage (Km)	Approx. distance from the edge of the road (m)	Physically impacted or not
1	Church	LHS	1+950	30.55	Not impacted at all
2	Church	RHS	2+800	42.92	Not impacted at all
3	School	RHS	2+900	28.74	Not impacted at all

Sl.	Receptor	Side	Chainage (Km)	Approx. distance from the edge of the road (m)	Physically impacted or not
4	School	RHS	3+050	22.53	Not impacted at all
5	School	RHS	3+050	45.54	Not impacted at all
6	Sibsing Memorial Government Secondary School	LHS	3+350	25.05	Not impacted at all
7	Institute	RHS	3+550	105.86	Not impacted at all
8	School	RHS	3+850	36.83	Not impacted at all
9	Church	LHS	4+250	12.71	Not impacted at all
10	School	LHS	4+250	21.38	Not impacted at all
11	School	RHS	4+300	24.52	Not impacted at all
12	Church	RHS	14+850	105.10	Not impacted at all
13	Graveyard	LHS	15+150	19.17	Not impacted at all
14	Church	RHS	20+300	64.32	Not impacted at all
15	School	LHS	34+050	17.85	Not impacted at all
16	School	LHS	34+100	11.96	Not impacted at all
17	School	LHS	34+150	22.74	Not impacted at all
18	School	LHS	34+250	67.04	Not impacted at all

Figure 29:Sibsing Memorial Government Secondary School' at 3+350 Km on left side of project road

	
School at 3+000 KM on RHS	**School at 34+100 KM on LHS**

Figure 30: Schools at 3+000 Km and 34+100 Km respectively

Social Environment

The State Profile of Meghalaya

The State of Meghalaya was carved out of Assam as an autonomous State in April 1970 and was declared a full-fledged State in January 1972. Meghalaya, situated in the north eastern region of India is a narrow stretch of land, running between Bangladesh on the South and West and Assam on the North and East, Meghalaya lies between 24° 58' N to 26° 07'N latitudes and 89° 48'E to 92° 51' E longitudes. It covers an area of 22,429 sq. km. The State has most of its land covered by hills interspersed with gorges and small valleys. Endowed with dense forests and rivers cascading down undulating terrain, this region is one of the most scenic of the North Eastern States.

Thus, out of the total forest area of 15,657 sq. km in the State only 1,027.20 sq. km is under the control of State Forest Department, which constitutes only 4.58 % of the total geographical area of the State and 6.56 % of the total forest area of the State. Rest of the area is either private or clan /community owned and is under the indirect control and management of the Autonomous District Councils.

The population of Meghalaya is predominantly tribal, the main tribes are the Khasis, the Jaintias and the Garos besides other plain tribes such as Koch, Rabhas and Bodos etc The Khasis and the Jaintias predominantly inhabiting the districts towards eastern part of Meghalaya, belong to the Proto AustroloidMonkhmer race. The ESIA Study Proposal of Roads lies under West Khasi, RiBhoi, South West Khasi, Jaintia, East Garo Hills respectively.

District Profile:

West Khasi Hills is an administrative district in the state of Meghalaya in India. The West Khasi Hills district was carved out of the Khasi Hills district, which was divided into West and East Khasi Hills districts on 28 October 1976. The district headquarters is located at Nongstoin. The district occupies an area of 5247 km2. Khasi society has greatly been transformed by many factors which have arisen in recent times. Adoption of the Western style of life, especially among the literate and educated, has been quite rapid although the matrilineal laws of inheritance and succession and the other cultural states are still retained.

West Khasi Hills District was carved out of the state of Meghalaya in the year 1976 on the 28 day of October which in fact is the largest of all the eleven districts in the state of Meghalaya and since its existence, it has been bifurcated into two Civil Sub-divisions and a new district in South West Khasi Hills. It spreads through the heart of the state running high with plateau ranges and low with rich plain lands.

Demographic Profile

Out of total population of Meghalaya, 54.75% people live in urban regions.The district occupies:

Table 50;Demographic Profile of West Khasi Hills District

Description	Census 2011	Census 2001
Total Population	383461	296049
Male	193715	150419
Female	189746	145630
Population Growth	29.53%	33.05%
Area Sq.Km	5247	5247
Density /Km2	73	56
Proportion to Meghalaya Population	12.92%	12.77%
Sex Ratio (Per 1000) Males	980	968
Average Literacy	77.87	65.10
Male Literacy	78.53	66.49
Female Literacy	77.19	63.65
No. of Blocks	6	NA
No. of Villages	232	NA

Source: Census 2011

As per 2011 census, 88.76% population of West Khasi Hills district lives in rural areas of villages. The total West Khasi Hills district population living in urban areas is 43105 of which males and females are 21335 and 21770 respectively. In rural areas of West Khasi Hills district, sex ratio is 974 females per 1000 males.

Table 51;Distribution of Rural and Urban Population

Description	Urban	Rural
Population (%)	11.24%	88.76%
Total Population	43105	340356
Male Population	21335	172380
Female Population	21770	167976
Sex Ratio	981	974

Source: Census 2011

Schedule Castes and Schedule Tribes

The social stratification of the project area shows of Schedule Tribe population with 97.8% households. The second stratum of the social grouping in the area is of Schedule caste population of 0%.

Literacy Rate

The literacy rate in the district of West Khasi Hills is 77.87%, whereasthe literacy rate in the PIA is around 67.37%. The respective male and female literacy rate is 78.53% and 77.19% in the district of West Khasi Hills, whereas resembles 50.21% and 51.2% in the PIA.

Employment Pattern

Economic backwardness is the leading problem of the state as majority of the population is below the poverty line. Although the state is rich in mineral resources, the industrial linkages are virtually absent and government is the major source of employment in the organized sector. Activities like animal husbandry, fishery, poultry and horticulture have not been targeted as a major source of employment. Therefore, agriculture forms the only option for the people to seek gainful employment. This too is influenced by impediments such as shifting agriculture, poor productivity, land tenure system and traditional methods of cultivation. All these factors have resulted in poor land and labour productivity.

As unemployment and poverty are correlated, it becomes necessary to understand the occupationalpatternoflabourforceandstatusofemploymenttoanalysethedevelopmentinthe state.

West Khasi Hills:

More than 80% of the total population in West Khasi Hills is agrarian as their main backbone of livelihood is basically agriculture. Rice, Maize, potato and ginger are the main crops grown in West Khasi Hills. Agriculture and allied activities provide income and employment for the people in West Khasi Hills. Mono cropping in low land areas and mixed cropping in upland areas are the features of agriculture in the district.

Economic Development

Meghalaya has predominantly an agrarian economywith a significant commercial forestry industry. Meghalaya's gross state domestic product for 2012 was estimated at16,173 crore (US$2.5billion) in current prices.The state is geologically rich in minerals.The state has about 1,170km of national highways. It is also a major logistical centre for trade with Bangladesh.Meghalaya has an ideal location advantage for South East Asia Market. The neighbouring countries of India viz Bhutan, Bangladesh, Myanmar has been involved with the state for business and commerce. It has a huge potential to reach other South Asian countries as well. Meghalaya is also geographically rich in minerals and has the potential for industrial setups based on these mineral resources. Above all the Meghalaya Industrial Policy is framed for the ease of doing business and increase trade and commerce. The added advantage being the climate in Meghalaya is good for the development of electronics chips.

Different types of Industry that can be ideally formed in the state are Mineral based Industry, Horticulture and Agro-Based Industry, Electronics and Information Technology, Export Oriented Units, Tourism and besides these the recent development in the state has seen many upcoming service sectors on customer service, real estate's etc.The State Government also provides various types of Central and State Incentives for the established Industrial Setups which includes Transport Subsidy, Income Tax Exemption, Excise Exemption, Capital Investment Subsidy, Special Incentives for Food Processing,Subsidy on Comprehensive Insurance, Power Subsidy, Subsidy on Power Line (33 K.V. and above),Employment Subsidy, Refund of Central Sales Tax.Meghalaya is coming up with 150 LPM (Litres Per Minute) Oxygen Plant at Nongpoh Civil Hospital in RiBhoi district.

West Khasi Hills:

Although the district is endowed with many economically important minerals but the operations are limited mostly to the mining of these minerals. The minerals found in the district are coal, limestone, sillimanite and uranium, among these last two are major deposits in the district (coal mining is carried out at minor scale at shallang and rambari, Coalfields are mainly found and extracted in large scale from Nongri, Nonghyllam, Nongkulang areas). Mining of Uranium has not so far been undertaken due to opposition from the people. As per census, 2011, there are many small scale industries in the district.

Road Network

Meghalaya has a road network of around 7,633km, out of which 3,691km is black-topped and the remaining 3942km is gravelled. The state has couple of national highways running through it viz NH 40, NH 44, NH 51 and NH 62.

The project road will connect Nongstoin to Maweit is of great importance, as the road will carry not only the normal city traffic, but also the freight traffic that will connect the export points to the National Highway. The road network of the West Khasi Hills district is given below:

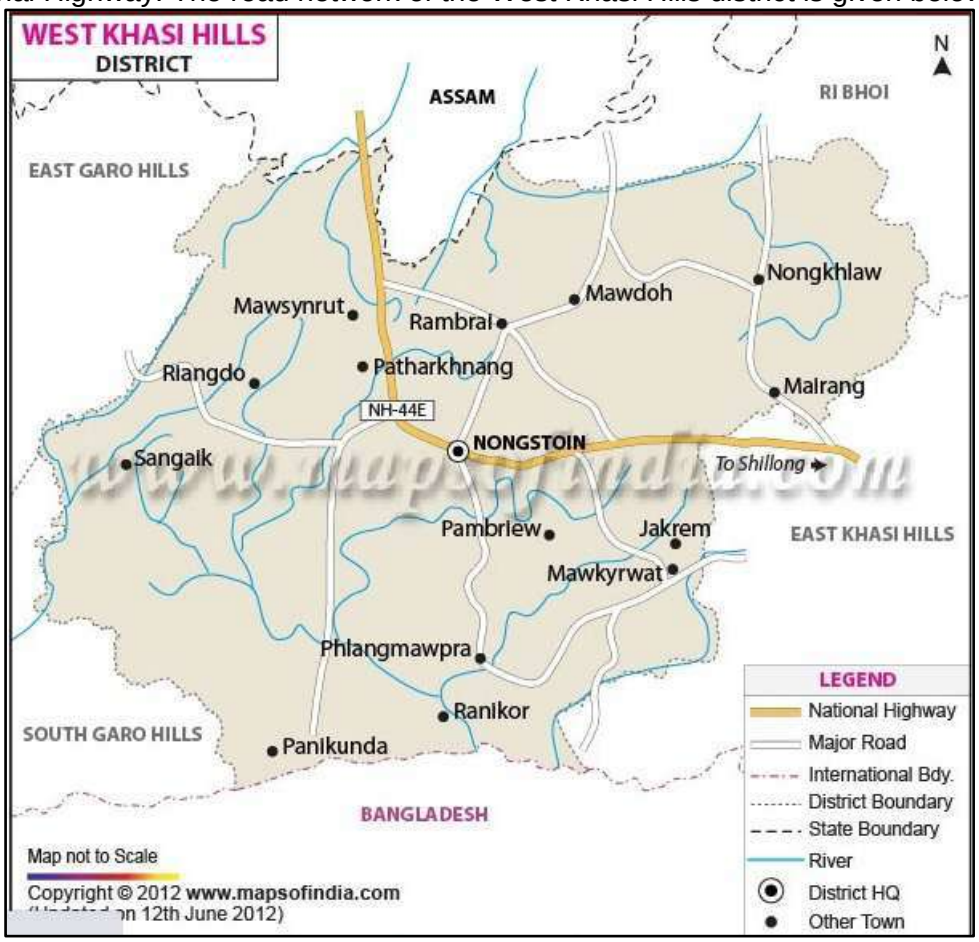


Figure 31;Road Network of West Khasi Hills

Railway

Meghalaya has a railhead atMendipatharand regular train service connecting Mendipathar in Meghalaya andGuwahati inAssam. Guwahati is the nearest major railway station connecting the north-east region with the rest of the country through a broad-gauge track network.

Aviation

The state has an airport atUmroi which is at a distance of 30 kilometres from Shillong. There is also a helicopter service connecting Shillong to Guwahati and Tura. Baljek Airportnear Turabecame operational in 2008. Other nearby airports are in Assam, Borjhar, Guwahatiairport, about 124 kilometres (77 mi) from Shillong. Newly operational Rupsi Airport is also near to Tura.

Agriculture and Cropping Pattern

Agriculture is the main occupation of the people of the watershed areas. The principal agricultural crops are paddy, ginger, yam, chillies, turmeric etc. However, few horticultural crops like pineapple, arecanut, banana etc. are cultivated in the Watershed area.
. However, some forest species like *Shorearobusta, Artocarpus heterophyllus, Albizzia species, Bahauniavariegetta* etc. are seen in the Watershed Area.

West Khasi Hills:

More than 80% of the total population in West Khasi Hills is agrarian as theirmain backbone of livelihood is basically agriculture. Rice, Maize, potato and ginger are the main crops grown in West Khasi Hills. Agriculture is the main stay of the population in the district. As per census 2011, 52% of the population is engaged in agriculture and 22.8% of total workers population is engaged as agriculture labourers. The area is endowed with diversified climatic condition thereby offering good scope for cultivation of temperate and subtropical crops. Principal crops grown in the district are rice, maize, millets, oilseeds and pulses. Horticulture products include orange, pineapple and many local fruits. Vegetables like potato, cucumber, squash, beans etc. are also grown.

Animal Husbandry

Animal husbandry and Agriculture are related with the overall socio – economic conditions of rural tribal people of Meghalaya. Animal husbandry plays a significant role in overall farming system of the state. The total livestock and poultry population of the state are 15.51 lakhs and 28.20 lakhs respectively out of which Ri Bhoi district possesses 1.12 lakhs and 3.52 lacks respectively (Sample survey 2005- 06). The livestock availability in the district ranges from pig, cattle, buffalo, poultry, goat, rabbit and sheep. Although the district possesses a good number of livestock and poultry, the productivity of livestock and poultry is very poor due to stunted growth and low production of local breeds of livestock and poultry, non-scientific approach of livestock and poultry farming.

West Khasi Hills:

The Animal Husbandry and Veterinary Department was established in the District right from 1976-1977 with the main objective of combating diseases in livestock and to encourage and assist the people of the district to take up farming in livestock on commercial scale so as to substantiate their income generating capacity. The people mostly rear local breeds of livestock characterized by low productivity in terms of meat, milk and meat.

Fishery

ThePIA has unique topographical condition. Consequently, the PIA is blessed with vast and varied water resources in the forms of rivers, reservoirs, beels, lakes, swamp, pond, mini barrages and low-lying paddy. The district shared maximum 20% in total area of pond/mini barrages of the state followed by 10.2, 9.23 and 2.46% in case of reservoirs, rivers, and beels, lakes etc. respectively, but no contribution in state in terms of paddy cum fish culture in the district, although it is a proven technology scope and potential of ornamental fish (*Puntius bartissp*) is not so much satisfactory.
The Government of Meghalaya has identified fisheries as a key sector and launched the Meghalaya State Aquaculture Mission (MSAM) in 2012. Under this mission, a large water area in the state has been brought for fish culture.

In West Khasi Hills District, the total water area assisted under MSAM is 99.5 ha which includes 970 nos. of individual ponds and 5 nos. of community ponds. There are 5 nos. of fish ponds

under convergence of MSAM with other Departments covering an area of 3.5 ha which will be implemented shortly. The area covered under the 1000 ponds scheme of the Fisheries Department is 67.45 ha. There are 2 nos. of Govt. fish farm in the District. There are also 3 nos. of fish sanctuaries which aims at conserving the indigenous and endemic fish species. According to the Fisheries Department, fish production (2014-15) in the District is 386 MT.

Hospitals

The PIA has 1 hospital, 2 dispensaries, 8 primary health centres, 3 community health centres, 27 sub centres, 1 leprosy control unit, 1 set centre, 1 ayurvedic dispensary and 3 homeopathic dispensaries. Para medical personnel registered during the year for the service of the people of the district.

CHAPTER-VI: ANALYSIS OF POTENTIAL ENVIRONMENTAL& SOCIAL IMPACTS & MITIGATION- MEASURES

During Planning and Design phase the road alignment, construction details, materials of construction etc. which ultimately decide the impacts during later phases are evaluated. Most of the impacts are occur during construction and operation phase. While some of the construction phase impacts are temporary, others are permanent. Operation phase impacts are continuous in nature. The important criteria for identification of impactsisthe identification of the impact zone. For present screening studies, a direct Corridor of Impact (COI) within 500 m road alignment has been considered.
Environmental parameters are broadly classified into three groups.

- **Physical Environment includes:** Water Resources, Water Quality, Air Quality, Noise and Land environment etc.
- **Biological Environment includes:** Terrestrial and aquatic biodiversity and Roadside Plantation etc.
- **Social Environment includes**: Demography, Employment, Agriculture, Housing, Culture etc.

Environmental Impacts and Mitigation Measures

The assessment of potential environmental impact consists of comparing the expected changes in the environment with or without the project. The analysis predicts the nature and significance of the expected impacts. The detail of potential impacts & mitigation measures are mentioned in the below table.

Impacts During Design/ Pre-constructional Phase

The project envisages upgrading the existing single lane carriageway to intermediate lane foraugmenting the capacity of the project road and significantly extending its service life. However, at few locations small parcel of land will be required to accommodate the proposed improvement/widening. The impacts during Design and Preconstructionstagehavebeendiscussedinthefollowingsections:

Impacts on Physiography

The project section is an already existing road and located on hill and plain terrain. The same alignment will be followed for improvement from existing single lane with earthen shoulder to standard single lane configuration with paved shoulder and geometric correction at few locations. The existing ground profile will be followed with minor profile corrections at few locations without significant alteration of existing vertical profile, except for improvement of geometrics and road safety. The rehabilitation and widening will be generally restricted within the existing ROW, except for few locations where small land parcel would be required beyond existing RoW. The project will not have any impact on the topography/ Physiography within the project influence area and hence does not require any mitigation measures.

Ambient Air Quality

Impact to air environment during pre-construction stage will be limited to activities such as setting of construction camp, unloading of materials, exhaust from Diesel Generators, etc.

Mitigation Measure:

Consent to Establish for emission/continuation of emission under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 should be obtained for Diesel Generator Set (s) of > 15 KVA for Non-Industrial use from SPCB

LPG should be used in the labour camps for cooking purposes instead of wood.

Felling of Trees

The amount of tree within toe line due to widening of highway is 166 trees.. The project road is not passing through any Reserve Forests or Protected area such National Park or Wildlife Sanctuary. Hence does not require any mitigation measure. Needs mitigation measures to plant trees as per the Meghalaya Government Compensatory afforestation rules.

Impacts on Fauna

There is no wildlife habitat located along the project area nor any migratory route/ animal crossingsin the project area. So any risk or impact on wild animals or incidence of habitat fragmentation ordisturbances to the wildlife migration route due to project is not anticipated in any of the projectsections.

Impacts on Ecologically Protected Area

The project road does not pass through any ecologically protected areas such as Wildlife Sanctuary, National Park, Tiger Reserve or any notified ecologically sensitive area not is located in any Eco-sensitive zone. Further no movement of wild animals has been reported near the project alignment. So, any impact on such feature due to the project is not envisaged.

Impacts during Construction Phase

Most of the adverse environmental impacts are related to construction works which are inevitable but are manageable through certain environmental friendly practices. The negative environmental effects can be taken care of at an early stage through proper engineering designs and through the contract during construction practices.

The standard road construction works involve are site clearance, excavation, filling of earthmaterials and sub grade materials, laying of bituminous mixtures, handling of hazardous materialslike bitumen, diesel, etc., dumping of unusable debris materials, transportation of materials fromproduction site to construction site, and other constructional activities and associated works likemobilization of constructional equipments, setting up of different construction plants, setting up ofworkforce camps, quarrying, material storage etc. These activities have certain impacts of variousmagnitudes on different components of environment.

No significant natural habitat conversion is envisaged to take place as a direct consequence of this project. Since the road improvements would follow the existing alignment of the road and all improvements will be undertaken within the formation width of the road, there will no direct impacts on land use conversion. The anticipated impacts due to all theseactivities have been described below:

Compaction and Contamination of Soil

Contamination of soil during construction stage may happen primarily due to construction and allied activities. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping near water bodies.

Mitigation Measures:

Construction equipment/vehicles should be routinely maintained to prevent leakage of fuels/ lubricants;
Construction equipment/vehicles should be parked and maintained in designated areas on hard stand having perimeter drains to collect spilled liquids;
Fuels and other liquid chemicals should be stored in designated storage areas with drip trays to collect leaked materials, if any.
The Contractors shall ensure the use of a relatively new, well maintained hot mix plant (batch type) and maintenance of hot mix plants and batching plants should be regular and periodic to prevent any kind of oil leakage on soil surface.

Increased erosion and loss of top soil

Loss of topsoil: The topsoil on the land parcels, which is either used for short term (e.g., borrow areas, construction camps etc) or permanent use (expansion of the road alignment), would be lost unless the same is preserved. The alignment passes through areas which have sandy loam or sandy clayey loam. These soils are light textured and are thus prone to erosion by winds and during rain, gravity erosion. Further, the movement of vehicle over land next to existing road and to access the construction site would also cause compactions of soil and affect soil fertility.
Waste from off-spec hot-mix as wells as from the regular operations of the machinery e.g. layers and bitumen sprayers during the surfacing of the roads. The concrete wastes from the batching plant and transit mixer wash water would also be generated.
The labour camps that would be setup for construction would generate municipal solid waste and hazardous waste (waste oil from the maintenance and operation of machinery). These wastes have potential to contaminate the soil around the site if it is not properly stored, handled and disposed. If these excess excavated material, construction and demolition wastes are disposed on agricultural land it may result in loss of productivity of land.

Mitigation Measures:

The existing vegetation on slopes outside the immediate area of construction must remain undisturbed during construction and/or upgrading.
Engineering and bioengineering techniques to be used to prevent barren slopes and to stop soil erosion and protect erosion prone areas from excessive grazing by animals;
Slope failures should be monitored and remedial actions initiated at the earliest possible time
Logging immediately above road should be restricted to reduce erosion/landslide potential;
Retaining structures like gabion wall, breast wall and retaining wall, slope protection measures are provided to ensure stability of hill slope during and after the construction of project road. Gabions are made up of Galvanized iron wire netting of 4 mm diameter having 10 cm square or hexagonal openings and filling the sausages with hammer dressed stones and wrapping the wire net at top.Erosion protection measures identified to be undertaken in specific road sections are specified below:

Table 52: Details of proposed erosion protection wall

Chainage(m)		Side	CD Length(m)	Length(m)
From	To			
Gabionwallsofheight1.5m				
880	950	Valley		70
1050	1100	Valley		50
6410	6440	Valley		30
13210	13350	Valley	2	138
13390	13460	Valley		70
13560	13620	Valley	2	58
13720	13750	Valley		30
14180	14210	Valley		30

Chainage(m)		Side	CD Length(m)	Length(m)
From	To			
15790	15820	Valley		30
16210	16240	Valley		30
16320	16440	Valley		120
21910	21980	Valley		70
22380	22420	Valley		40
22470	22530	Valley	2	58
22575	22610	Valley		35
22660	22690	Valley		30
22790	22830	Valley		40
23030	23100	Valley		70
23200	23260	Valley		60
27630	27660	Valley	2	28
28125	28190	Valley		65
31250	31310	Valley		60
Gabion walls of height 2.0m				
15760	15790	Both		60
19590	19640	Valley		50
19760	19850	Valley		90
21550	21580	Valley		30
22030	22075	Valley		45
29800	29875	Valley		75
29940	30000	Valley		60
Gabionwallsofheight3.0m				
3420	3460	Valley		40
3640	3700	Valley		60
7905	8000	Valley		95
Gabion walls of height 4.0m				
19930	19980	Valley		50
Gabion walls of height 5.0m				
3460	3540	Both	2	156
9470	9580	Valley	47.88	62.12
19850	19930	Both	33.42	93.16
19980	20080	Both	18.24	163.52
31780	31950	Both	33.42	273.16
Proposed Breastwalls				
5825	6175	Hill		350
6770	6875	Hill		105
6875	6920	Hill		45
12450	12495	Hill		45
12930	12990	Hill		60
14150	14180	Hill		30
14210	14250	Hill		40
17975	18075	Hill	2	98
18750	18820	Hill		70
19030	19175	Hill		145
19360	19590	Hill	2	228
20410	20460	Hill		50
20490	20530	Hill		40

Chainage(m)		Side	CD Length(m)	Length(m)
From	To			
21040	21090	Hill		50
21400	21475	Hill		75
21580	21630	Hill	2	48
22380	22420	Hill		40
22470	22530	Hill	2	58
22530	22575	Hill		45
22975	23030	Hill		55
23030	23100	Hill		70
23100	23140	Hill		40
23200	23260	Hill		60
24525	25050	Hill	6	519
25050	25175	Hill	2	123
27200	27275	Hill		75
27660	27700	Hill		40
28925	29675	Hill	14	736
32410	32460	Hill	2	48

Slope protection measures are to be provided along the project stretch in the form of erosion blanket with shrub plantation, Hydro seeding, interlink chain mesh with grass strips, shotcrete crib wall with vegetation and hedge brush layer

Where practicable, excavated areas should be backfilled at the end of the working day.

Guidance for establishment of construction camps, material storage or staging of plant and machinery.

Sites /land types to be avoided:

–Lands close to habitations

– Irrigated agricultural lands

– Lands belonging to small farmers

– Lands under village forests

– Lands within 100m of community water bodies and water sources as rivers to avoid contamination.

– Lands supporting dense vegetation and Forest with/without conservations status

– Low lying lands within 100m of watercourses

– Grazing lands and lands with or without tenure rights

– Lands where there is no willingness of the landowner to permit its use

– 2km from towns 500m from any villages

– Community land (Chruch, community forest) which is traditionally used as conservation areas

Land Types Preferred:

– Waste lands.

– Waste Lands belonging to owners who look upon the temporary use as a source of income.

– Community lands or government land not used for beneficial purposes.

– Private non-irrigated lands where the owner is willing.

– Lands with an existing access road.

Borrow Areas and Quarries

Need for opening borrows areas is anticipated. It may cause some adverse impacts if left un-rehabilitated. It may pose risk to people, particularly children and animals of accidentally falling into it as well as become potential breeding ground for mosquitoes and vector born diseases. Illegal quarrying may lead to unstable soil condition; destroy the landscape of the terrain, air and noise pollution. Quarry material will be sourced from existing licensed quarries. The dredging and use of dredged material, if involved, may have its impact in terms of localized sedimentation level increase and dispersion of pollutants present in the dredged material in the river water. A total number of 2 borrow areas have been identified around project road, one is at a distance of 23.3 Km and another is at 33.8 Km from the project stretch (refer to table 13 and 14). For meeting the required quantity of sand for construction, one sand mining areasavailable around the project area, which is located in Jaidoh village on Nongkasen. Details of borrow area is given in Section 0.

Mitigation Measures

Borrow areas if required, shall not be located near forest areas. The edges of borrow sites shall be no closer than 3 meters from any fence line or boundary. Adequate clearance shall be provided for the construction of catch drains. Borrow sites shall have adequate drainage outlets unless the relevant landowner has agreed that the borrow area is to create a permanent tank or dam. Cut batter slopes shall not be steeper than 3 to 1 and shall be left by the Contractor in a tidy and safe condition to the satisfaction of the Engineer. Written clearance from the land owner/village head shall be obtained before leaving a site

Borrow pits shall be selected from barren land/wasteland to the extent possible. Borrow areas should not be located on cultivable lands except in the situations where land owners desires to level the land. The top soil shall be preserved and depth shall be restricted to the desired level.

Borrow areas should be excavated as per the intended end use by the owner. The Indian Road Congress (IRC):10-1961 guideline should be used for selection of borrow pits and amount that can be borrowed.

The top soil in the borrow area should be stored for use in agriculture/horticulture.

The dredged material from the nearby water body shall be tested for presence of heavy metals and other pollutants before its reuse.

The depths in borrow pits is to be regulated so that the sides shall not be steeper than 25%.To the extent possible, borrow areas shall be sited away from populated areas. Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil.

Ambient Air Quality

Construction stage impacts will have adverse impacts on the workers as well as the settlements adjacent to the road, especially those in the down wind direction.

The adverse impacts on air quality during construction stage are classified and presented in the table below. There are two types of pollution i.e. dust pollution and pollution from harmful gases.

Table 53;Adverse impacts on air quality during construction stage

Sl.	Impact	Source
1	Generation of dust	Transportation and tipping of cut material - while the former will occur over the entire stretch between the cutting location and disposal site, the latter is more location specific and more intense;
		Transportation of raw materials from quarries and borrow sites
		Stone crushing, handling and storage of aggregates in asphalt plants
		Site levelling, clearing of trees, laying of asphalt
		Concrete batching plants;
		Asphalt mix plants – due to the mixing of aggregates with bitumen;
		Construction of structures and allied activities
2	Generation	Hot mix plants

Sl.	Impact	Source
	ofpolluting gasesincluding SO_2,NO_x and HC	Large construction equipment, trucks and asphalt producing and paving equipment
		The movement of heavy machinery, oil tankers etc.
		Toxic gases released through the heating process during bitumen production
		Inadequate vehicle maintenance and the use of adulterated fuel in vehicles.

The impacts are expected to be temporary (limited to construction period) and confined within construction areas.

Mitigation Measures:

Vehicles delivering loose and fine materials shall be covered
Limiting unnecessary idling of heavy machineries and other vehicles significantly reduce emission of polluting gases.
Loading and unloading of construction materials in covered area or provisions of water fogging around these locations.
Storage areas should be located downwind of the habitation area.
Periodic water sprinkling needs to be done, wherever required.
Regular maintenance of machinery and equipment needs to be done. Vehicular pollution check shall be made mandatory and renewed as per requirement.
Hot mix plants and other plants should be located at least 1.5 km from the nearest habitation, school, hospital, archaeological site, forest, rivers, streams and lakes, 500 m from ponds, and national highway, 250 m from state highway, unless otherwise required by statutory requirements after securing a No-Objection Certificate (NOC) from the SPCB. Hot mix plant shall be fitted with stack of adequate height as may be prescribed by SPCB to ensure enough dispersion of exit gases.
Bitumen emulsion and bitumen heaters should be used to extent feasible.
CTE & CTO for HMP, BMP, crushers & DG sets needs to be obtained.
LPG should be used as fuel source in construction/labour camps instead of firewood.
Mask and other PPE shall be provided to all the staffs/workers at construction site.
Diesel Generating (DG) sets shall be fitted with stack/chimney of adequate height as per regulations (Height of stack = height of the building + 0.2 KVA). Low sulphur diesel shall be used in DG sets as well as machineries.
Contractor should submit a site specific air pollution management plan.
Avenue plantation may improve the air quality during operation stage.

Regular air monitoring will be done to check the ambient air quality of the area.

Table 54:Impact on Air Environment and Mitigation Measures

Parameters	Potential Impact	Mitigation Measures Suggested
Air Environment	Generation of dust	Sprinkling of water Earth handling site Borrow area Road construction site Access road route Air pollution control at crusher and Plants PPE for Workers Stone crushing units and Plants should be with environment compliance. Necessary clearance needs to be obtained prior to operation of the borrow area. Regulations of construction timings near sensitive receptors and settlements
	Gaseous Pollution	Vehicles and machineries will be regularly maintained to conform to the emission standards. Asphalt mixing sites and Crusher should be placed 1 km away from residential area and outside forest area. Asphalt plant will be equipped with pollution control equipment Use of PPE by workers engaged in construction and application of asphalt mix on road surface.

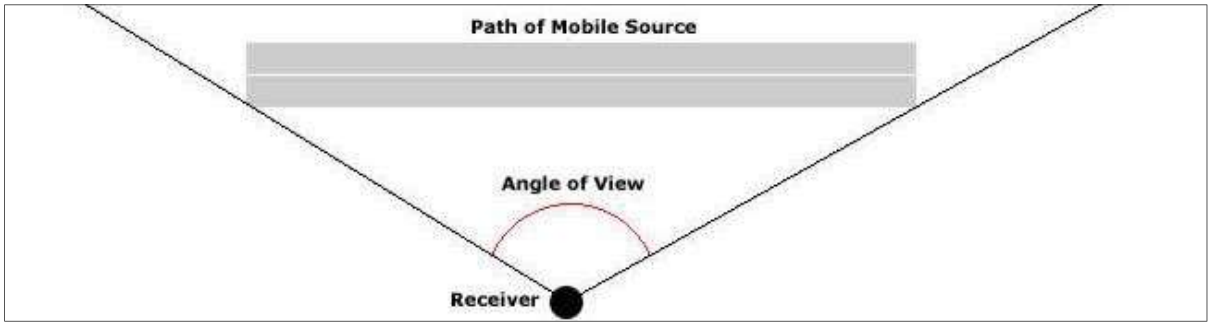
Noise

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.

At the outset, it should be noted that unavailability of exact information on the construction methodology, hours of work, no. of equipment and their ratings / fuel consumption, construction schedule, etc. are the limiting factors while estimate the construction noise for this subject project; however, to represent the possible worst-case scenario, an effort has been made based on our knowledge on the construction of similar project using QUESTOR Construction Noise Tool.

The QUESTOR Construction Noise Tool is a simple application capable of calculating noise levels for construction sites. It is based on the construction site noise calculation model documented in PR70 "How much noise do you make? A guide to assessing and managing noise on construction sites" by Dr Alan Wills (KVÆRNER) and David Churcher (CIRIA). The tool itself works on a relationship of one receiver to many sources.

'QUESTOR Construction Noise Tool' provides a library of sample plants and the activities they are performing from the BS 5228 standard: The British Standard on Noise. The total noise level calculated by the application is the noise level at the receiver.



As depicted in the above picture, it is considered that for particular construction zone, the source is located at a distance of 50m with 900angle of view. Accordingly, the sound pressure levels are predicted at the receptor location during different activities.

Inference

Based on the calculations, presented below it is anticipated that whenever the construction will happen in any zone other than industrial, the ambient noise level will exceed the statutory level at a distance of 50m away from the construction zone, if no barrier is put.

Table 55:Typical noise levels of principal construction equipment (Noise Level in dB (A) at 50 Feet

ID	Type	Noise pressure (dB), 1m from the source	Distance (m)	Barrier	Reflection	On Time (%)	Angle of View (^{0})	Traffic Volume / hour	Speed (km/hr)	Total (dB(A))
Site Clearing										
1	Dozer	116	50	None	None	20	90	10	10	46
2	Tracked excavator	113				20	90			76
3	Tracked loader	113				20	90			76
4	Wheeled loader	108				20	90			71
									Total noise from site at receiver	80
Ground Excavation										
1	Dozer	114	50	None	None	20	90	10	10	44
2	Tracked excavator idling	96				20	90			59
3	Tracked excavator	113				20	90			76
4	Wheeled loader	104				20	90			67
5	Tracked loader	112				20	90			75
									Total noise from site at receiver	79
Tipping Fill										
1	Dump Truck	110	50	None	None	100	90	10	10	57
									Total noise from site at receiver	57

ID	Type	Noise pressure (dB), 1m from the source	Distance (m)	Barrier	Reflection	On Time (%)	Angle of View (^{0})	Traffic Volume / hour	Speed (km/hr)	Total (dB(A))
Spreading Fill										
1	Wheeled excavator / loader	104	50	None	None	50	90	10	10	81
2	Dozer	117				50	90	10	10	61
									Total noise from site at receiver	81
Spreading Fill										
1	Wheeled excavator / loader	104	50	None	None	50	90	10	10	81
2	Dozer	117				50	90	10	10	61
									Total noise from site at receiver	81
Ground leveling										
1	Dozer	114	50	None	None	50	90	10	10	58
2	Grader	111				50	90	10	10	55
									Total noise from site at receiver	60
Unloading										
1	Tipper lorry	113	50	None	None	50	90	10	10	57
2	Tracked loader	112				50	90	10	10	89
									Total noise from site at receiver	89
Rolling gravel / bricks										
1	Road roller	108	50	None	None	100	90	10	10	55
									Total noise from site at receiver	85
Compacting fill										
1	Vibratory roller	106	50	None	None	50	90	20	15	84
2	Compactor rammer	108	50	None	None	50	90	20	15	86
									Total noise from site at receiver	88
Compacting sub-base										
1	Compactor rammer	108	50	None	None	100	90	20	15	89
									Total noise from site at receiver	89
Compacting earth										
1	Compactor rammer	108	50	None	None	100	90	20	15	89
									Total noise from site at receiver	89
Road surfacing										

ID	Type	Noise pressure (dB), 1m from the source	Distance (m)	Barrier	Reflection	On Time (%)	Angle of View (^{0})	Traffic Volume / hour	Speed (km/hr)	Total (dB(A))
1	Asphalt melter (Stationary)	103	50	None	None	70	NA	NA	NA	59
2	Asphalt spreader	110	50	None	None	70	90	10	10	88
3	Road roller and lorry	96	50	None	None	80	90	10	10	42
									Total noise from site at receiver	88
Installation of traffic light controls										
1	Groove cutter	115	50	None	None	100	NA	NA	NA	73
									Total noise from site at receiver	71

- **Receiver Distance:** The minimum distance in meters between the source plant and the receiver – considered as 50m.
- **On Time (%):** The percentage of time (of the overall time period in question) for which this plant is on.
- **Barrier:** If there is a barrier between the source and the receiver (None - To reflect the worst-case scenario)
- **Reflection:** If the receiver is within 1m of a wall then select this option
- **Angle of view:** 900
- **Traffic Volume (veh/hour):** Total number of return journeys that is made by the mobile plant in an hour
- **Speed:** Average speed of the plant in kilometres per hour

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 are located which includes schools, hospitals, and religious places. Noise impacts during project construction will be significant on these but temporary.

The principal source of noise during construction of highway would be from operation of equipment, machinery and vehicles. Earth moving machineries e.g. excavators, graders and vibratory rollers has potential to generate high noise levels. These machineries produce noise level of more than 70 dB (A). This can cause disturbance to the settlement, adjacent to the carriageway or at 500 m from the worksite. The vibration produced by rollers can be transmitted along the ground. This may cause damage to kutcha structure located along the alignment. The extent of damage would be dependent on the type of soil, the age and construction of the structure. The noise generated during the construction would cause inconvenience to the population adjoining the road especially within 500 m of the alignment after which it would be attenuated to acceptable levels Since, the settlement along the road alignment is sparse the severity of the noise in sensitive receptor are given below..

Further, using the Inverse Square Law of noise propagation, anticipated noise at the sensitive

Table 56:Anticipated Noise due to construction in the sensitive receptor

Name of the Component	Description	Chainage	side of the road (L/R)	Distance from the road (m)	Noise Level (dB)
CHC	Church	1+950	LHS	30.55	75.27
CHC	Church	2+800	RHS	42.92	72.32
SCH	School	2+900	RHS	28.74	75.80
SCH	School	3+050	RHS	22.53	77.92
SCH	School	3+050	RHS	45.54	71.81
INS	Institute	3+550	RHS	105.86	64.48
SCH	School	3+850	RHS	36.83	73.65
CHC	Church	4+250	LHS	12.71	82.89
SCH	School	4+250	LHS	21.38	78.37
SCH	School	4+300	RHS	24.52	77.18
CHC	Church	14+850	RHS	105.10	64.54
GY	Graveyard	15+150	LHS	19.17	79.32
CHC	Church	20+300	RHS	64.32	68.81
SCH	School	34+050	LHS	17.85	79.94
SCH	School	34+100	LHS	11.96	83.42
SCH	School	34+150	LHS	22.74	77.84
SCH	School	34+250	LHS	67.04	68.45

From the above study we have observed that the range of noise level of maximum locations is exceeding the permissible limit. To avoid the impact, the mitigation measures are mentioned below.

Although all the construction related activities are not expected to occur simultaneously at a given location yet increase in noise due to construction activities (land clearing, site preparation, material/ equipment's /machinery movement, establishment of camps/site offices) are expected.

Control Measures adopted during Construction Phase for Noise Environment

1. **Site Controls:** Stationary equipment will be placed along un-inhabited stretches as per distance requirements computed above as far as practicable to minimize objectionable noise impacts. These locations should be away from known bird nesting areas.
2. **Scheduling of Project Activities:** Construction activities will be scheduled to coincide with period when people would least likely to be affected. Construction activities will be strictly prohibited between 10 P.M. and 6 A.M. Near sensitive areas like schools', construction activities should be prohibited at the schooling hours. . Noisy operation near known nesting areas should be avoided during winter, typical breeding period of migratory birds.
3. Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.
4. Construction equipment and machinery should be fitted with silencers and maintained properly.

5. Noise measurements should be carried out along the road to ensure the effectiveness of mitigation measures

Mitigation Measures:

In view of above, following mitigation measures are proposed:

- All construction equipment used for an 8-hour shift shall conform to a standard of less than 90 dB(A). If required, machinery producing high noise as concrete mixers, generators etc., must be provided with noise shields;
- At construction sites within 500m of human settlements, noisy construction activities shall be stopped between 9.00PM and 6.00AM and near sensitive locations such as schools' construction activities should not be done during the schooling hours.
- Vehicles 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 and should be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 85 dB(A)per8-hourshift.

Surface Water Quality and Siltation

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

Extraction of sand from the river bed will increase turbidity and affect propagation of fishes and other aquatic life mainly benthic organisms. The macro-benthic life which remains attached to the river bed material may get dislodged and carried away downstream by turbulent flow. Mining and dredging activities, poorly planned stockpiling and uncontrolled dumping of overburden, and chemical/fuel spills from equipment's and machinery involved in dredging may cause deterioration of water quality for downstream users, and poisoning of aquatic life. However, the river bed sand quarries identified for the project have no density and diversity of benthic fauna. Fishing is practiced in the water bodies intersecting the project road. There are several ponds adjacent to the proposed project road. Moreover, any extraction of river bed material is regulated by different authorities like State Environmental Impact Assessment Authority, State Pollution Control Board and State Mining Department with an objective to conserve top soil, avoid impact on aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals. The project will utilize river bed materials from existing licensed quarries with all stipulated conditions of above mentioned authorities.

Mitigation Measure:

Construction works near waterways/water bodies will not be undertaken during the monsoon season

Retaining walls have been proposed to prevent erosion

Installation of temporary silt traps or sedimentation basins along the drainage leading to the water bodies;

No construction camp within 500m of any water body

Locating all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards.

Refueling of vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water separator before discharge

Collection of all waste oil, store in sealed damage-proof containers and dispose it to recyclers.

All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual cleanup.

Installation of temporary retention ponds, interception drains, and silt traps to prevent silt laden water from entering adjacent water bodies/waterways;

Modification and rechanneling of the slope of embankments leading to water bodies to prevent entry of contaminants.

Compliance with requirements of the clearance issued by the relevant state authority formining in rivers

No construction related activities of bridges during breeding season of fish and other aquatic species.

Impacts on natural drainage and watershed management (flooding)

Along the rivers and streams crossed by the road, there is a need for bank protection measures to avoid accelerated sedimentation that can affect drainage pattern as well as riverine habitats. The alignment follows the existing topography except for the location of the cross-drainage structure. There is no existing Major Bridge on the Project road section only 4 nos. of RCC Bridge and 11 nos. wooden bridges exist, and No additional bridges are proposed to be constructed. Out of the 196 nos. of existing culverts, 45 nos. are Pipe Culvert, 1 no. is RSJ with Wooden Deck & 150 nos. are Slab culvert. All culverts present in the project road are either hydraulically inadequate or structurally unsafe & hence are proposed for reconstruction.

Proposed Mitigation Measure

At all locations where the preliminary design has indicated a raise in the level of the embankment, the final design should review the feasibility of the same and if possible, reduce the embankment height.

At all location where the vertical profile has increased by 0.25 to 0.50 m or more protections of embankment is required.

A slope protection measure that has been successful in Meghalaya has been the use of Vertiver as a Bio engineering measure. The basis of this technique is plantation of Vetiver plants of approved variety specifically designed as per the soil and site conditions. For controlling the underwater erosion, a flexible mattress is proposed to be used. This mattress made of waste/recycled items like empty cement bags which will remain intact for long periods under water has been found effective in controlling underwater erosion elsewhere in Meghalaya. The stretches along the river bank will also have a reed bed which will absorb the flow energy before the water current hits the bank.

Ground Water Quality

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

Mitigation Measures:

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

Construction and Demolition Waste

Construction and Demolition waste shall be generated during the project construction phase. A certain amount of waste will be generated. Those wastes shall be utilized by theContractor depending upon suitability. However, Contractor shall dispose unused C&D waste atdesignated disposal site as perConstruction and Demolition Waste Management Rules 2016.

Mitigation measures:

Contractor will use the excavated road side material for construction of road. The rest unsuitable material will be disposed suitably. The lead and lift has been considered in cost estimates. The Contractor will not dispose the excavated unsuitable material generated from hill section to other side (valley side) of the project road. Proper disposal plan will be prepared by the Contractor to dispose the unsuitable material generated from hill cutting/ road excavation.

Natural Disaster

Flood and flash flood is common during the monsoon in the vicinity of the proposed project road. During public consultation it was revealed by the local people that flash flood occurs in several villages in the project area during the months of monsoon season. Hence All CD structures have been proposed to be designed with anticipated risk of flood. Embankment height along potential flood affected areas shall be increased. Lined and unlined side drains have been included in the design to avoid water-logging.
Relevant IS codes have been adopted in designing the structures to sustain the highest magnitude of earthquake.

Disruption of Community Services

Local services, including water supply lines, irrigation line, drainage, ditches, streets are commonlycut during road earthworks. These activities are required by the local people for crop production,drinking water supply and access, and have the potential to damage road work too. These servicesare often either inadequately reconnected or not reinstated at all.

Mitigation Measures

The Contractor will arrange their own source to cater for their water requirement for construction and other activities and will not interfere with the local water supply system

All irrigation canals, water supply lines and stand pipes, drainage and streets will be maintained during construction or if necessary, temporary services shall be arranged of the owner/ user's permission for temporary cessation will be gained.

All the Services will be progressively reinstalled as soon as road excavation has been completed.

Diversion of Traffic

Since the road upgradation works will be on the existing road only, therefore there will be direct interface with the road traffic. The Short term impacts associated with the project will be traffic diversion and management during construction phase. Construction activities will cause hindrance to the existing traffic flow. There is possibility of accident hazards during construction phase of the widening project. There will be requirement for diversion of existing traffic at various construction sites during construction phase. It needs to be mentioned that though there are no direct impactson the natural environment due to disruption/diversion of such services, but diversion can also leadto adverse impacts, if not planned properly. Rapid restoration of diverted services can help inminimizing the severity of impacts arising out due to diversions of existing services.

Mitigation Measures

Proper preventive measures will be taken during the construction activities at theconstruction sites

Reduce speed through construction zones.

Construction of bridges/culverts will be carried out prior to construction of new carriageway at the first stage.

Strengthening/raising of existing two lanes will be done only after the completion of the first stage.

Proper warning signs will be displayed at construction sites.

Impacts on Occupational Health & Safety

The Construction workers are continuously exposed to dust and gaseous emission during construction activities. The construction industry falls in hazardous category and there are always risks of accidents to the labours. However this type of risks of Occupational hazards can be managed with implementation of proper safety at site.

Mitigation Measures:

The Contractor will comply with the requirements of the Environmental, Health, and Safety (EHS), Guidelines of the World Bank, April, 2007 and all national, state and local core labor laws on working conditions and safety during construction.

The Contractor will Develop and implement site-specific Health and Safety (H&S) Plan including SoP for preventing spread of COVID-19 epidemic which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H&S training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents

The Contractor will provide adequate good quality Personal Protective Equipment (PPE) to all the workers working at construction zones and Plant sites and will ensure that these PPEs are used by workers at all time during works.

Safe access to the work site and safe working conditions to be maintained throughout the working period.

Adequate drainage, sanitation and waste disposal will be provided at workplaces.

Proper drainage will be maintained around sites to avoid water logging leading to various diseases.

Adequate sanitation and waste disposal facilities will be provided at construction camps by means of septic tanks, soakage pits etc.

A health care system will be maintained at construction camp for routine check-up of workers and avoidance of spread of any communicable disease.

Readily available First Aid kit bearing all necessary first aid items will be proved at all the work sites and should be regularly maintained.

The Contractor will organize awareness program on occupational health and safety aspects as well as on HIV/AIDS and sexually transmitted diseases (STDs) and COVID-19 on periodic basis through authorized agency.

Preventive measures are required to be followed to avoid or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labour for workers on periodic basis.

Work Site Safety

Construction site safety is one of the most overlooked things during a construction project. In most workplaces accidents are common due to lack of work site safety. Accidents have the potential to be life-threatening and can be avoided through proper Work site Safety.

Mitigation Measures:

Safe access to the work site and safe working conditions to be maintained throughout the working period

Scaffolding to be used properly.

Avoiding entering a trench that is unprotected.

Avoiding ladders with metallic components near electrical work and power lines

Head Protection, use helmet or body harnesses

Construction workers should wear work boots with slip-resistant and puncture-resistant soles

Hazard communication: Make information accessible to employees at all times in a language or formats

Checking of all electrical tools and equipment regularly for defect

The Contractor will comply with the requirements of the Environmental, Health, and Safety (EHS), Guidelines of the World Bank, April, 2007 and the statutory norms on safety during construction.

Anticipated Impact on Biological Environment:

Impact on Faunal and Terrestrial Ecology:

Most of the project road stretch passes through human habitation, agricultural area, built-up and degraded non classified forest areas without any National Parks, Wildlife Sanctuaries and other eco-sensitive areas nearby.

As per the list attached here the area has Endangered/ Schedule - I species, confirmed by site visit as well as consultation with community and Forest/Wildlife department. Majority of the important species are reported from outside of the ROW.
The traffic – animal conflicts during the operation stage shall be resolved by implementing speed calming mitigation measures such as road humps, rumble strips, speed limits, sign boards etc.
It is essential to make provisions for the transportation of agricultural equipment and animal crossing, wherever necessary, by providing service roads, speed breakers (road humps, rumble strips, signboards, etc.). Although situation does not warrant for the provision of exclusive underpasses, all possible efforts shall be made to avoid animal- traffic conflict arising out of proposed improvement of project roads.
There is a scope of slight impact to local domestic animals, which graze in the area especially after the road is constructed. Increased vehicle movement in the area might lead to accidents involving animals. Apart from this, micro-ecosystems developed on the roadside with the birds, animals and insects using the plantation over the years would be lost due to loss of their habitat.

Mitigation Measure

The Contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal.

Awareness shall be made among the workers community regarding the wildlife in the area and laws preventing poaching of wild animal or injuring them.

Mandatory / Regulatory sign for entire section of project road, for every 2 km, on alternate sides is proposed.

The compensatory plantation shall act as the new habitat for the birds, animals and insects species

If any animal is found near the construction site at any point of time, the contractor shall immediately upon discovery thereof contact authorized wildlife rescuer or Forest Dept. for rescue of snakes or other distressed wildlife.

Special care of ponds shall be taken since the wildlife and public dependent on these water bodies.

Impact on Flora and Mitigation measures:

The project has a significant, direct and long-term impact on roadside trees in the Pre-construction stage. The cutting of trees shall have manifold impact. Most visible impact is the loss of shade. Also, there is a possibility of the local people being deprived of tree products, such as wood, fruits, leaves etc. Removal of roadside tress will reduce comfort levels for slow moving traffic and pedestrians.
Trees impacted due to the project shall only be cut after requisite permission from State Forest Department is obtained.

Trees impacted by the project shall be compensated by planting of endemic tree species which are highly tolerable to vehicular emissions and dust will be taken up as per IRC: SP 21.

All necessary measures such as siting of construction establishments away from human habitations; increase of stack height; regular maintenance of construction equipment's and vehicles; etc. shall be taken up to reduce the dust and gaseous emissions during construction activities.

The compensatory plantation shall act as the new habitat for avifauna, lesser mammals, herpetofauna & insects. List of species recommended for taking up compensatory afforestation has been presented in below tables. Local authority and populace may also be consulted for selection of species types.

All efforts shall be made for the survival of the planted trees. A Memorandum of Understanding should be signed with competent authority or agency to take up the plantation.

Table 57:Species Recommended for Plantation

Scientific Name	Role
Azadirachtaindica	Noise barrier, Pollution sink, Economic & Medicinal Value
Cassia fistula	Landscaping, Flowering plant, Pollution sink
Ficus bengalensis	Noise barrier, Pollution sink, Shade, Supports other species, Religious values
Ficus religiosa	Noise barrier, Pollution sink, Shade, Supports other species, Religious values
Magnifera indica	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value
Syzygium cumini	Pollution sink, Economic Value (fruit bearing)
Terminalia arjuna	Noise barrier, Pollution sink
Terminalia chebula	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value
Alstonia scholaris	Noise barrier, Pollution sink, Shade, Supports other species
Dillenia indica	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value
Mimusops elengi	Noise barrier, Pollution sink, Shed, fruit
Lagerstroemia speciosa	Landscaping, Flowering plant, Pollution sink
Bombax ceiba	Landscaping, Flowering plant, Pollution sink
Mesua ferrea	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value
Neolamarckia cadamba	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value

Impact on Aquatic Ecology:

Impacts on the aquatic ecology during construction include increase in the silt inflow to the surface water bodies and disposal of liquid wastes and untreated sewage from construction camps and labour camps into the surface water bodies. There is no significant impact on aquatic ecology during operation stage as there is no major rivers or water body in the ROW. Minmal levels of impacts has been anticipated if silts and debris deposited inside river/wetland etc. on the aquatic ecology during the operational phase.

Mitigation measures

Construction of road embankments shall be doneadheringto specified norms as per slope ratio and turfing on the slopes will be done to reduce the embankment erosion. Construction of cross drainage structures will be taken up during lean flow period to avoid the silt inflow to the surface water bodies.

If any aquatic animals, such as turtles, are found near the construction site at any point of time, the contractor shall immediately upon discovery thereof contact authorized wildlife rescuer or Forest Dept for rescue of said animals.

No fishing should be allowed by construction workers

Liquid wastes and sewage from the construction establishments will be treated to meet the CPCB standards before disposing it into water bodies.

Accidental chemical spills shall be handled by emergency spill procedure such as stopping the flow; removing ignition source; initiating emergency response; cleanup and safe disposal will be followed.

Provision for silt traps will be made at regular intervals, especially at major cross drainage structures, to trap the silt before it reaches the water bodies along the subproject road.

No Debris to be deposited in the river, streams, wetlands and ponds.

Management of Construction Debris/Waste

Construction debris/waste is generated due to demolition of existing structures, scarification of existing pavement and excavation at some section of the subproject road. Improper disposal of scarified bitumen causes decrease in soil fertility and water pollution. Careless disposal of debris can obstruct waterways causing siltation of reservoirs and reduce capacity. Unleaded demolition wastes will cause traffic blockage and dust causing inconvenience and health risks.

Mitigation measures

During the site clearance and disposal of debris, the contractor shall take full care to ensure that public or private properties are not affected; there are no dwellings below the dumpsite and the traffic is not interrupted.

The Contractor shall at all times ensure that the entire existing canal and drains within and adjacent to the site are kept safe and free from any debris.

Construction waste debris shall be utilised for backfilling embankments, filling pits, construction of cross roads, approach roads and landscaping before being disposed into disposal pits.

Debris disposal sites shall be sited away from sensitive locations like settlements, water body, forest areas and any other sensitive locations.

The debris dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants so that the landscape is coherent with the local environment.

Care should always be taken to maintain the hydrological flow in the area and dumping sites do not contaminate the water sources such as rivers and ponds.

Public perception about the location of debris disposal site has to be obtained before finalizing the location. Permission from the Village/local community is to be obtained for the Disposal site selected.

Mitigation Measures for Bridge/Culvert Construction Sites

There is proposal for construction few major and minor bridges along the ROW. None of these bridges are situated on any major river or its tributaries. 11 numbers of bridges along the project road need to be reconstructed. All are either seasonal Nullah, Water logged area or Redundant part of old River channel. For construction of these bridges, following steps has to be adopted: -

Construction will be carried out during lean flow period as far as possible;

All slopes will be stone or brick pitched as per design recommendations;

Silt fencing will be provided at base of embankment of entire water body;

Siltation of soil into water bodies will be prevented;

All solid waste/ construction material will be properly disposed off from bridge sites;

Contractor will ensure that construction material/ solid wastes are not disposed off in water body;

No oil or lubricant will be discharged from construction yard or machinery into water body

The Construction materials will be stored at a minimum distance of 500m from the water body.

To maintain an efficient storm water flow, all drains will be regularly cleaned as part of regular maintenance.

Impacts during Operational Phase

During operation stage, the main sources of environmental impacts are the increased traffic volumeand speeds. The increase in traffic volume and speed may enhance the safety risk especially in therural area. No sudden change in the traffic volume is expected due to this road as the road isalready existing one and opened for public traffic. The project also provides the opportunities of the restoration of vegetation around the vicinity of the worksite and roads by implementing the compensatory plantation programme, which will not only enhance the aesthetic view but can also help in reclamation of soil. During operational phase this will be enhanced with the activities associated with the maintenance of landscape such as plantation programme, by providing roadside amenities, parks etc

During the operational phase when the plantation works will be adequately implemented will enhance the aesthetic as well as hygienic environment thereby reducing the chances of diseases due to vehicular emission. Widening will ensure smooth plying of the vehicles and also will help in reducing the congested zone and thus will reduce the emission rate of vehicles. Various impacts during operation phase are discussed below:

Impacts on Water Quality and Resources

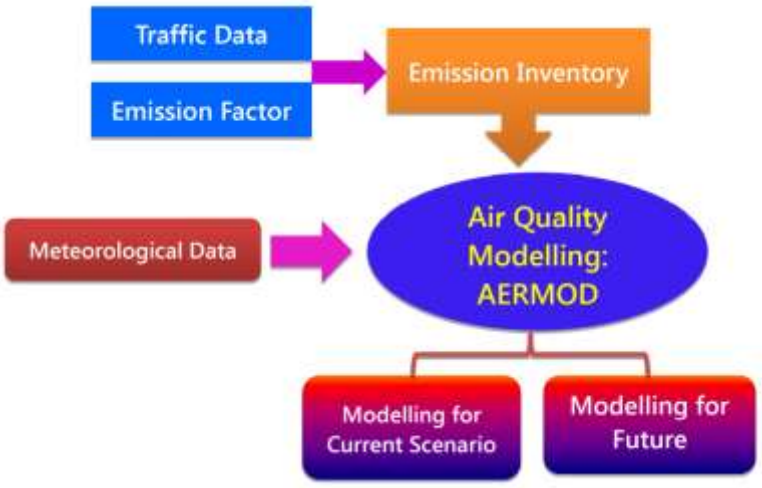
During the operation phase, the possibility of degradation of water quality is very remote. The impact on the surface water quality during operation can be expected due to accidental spillage. However the probability of such accidents are minimal since enhancement of road safety measures such as improvement of curves and widening of the roads and other pedestrian facilities are takencare of in the design stage. Periodic monitoring of water quality will be done at selective location of proposed project.

Impact on Air Quality

Vehicular emissions are the principal source of pollution during the operation stage. The subproject road being mostly located in adjacent to open agricultural land, adequate dispersion of gaseous pollutants is expected.

Prediction of Impact on Ambient Air Quality

To assess the impact on air quality of the project area during the operation phase, air pollution dispersion modelling was carried out using future traffic projections. The modelling was carried out using AERMOD developed by USEPA. The methodology used for air quality assessment is depicted below.



AERMOD Model

The AERMOD air dispersion model is USEPAs official “Appendix A” air dispersion model for regulatory use and was developed by the AERMIC (The American Meteorological Society/EPA Regulatory Model Improvement Committee) work group (Cimorelli et al., 2004).
It is a steady-state plume model. In the stable boundary layer (SBL), it assumes the concentration distribution to be Gaussian in both the vertical and horizontal. In the convective boundary layer (CBL), the horizontal distribution is also assumed to be Gaussian, but the vertical distribution is described with a bi-Gaussian probability density function (PDF).
AERMOD aims at modelling short-range (up to 50 km) dispersion from a variety of polluting sources (e.g., point, area, and volume sources) using a number of model configurations. These configurations include different sets of urban or rural dispersion coefficients as well as simple and complex topography. The model has the capacity to employ hourly sequential pre-processed meteorological data to estimate concentrations of pollutants at receptor locations at different time scales ranging from 1 h to 12 months. AERMOD is an advanced plume model that incorporates updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of terrain interactions.
AERMOD has two pre-processors AERMET and AERMAP. AERMET is a meteorological pre-processor that calculates meteorological parameters and passes them to AERMOD. AERMAP is a terrain pre-processor that calculates terrain elevations above mean sea level and passes them to AERMOD. Input data requirement for AERMOD is presented below.

Input Parameters:

- Emission Data (i.e. vehicles emission)
- Geographical Terrain Data
- Meteorological Data (Hourly Nine Meteorological Parameters) Wind Speed, Wind Direction, Ceiling Height, Rain Fall, Pressure, Humidity, Global Horizontal Radiation, Cloud Cover and Temperature

Source and Receptor

Receptor and dispersion modelling are carried considering a study area of 2 km and considering grid of 100 m x 100 m. All the sensitive receptors located within 15m of road edge has been considered as discrete receptors. The entire carriage way of the roads (Nongstoin-Maweit) are marked and considered as area source. The average height of release for vehicular emission is taken as 0.15 m.

Model Setup

The model was setup with help of meteorological and emission data based on geographical information. Receptors were set over the domain. Background concentrations were calculated using monitored values from sites which is shown in table below.

Table 58: Details of Model

Model Used	AERMOD
Source Type	Line Source: Vehicular Emissions Source
Receptors Grid	1 Cartesian Grid, 100 m x 100 m Uniform Cartesian Receptors: 441 and Discrete : 22
Emission Factor	ARAI Emission Factors were used and it is for Indian Vehicles Emission
Traffic Data	It has been taken for the year 2020 and 2040
Meteorological Data	1st January 2020 to 31st December 2021 from Shillong Airport
Prediction Years	2021 (Base Year) & 2044 (End of Operation Phase)

Modeling Result and Analysis

Model outputs as concentration has been obtained for estimated emissions of the source at each receptors of the grid. The concentration contours from these emissions are plotted for each pollutant. Isopleths, so obtained, are superimposed on the Google Earth imagery of the project location. The air quality results in the future are also predicted based on projected traffic. To determine the impact of project due to projected increase in traffic during operational phase separate modelling was carried out for the base year (2020) – before start of project and year 2040 (end of project operation phase). The modelling was conducted for two criteria pollutants namely PM10 and NO_x. Though CO is one of the major pollutants from vehicular emission, it has not been modelled as the allowable limit in ambient air is considerably high and unlikely to cause any exceeding.

Significance of Impact- Operation Phase

As perthe prediction of modelling, the resultant concentrations of NOX & PM10 are well within the NAAQS standard duringtheoperation phase.
Thepredicted values are less than90%ofthe NAAQS hencetheseverityof the impact is categorized asminor. Also, astheextentofthe impact is within the500mofthe project boundaryhencethe extent is categorized asModerate and asthedurationof the impactwhich is regular (e.g. traffic generated bytheproject occupants) during operation phase thereforeitis categorized as high with probability of definite occurrence.

The predicted results and corresponding isopleths are presented below.

Table 59;Predicted PM10 and NOx concentration at sensitive receptor within 15m from ROW

Description of the component	Chainage	Easting	Northing	PM10 Base	PM10 2041	Nox base	Nox 2041
Church	1+950	325015.18	2823450	0.01046	0.01536	1.15545	0.66448
Church	2+800	324340.30	2823289	0.26455	0.38855	29.2193	16.78559
School	2+900	324237.30	2823244	0.13802	0.20272	15.2442	8.75733
School	3+050	324104.80	2823208	0.12473	0.18320	13.7764	7.91412
School	3+050	324133.00	2823190	0.35469	0.52094	39.17497	22.50477
Educational Institute	**3+550**	323633.20	2823089	0.09273	0.13619	10.24182	5.88360
School	3+850	323520.80	2822841	0.03191	0.04687	3.52472	2.02484
Church	4+250	323198.60	2822682.6	0.02173	0.03192	2.40015	1.37881
School	4+250	323139.15	2822713.3	0.02377	0.03491	2.62507	1.50802
School	4+300	323116.10	2822715	0.02445	0.03591	2.70081	1.55153
Church	14+850	314655.30	2821203	0.05683	0.08347	6.27701	3.60670
Graveyard	15+150	314465.56	2820939.6	0.13103	0.19692	14.80812	9.89731
School	34+150	306245.75	2814632.1	0.12821	0.18836	14.16489	8.15349

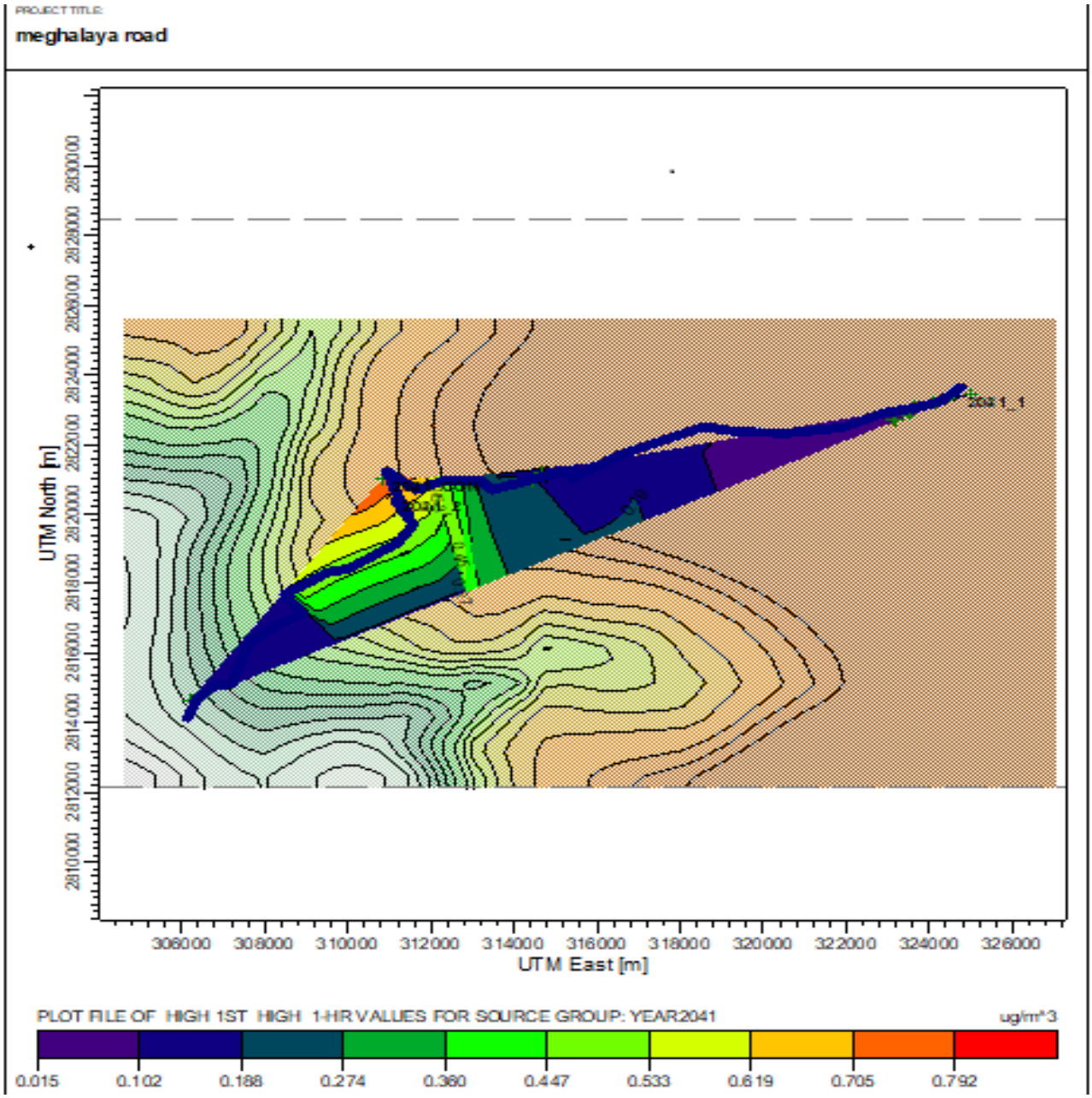


Figure 32 Predicted 1-hr Average PM10 Concentration due vehicular emission during Year 2041

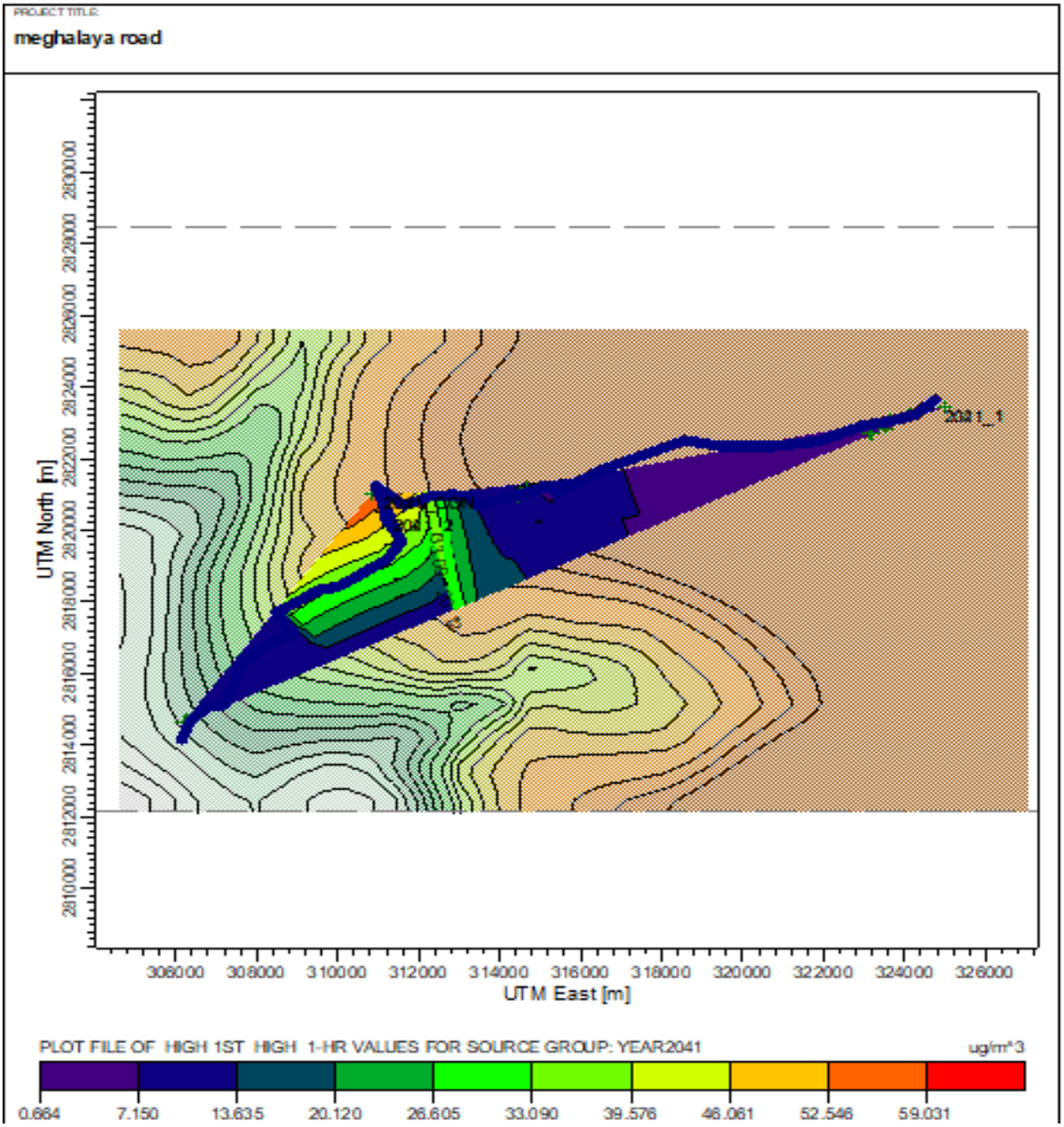


Figure 33: Predicted 1-hr Average NOx Concentration due vehicular emission during Year 2041

Mitigation Measures:

Implementation of stricter emission norms for the vehicles is the only mitigation measure that will have significant influence on the ambient air quality. In the year 2040, if 50% of the total vehicle turns into electric vehicle then the impact will be less. However, implementation of such norms for vehicles plying on the project road is beyond the control of the proponent.
Therefore, the proponent may take initiatives to raise the awareness of the road users.

Impact on Noise Quality

To assess the noise levels at the various sensitive receptor locations along the corridor during operation phase, the prediction of noise levels has been made for the horizon years 2021 and

2044, using the FHWA Transport Noise Model version 3.0. 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 tires -- primarily designed to carry nine or fewer people (passenger cars, vans) or cargo (vans, light trucks) – generally with gross vehicle weight less than 4,500 kg (9,900 lb);
- Medium trucks: all cargo vehicles with two axles and six tires -- generally with gross vehicle weight between 4,500 kg (9,900 lb) and 12,000 kg (26,400 lb);
- Heavy trucks: all cargo vehicles with three or more axles -- generally with gross vehicle weight more than 12,000 kg (26,400 lb);
- Buses: all vehicles designed to carry more than nine passengers; and
- Motorcycles: all vehicles with two or three tires and an open-air driver / passenger compartment

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

- Identification of various receivers,
- Assemble input parameters, and
- Application of the model.

Input Data used to run the model are as following:

- Traffic Volume - average hourly traffic volume and type data from traffic survey (Refer Chapter 3, Section 3.4). In noise propagation model vehicles are classified onto 5 categories namely: Automobile, Medium Trucks, Heavy Trucks, Buses, and Motorcycles.
- Background noise such as noise generated due to anthropogenic activities, industrial activities, movement/ operation of other noise generating sources, such as trains, aero planes, etc. was not considered in the model as background noise level at all sensitive receptors was not available.
- During the pre-project scenario (Year 2021), average speed was considered as 55 km/h and 40 km/h for buses and heavy vehicles during day time. Furthermore, for other vehicle categories same is considered as 60 km/h during day time. Though the design speed of the project road is 80 km/h, however as a conservative approach, post project speed for heavy vehicles is considered as 55 km/h during daytime, whereas for other vehicles same is considered as 80 km/h.
- The receptor site condition in terms of existing tree zone, barrier (boundary walls) is also incorporated
- The prediction of noise propagation has considered following three assessment years based on the traffic projections provided in the DPR.
- 1st Prediction- (Year 2021, i.e., current operation)
- **2n d Prediction- Year 2044**

In order to assess the impact on ambient noise during the operation phase comparisons are made between the baseline noise level and predicted noise level for the year 2021 and in year 2044. The outcome of the modelling exercise is presented below:

Receptor Name	Description of Receptor	Coordinates		Base Year Noise Level 2021	Predicted Noise Level in 2044	Remarks
		Easting	Northing			
CHC 1.950-1	Church	325015.18	2823450.29	57.0	61.8	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044 exceeds the limit i.e., 50dBA.
CHC 2.800-2	Church	324340.3	2823288.94	45.6	50.4	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB. The predicted noise level in 2021 is below the permissible limit and the noise level in 2044 slightly exceeds the limit i.e., 50dBA.
SCH 2.900-1	School	324237.26	2823244.18	36.7	41.5	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.
SCH 3.050-2	School	324132.99	2823190.22	38.4	43.2	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.
SCH 3.050-3	School	324104.84	2823208.07	37.2	42	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The

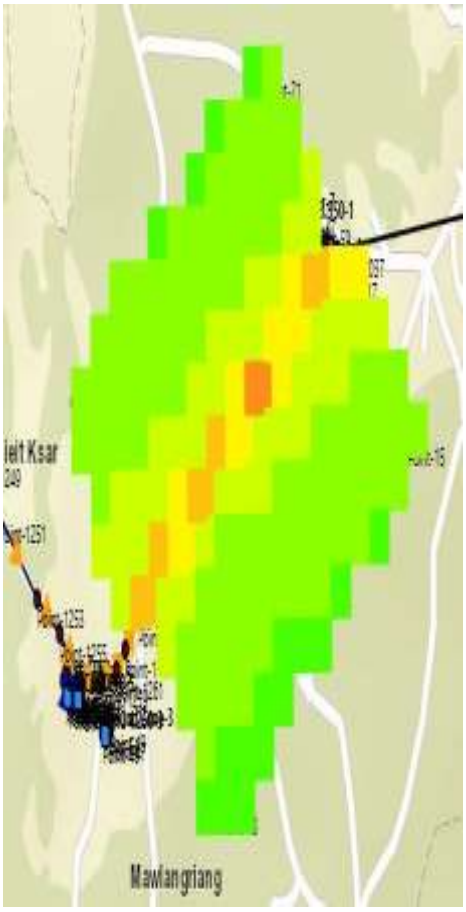
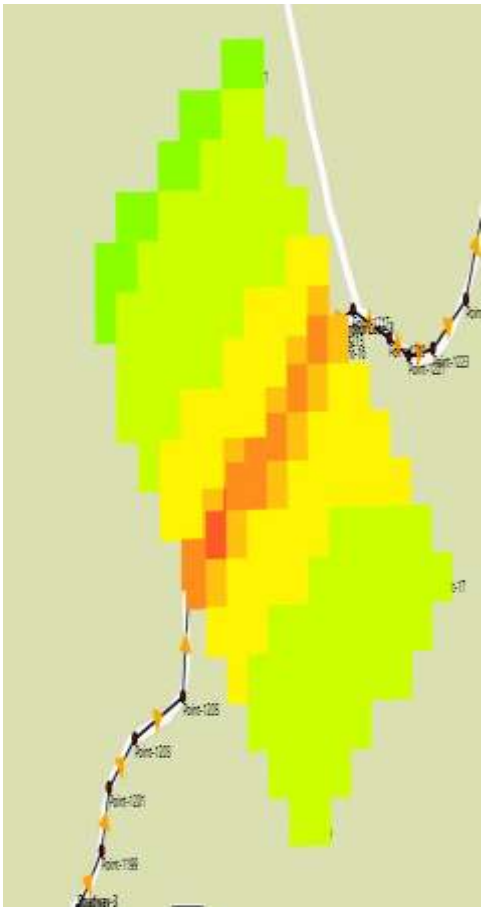
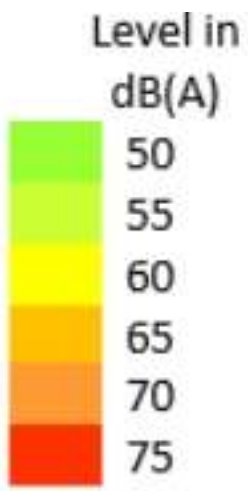
Receptor Name	Description of Receptor	Coordinates		Base Year Noise Level 2021	Predicted Noise Level in 2044	Remarks
		Easting	Northing			
						predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.
INS 3.550-1	Institute	323633.18	2823089.21	40.7	45.5	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e. 50dBA.
SCH 3.850-4	School	323520.78	2822840.73	38.5	43.3	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.
CHC 4.250-3	Church	323198.6	2822682.66	52.7	57.5	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044 exceeds the limit i.e. 50dBA.
SCH 4.250-5	School	323139.15	2822713.34	44	48.8	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e. 50dBA.
SCH 4.300-6	School	323116.07	2822714.62	41.3	46.2 *	The difference between the 2021 noise level and predicted noise level

Receptor Name	Description of Receptor	Coordinates		Base Year Noise Level 2021	Predicted Noise Level in 2044	Remarks
		Easting	Northing			
						in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.
CHC 14.850-4	Church	314655.31	2821203.39	47.1	51.8	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 is below the permissible limit and the noise level in 2044 exceeds the limit i.e., 50dBA.
GY 15.150-1	Graveyard	314465.56	2820939.66	58.5	63.3	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044 exceeds the limit i.e., 50dBA.
CHC 20.300-5	Church	310816.32	2821000.2	36.6	41.3	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.
SCH 34.050-7	School	306268.74	2814670	41.7	46.4	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.

Receptor Name	Description of Receptor	Coordinates		Base Year Noise Level 2021	Predicted Noise Level in 2044	Remarks
		Easting	Northing			
SCH 34.100-8	School	306245.75	2814632.16	58.1* * Above desired limits of Ambient Noise Standards for Silent Zones	62.8* * Above desired limits of Ambient Noise Standards for Silent Zones	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044 exceeds the limit i.e., 50dBA.
SCH 34.150-9	School	306224	2814617.31	43.4	48.1	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.
SCH 34.250-10	School	306184.22	2814637.54	42.8	47.5	The difference between the 2021 noise level and predicted noise level in 2044 is more than 3dB.The predicted noise level in 2021 and 2044, both are below the permissible limit i.e., 50dBA.

Noise levels (Leq) near maximum receivers are found to be lower than the desired levels for the respective categories, noise level exceeds the limit at a few locations. The maximum predicted value 63.3dB(A) in 2044, is recorded at the receiver located at chainage 15.150 km. It is evident from the above tables that there will be an increase in the noise levels due to increase in traffic intensity as well as average speed of vehicles over the road's design life.

The predicted noise level across the project road for the model years are also presented below:

		
Grid Noise Assessment along the Project Roads in 2021 (200 m each side)	**Grid Noise Assessment along the Project Roads in 2044 (200 m each side)**	

Noise level for the base year (2021) is mostly around 50 dB(A)except for a School where the noise level exceeds than those prescribed for Sensitive Receptors (. Also, during the year 2044, the ambient noise level near the road is predicted to bebelow 50 dB(A) except at the same chool.Thus, a noise barrier needs to be installed in this location to reduce the impact of noise in the sensitive zone. Althoughas per IFC definition of significant noise impact is expected since the difference is more than 3dB(A) but exigence of regulatory limit of the specified land use is not anticipated.

, the noise level is exceeding the statutory limit

Mitigation Measure

To reduce noise and vibrations, noise barriers in the form of compound wall is proposed. In case of space crunch, the use of concrete screens is also suggested. The noise barrier wall shall be constructed by excavation of foundation, laying of brick masonry wall up to a height of 2m aboveground, plastering and coping as per the direction of the engineer and as laid in the specification. Creepers and paints shall be used in consultation with the affected community to give an aesthetic look. Shade and flowering trees shall be planted within the boundary of the sensitive receptor, between the building line and the compound wall, wherever space shall be available, 5m centre to centre.

Themeasuresadoptedfornoiseattenuation isgivenbelow

- Plantationwithinthepremisesifspaceavailableforplantation
- Raisingof existingboundarywall/constructionof newwallupto2mheight
- Plantingcreeperstoprovideaestheticview

Inurbanareastheboundarywallcanbepaintedwithposterstoprovideaestheticviews.Theoption ofpostersorcreepersshallbeagreedbytheschool/hospitaladministrator.

Accidents Involving Hazardous Materials

Accidents involving hazardous chemicals will generally be catastrophic to the environment, though the probability of occurrence is low. Prevention of an accident involving hazardous material is a better way of minimising the impacts. The provisions mandated by 'The Hazardous Wastes (Management and Handling) rules, 1989' and “Manufacture Storage and import of Hazardous Chemicals Rules” 1989 under the Environmental (Protection) Act, 1986 will be complied with. Vehicles delivering hazardous substances will be printed with appropriate warning signs.

In case of spillage, the report to relevant departments will be made and instructions will be followed in taking up the contingency measures immediately.

Social Impact Assessment

Projects Impacts

The urban infrastructures project is associated with some adverse impacts as well as some benefits. The major impacts of the project include temporary loss of livelihood during the actual construction period due to inaccessibility to the commercial enterprise all along the project corridor and in Parking Areas. Socio Economic survey was done September, 2021. Due to the pandemic situation the Census Survey Started from 10th November to 20th December, 2021 is nearly completed and will be updated in the final DPR. The SES was done in September 2021 and also consultation was done from September to December 2021 which are completed for the present design phase.

Positive Impact

This sub-project aims to reduce traffic congestion within the Nongstoin-Maweit road. The storm water drain improves the existing system of rain water flow as most of the drain chokes due to silting. The new design will make easy cleaning/desilting of the storm water drain and thus prevent the overflow of water on the black top. The footpath over the drain and utility corridor will reduce accident.

- People residing at the Nongstoin-Maweit road can easily travel within the area. It will give a major fillip to the quest for all weather good roads for the PIA.
- Lower accident and provide quick accessibility to services like hospital, market, office etc.

Impact on Land

As discussed earlier also the scope of land acquisition is insignificant in the project area because most of the proposed sub-projects are well within the available existing RoW. The proposed construction of Parking areas is within the available Government land.

Impact on Structures

During the census survey the structures were also enumerated along the proposed developments. Based on the social survey data, a total of 27 structures belonging to private individuals non-title holders' nature, would be affected due to the construction/upgradation of which 20 are petty shops and 18 are vendors. The detailed of the structures are depicted

Table 60 Loss of Structure in the Sub-Project

Sl.	Type of Ownership	No. of Structures
1	Total Affected Families	42
2	Title Holders	
3	Non-Titleholders – Encroachers	5
4	Non-Titleholders – Squatters	37
5	BPL Families losing Commercial Properties	14
6	Total vulnerable families (including BPL)	42
7	Total Tribal Families	41
9	Petty shop keepers & Kiosk affected	42

Source: Census Survey, September 2021

Impact on Community Structures

The Details of all common Properties and Government structure are summarized in Table 59 below.

Table 61Loss of CPRs in the Sub-Project

Sl.	Summary of CPRs	Numbers
1	Religious structure (specify)	Nil
2	Well	Nil
3	Waiting Shed/Rain Shelter	1
4	Schools/Educational/ Cultural Structures	1
5	Government/ Community Structures	Nil

Source: Census Survey, September 2021

Displaced Families

Displaced family: means a family, who on account of acquisition or purchase of land needs to be relocated and resettled from the affected area to the resettlement area or elsewhere;

- **Titleholder:** A person who has legal rights of the land acquired/purchased by the project;
- **Encroacher:** A person/family, who transgresses into the public land (i.e., extended their building, agricultural lands, business premises or work places into public land), adjacent to his/her own land or other immovable assets and derives his/her additional source of shelter, livelihood, etc.;
- **Squatter:** A person/family who has settled on public/government land, land belonging to institutions, trust, etc. and or someone else's land without permission for residential, business and or other purposes or has been occupying public building without authority prior to the cut-off date and is depending for his or her shelter or livelihood and has no other source of shelter or livelihood;
- **Tenant:** A person who holds/occupies land/structure of another person and (but for a special contract) would be liable to pay rent for that land/structure. This arrangement includes the predecessor and successor-in-interest of the tenant but does not include mortgage of the rights of a landowner or a person to whom holding has been transferred; or an estate/holding has been let in farm for the recovery of an arrear of land revenue; or of a sum recoverable as such an arrear or a person who takes from Government a lease of unoccupied land for subletting it;
- **Family:** Includes a person, his or her spouse, minor children, minor brothers and minor sisters' dependent on him. Widows, divorcees, and women deserted by families shall be considered separate families;
- **Persons losing their livelihood:** Persons losing their livelihood are individual members of the PAFs/households, who are at least 18 years of age and are impacted by loss of primary occupation or source of income;
- **Business Owner:** Persons owning shops or running any commercial activities and/or within any commercial interest and above the age of 18 is considered as business owner.
- **Employees to Commercial Structures:** Persons being employed formal or informal, temporary or permanent to any commercial enterprise or entities in lieu of some remuneration/ salaries/ payments are considered as employees to commercial structures.
- **Petty shop/Kiosk:** It could be cubicle/booth/stall/cabin made of wood or iron or any other building material which could be shifted to another location as a single unit without much damage and is used for carrying out petty business, commercial activities and has been in operation/existence prior to cut off date;

Impacts on Affected Families

During the census survey in addition to structures belong to title holders, non-titleholders & Community/ Government. Based on the social survey data a total of 42 Families would be displaced due to the improvement of the project road within the proposed ROW has been identified. All the 42AFs are non-title holders would be affected. The details of the loss to the sub –project is depicted in the below table:

Table 62Impact of the PAFs in the Sub-Project

Sl.	Type of Ownership	No of Affected Household
1	Title Holder losing only Land	-
2	Owners losing structures	42
3	Tenant with formal document	-

Source: Census Survey, September 2021

Demography of Families

Socioeconomic survey was carried out for 42 sample families also enumerated in Censuswith 194 number of total populations. The sample was selected at the primary PIA such that there is proportional representation of the socio-economic parameters of the PIA. The sample survey data reveals that average family size of the sample family is (4.6).

Family Pattern

Socio-economic survey reveals that only 17% of the Surveyed Families are Joint in nature.

Table 63Family Pattern

Sl.	Family pattern	Numbers	Percentage
1	Joint	7	17%
2	Nuclear	35	83%
Total		42	100%

Source: Census & SES Survey, September 2021

Religious Stratification

Christianity is the predominant religion in the primary PIA followed by Other Religions. The detail presence of religion in the PIA is depicted in the Table below:

Table 64Religious Stratification

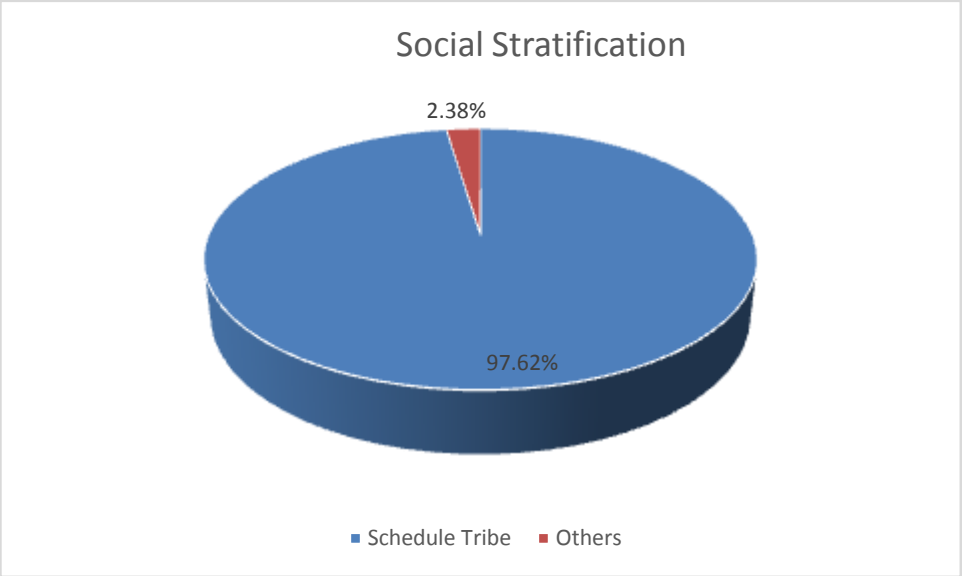
Sl.	Category	Percentage
1	Hindu	-
2	Muslims	-
3	Christian	97.62%
4	Sikh	-
5	Buddhist	-
6	Jain	-
7	Others	2.38%
8	Not Stated	-
Total		**100.00%**

Source: Census & SES Survey, September 2021

Social Stratification

The social stratification of the project area shows dominance of ST population with 97.62% families followed by General Caste families at 2.38%. The detail of social grouping in the project area is presented in the Figure below:

Figure 34 Categories of Surveyed Families along the Project Road

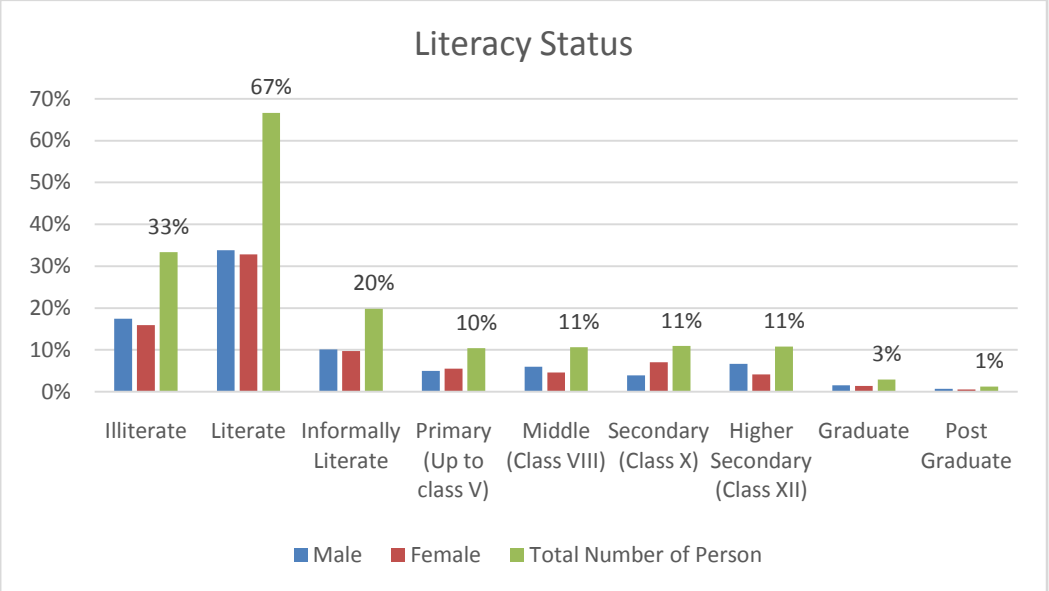


Source: Census & SES Survey, September 2021

Educational Status of PAPs

The educational status of the PAPs, above 6 years of age, reveals that overall scenario of literacy level is not very encouraging in the project area. Out of total 194 sample population the number of child population (0-6 yrs.) is 19 which are kept aside for this category. Only 33% of the population is still illiterate and about 3% PAPs are graduates; while very few have degree of master and above. The educational status is presented in the Figure below:

Figure 35 Educational Status of PAPs



Source: Census & SES Survey, September 2021

Occupation of PAPs

The occupational status of PAPs reveals that 16% Population are depending on business and this includes the business they are carrying out along the road, mainly shops and kiosks. About 48% Population are having agriculture as their source of income and 4% are engaged in

government jobs & private Jobs. The details of occupations by the PAPs are presented in the Table below.

Table 65Occupational Status of PAPs (18-60 Years)

Sl.	Type of Occupation	Percentage
1	Agriculture & Allied Activities	48%
2	Government & Private Services	4%
3	Trade & Business	16%
4	Self Employed	6%
5	Casual Labour	11%
6	Non-Remuneratively Engaged	15%
Total		100%

Source: Census & SES Survey, September 2021

The total number of persons is 194 and the number of persons within the active age group of 15 to 64 years is 131. Thus, the dependency ratio is about 35[6].

Income and Expenditure Profile of DFs

All the families surveyed have an average annual income more than Rs. 30000/. About 28% Surveyed Families are having average annual income in the range of Rs. 30000-50000, while 51% of the families are earning between Rs. 50000-100000. It has been observed that about 21% Surveyed Families have annual income more than Rs. 1,00,000. The average income level of DF in the project area is summarized in the Table below.

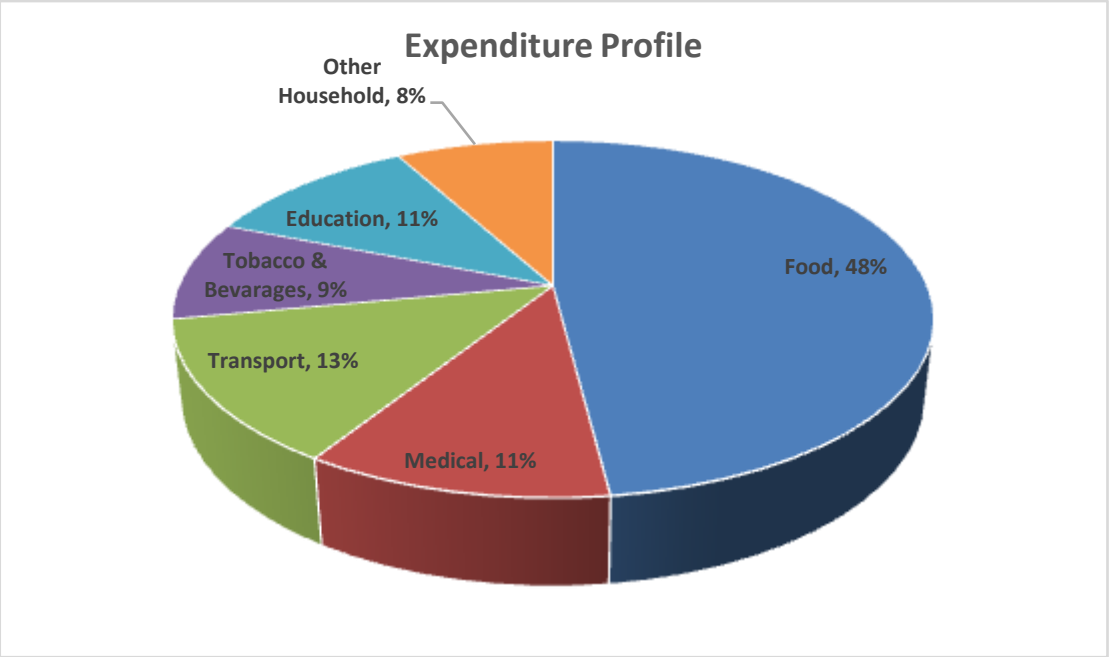
Table 66Annual Income Profile

Sl.	Annual Income Categories in (Rs)	% Age
1.	More than 30000 but less than or equal to 50000	29%
2.	More than 50000 but less than or equal to 100000	50%
3.	More than 100000	21%
Total		**100.00%**

Source: Census & SES Survey, September 2021

The expenditure pattern of the families surveyed revealed that about 48% of the average expenditure incurred by the Surveyed Families is on the food items. The detail of the same is presented in graphical format in Figure below.

Figure 36 Annual Expenditure Profile



Source: Census & SES Survey, September 2021

Holding of Agricultural Land (Immovable Assets)

About 21% of the population do not own any land. Only 12% of the population owes more than 0.5 acre of land. The detail of the land holding is depicted in the Table below.

Table 67Agricultural/Homestead Land Holding

Sl.	Land owned (area in Acres)	Numbers	Percentage
1	Less than 0.25	19	45%
2	0.25-0.5	15	35%
3	More than 0.5	4	10%
4	No land	4	10%
Total		42	100%

Source: Census & SES Survey, September 2021

Possession of Vehicle (Movable Asset)

Majority of the population (35%) have only two wheelers followed by four wheelers (28%) as mode of Family transport. The detail of the movable assets holding is depicted in the Table below.

Table 68Movable Assets Holdings

Sl.	Family assets	Numbers	Percentage
1	2-wheeler	11	26%
2	3-wheeler	-	
3	4-wheeler	12	29%
4	2-wheeler & 4-wheeler	6	14%
5	More than one 2-wheeler & 4-wheeler	2	5%
6	No Assets	11	26%
Total		42	100%

Source: Census & SES Survey, September 2021

Vulnerability

VulnerableFamiliesaredefined as, whoareeither:(i)belowpovertyline(BPL);or(ii)womenheadedhousehold(WHH);or(iii) differently able households(DAH);or(iv)elderly(60yearsandabove) living alone; or (v) scheduled tribes (ST); or (vi) scheduled caste (SC). It shall be noted here that though there are multiple categories of vulnerability groups exist in the project road, we have taken single impact of single vulnerable category for the authentication. For example, the number of BPL/DA/Aged Person/WHH mentioned in the below table does not include those who fall under SC and ST category to avoid the repetition of data and vice-versa. Vulnerability is defined on Census Survey data.

The census survey finding reveals that there is 97.82% surveyed population along the roadside who belong to the ST community and 0.04% belong to SC category & 1% families are Women headed household. The total vulnerable families in the PIA are about 98.86%.

Table 69Vulnerability Status of the Affected Families

Sl.	Category	%Age to total population
1	Schedule Tribe	97.62%
2	Schedule Caste	0.00%
3	Below Poverty Line (Excluding ST, SC)	2.38%
4	Women Headed Households	2.38%[7]
5	Senior Citizen living alone	0.00%
Total Vulnerable DFs		100.00%

Source: Census & SES Survey, September 2021

Impact on Gender

In Indian context, irrespective caste, creed, religion and social status, the overall status of women in lower than male and therefore a male child is preferred over a female child. According to 2001 Census in Meghalaya, the sex ratio was 972 females per 1000 male in 2001 but it has increased in 2011 with 989 females per 1000 male which is an indication of social development. However, the tribes of Meghalaya whosesocieties are organized on matrifocal principleshave obtained much greater gender equality than the societies (e.g. Hindu and Muslim) that are organized on the patriarchal principles.

The gender composition of surveyed persons shows that the male accounts for 51% and female accounts for 49%. The gender disparity is not so much visible in among surveyed persons i.e. 986 against state level statistic having 989 but as per census data of India, 2011. The sex ratio of West Khasi Hills district is 974 females per 1000 males in 2011. The illiterate among the female is slightly higher than of the male counterparts. There is One (1) of the Surveyed Families are Women Headed Households. From the SES survey the total Population is 194, of which 96 are males & 98 are females.

[7]Multiple Vulnerability. Both ST and WHH

Migration

The Decadal growth rate of the West Khasi Hills district and town clearly indicates influx of migrates from the nearby districts and villages. The SES reveals that about 2.38% of the population or One Family has immigrated in the urban in the last 25 years.

Impact on Tribal People

1. Impact on Land & Structure of ST

Most of structures impacted by the proposed project belong to the STs. Only one non-title holder family does not belong to ST which is commercial in nature.

Table 70Impact of ST DFs

Sl.	Type of Ownership	No of Affected Household Families	No. of Structures
1	Title Holder	-	-
2	Non-title holder	41	41
3	Tenants	-	-
4	Losing land only	-	-

Source: Census & SES Survey, September 2021

2. Impact on Socio Economic Profile of ST

The proposed sub-project can be viewed as boosting economic growth and poverty reduction, which will bring substantial social and economic development in the region. The ST Surveyed Families have income between Rs.50,000 to Rs. 1,00,000 annually.

3. Impact on Community

This sub-project has ensured that the designed and implementation will be in such away that it fosters full respect for ST identity, dignity, human rights, livelihood systems, and cultural uniqueness as they define them. There is only one school's boundary wall is impacted.However, there is no impact on the community structure or community land of cultural or religious sentiment of the ST Population in the Primary PIA.The proposed project willensure that STs receive culturally appropriate social and economic benefits, do not suffer adverse impacts as a result of projects, and can participate actively in projects that affect them.

There is no cultural heritage site of the ST which comes in the way of the road alignment. The proposed project will economically displace 41 ST families who mostly petty shop owners and/or vendors doing business on the roadside. The ST population among the Surveyed Families in the PIA are living in the towns and in the due course of time became the part of the main stream population. Presently the impacted ST population doesnot follow any customs that are attached to their land or natural habitat which will be impacted. Thus, there will be no cultural or social impact on the ST population.

4. Impact on Gender

As already pointed out that the tribes of Meghalaya whosesocieties are organized on matrifocal principleshave obtained much greater gender equality than the societies (e.g. Hindu and Muslim) that are organized on the patriarchal principles. Thus the impact Gender is not different from the general population. It was identified that social and economic benefits for affected STs which are culturally appropriate and gender and inter-generationally inclusive and develop measures to avoid, minimize, and/or mitigate adverse impacts on STs mainly the Gender. Suggestion of noise barrier, reduction of dust, providing employment of the female members as unskilled labourers during construction were the results of the focus group discussions.

Continuous meaningful focus group discussions with the ST women and affected STs communities and concerned STs organizations were carried out and will be carried on to solicit their participation (i) in designing, implementing, and monitoring measures to avoid adverse

impacts or, when avoidance is not possible, to minimize, mitigate, or compensate for such effects; and (ii) in tailoring project benefits for affected ST communities in a culturally appropriate manner.. Establish a culturally appropriate and gender inclusive grievance mechanism (detail at Section 9.6) to receive and facilitate resolution of the ST concerns.

Impact on Access to Services Amenities

- **Transport facility**

Transport facility is considered as the most basic of all civic amenities as this is the life line to access any kind of social services. Most of the clusters in the PIA have adequate road transport facility but it fails to cater its benefit due to bad condition of the road during winter and rainy season. Nongstoin-Maweit road is well connected with the rest of the state.

- **Solid Waste Dumping Facilities**

The PIA is congested with structures and roads and as it is situated on the hill slope, solid waste dumping is a very sensitive issue in the area. As per the SES it is revealed that more than 95% of the people dispose solid waste by the method of 'door to door' collection by local Authority in the urban area.

- **Source of Drinking Water**

The main source of drinking water in the PIA is river, streams and ponds (nearly 68%).

Table 71Source of Drinking Water

Sl.	Types of drinking Water Source	Numbers	Percentage
1	Tap Water by ULB	11	26%
2	Groundwater/surface water	31	74%
Total		42	100%

Source: Census & SES Survey, September 2021

- **Distance of Medical Facilities**

Medical facilities like government hospital and urban health centres (UHC) are not easily available within 5km for 26% of the population.

Table 72Distance of Medical Facilities

Sl.	Distance of Medical Facilities	Numbers	Percentage
1	Within 1km	2	5%
2	Within 2km	3	7%
3	Within 5km	26	62%
4	More than 5km	11	26%
Total		42	100%

Source: Census & SES Survey, September 2021

- **Other Services**

The proposed project will enhance the standard of living and/or quality of life of the residents of West Khasi Hills. During the construction there might some temporary restrictions in access which have to be taken care in the Resettlement Plan.

There is no permanent impact regarding the limited access to services or amenities are envisaged in the process of development of the proposed project.

Impacts on Road Safety and Human Health

The planning and designing of the project road is in accordance with the improved safety measures and better health conditions.

The chances of accidents could be minimized by (1) strengthening the pavements, (2) improving upon the curves in road geometrics, (3) grade separators (4) proposing the service lanes in market places and near schools, etc (5) improving upon road crossings (6) putting right signals and signboards and (8) generation of traffic awareness in the nearby schools and community centres.

Mitigation Measures:

The project is likely to bring some negative impacts on the environment and socio-economic structure of the region. While deciding the alignment from environment point of view, some negative potential impacts are unavoidable. In such cases, adoption of mitigation measures is the only solution. Mitigation should be focused on achieving goals within clear timeframes. Use of SMART approach is recommended to evaluate the likely effectiveness of alternative mitigation strategies or measures. The SMART refers to measures that are Specific, Measurable, Achievable, Realistic and Timely.

Table 73Potential impact and mitigation measure along the project road

Potential Impacts	Mitigation
Accidental spots can be reduced by providing proper signs and warnings, improvement of junctions, new under pass, fly-over etc.	• Proper provision of service roads, junctions, fly-over, under passes to be provided at appropriate places • Truck parking places • Medical facility to be provided (an ambulance fitted with all medical equipments and a doctor)
Sexually transmission diseases (STDs)	• Detected diseased person to be carried to the nearest city hospital • Preventive measures should be taken to check the spreading of STDs
Influx of Labour force from nearby states	• The project is not huge and can be easily completed with the local labour force. There might movement of labour from the neighboring districts within the state.

CHAPTER-VII: Climate Change Impact & Risk

A rapid increase in the number of motor vehicles on road in Meghalaya 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 and 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 emissions in the future and ease off the pressure of vehicles on the roads. This would require policy changes in the way lending is done by banks, enabling fuel mix with biofuels, and behavioural changes of the population whereby they use more and more non- motorized transport at short distances and public transport for long distances.

Climate Change Mitigation

The Transport Emissions Evaluation Model for Projects (TEEMP) developed by Clean Air Asia was utilized to assess the CO_2 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_2 emissions are:

- The road configuration will change from an intermediate lane to two lanes with a carriageway width of 7 m with 1.5 m hard shoulder on both sides. The road will have an asphalt concrete surface.
- 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.
- 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 74;Traffic Composition

Vehicle Type	Traffic Composition
2-Wheeler	0.6%
3-Wheeler	0%
PassengerCar+Mini LCV +Exempted Vehicles	6.1%
Mini Bus	0.2%
Standard Bus	0.2%
LCV	4.7%
2-Axle	74.8%
3-Axle	12.4%
MAV	0%
Tractors-With Trailer	0.9%
Tractors-WithoutTrailer	0%

Vehicle Type	Traffic Composition
TotalMT (Motorized Traffic)Traffic	**100.00%**
Bi-Cycle	0%
Cycle-Rickshaw	0%
Animal-Drawn	0%
Hand-Drawn	0%
TotalNMTTraffic (Non-motorized Traffic)	**0.00%**

Road capacity of 3,496 PCU/lane/day for was adopted for this project based on projection at the end of design year (2043). Emission factors were mostly taken from the CPCB/MOEF (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 presented in Table below. 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 intable below

Table 75;CO_2 Emission Factors

VehicleType	Petrol	Diesel	LPG/CNG
2-Wheel	1.37kg/l		
3-Wheel	2.12kg/l	2.58kg/l	3kg/l
Cars/bus	2.24kg/l	2.58kg/l	

- All 2-wheel vehicles are run onpetrol; average fuele conomy:50km/litres
- All3-wheelvehicles are run on diesel; average fuele conomy:30km/litres
- 50%of the cars/bus are run on petrol while the remaining are run by diesel; average fuel economy:15km/litres

For 45.000 km of road construction would result in emission of approximately 4635 tCO2eq. (Source: Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation - A Toolkit for Developing). This value if based on estimation of materials required to upgrade /construct of rural road which include cement, steel, gasoline, diesel, and bitumen etc.

Estimated carbon emissions:

Construction Phase

TheGHGemissionsduringaroadconstructionprojectinvolvethefollowingmajorsources:

12. Transportemissionsowingtotransportationofmanandmaterial
13. Materialemissionsowingtoextraction/productionofconstructionmaterials
14. Machinesemissionsowingto consumptionoffuelbyenginesusedin construction

A detailed study conducted for the World Bank titled “Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation- A Toolkit for Developing Countries” established the typical GHG emission rate in terms of ton CO_2eq per km of road construction. According to this study, for Rural Road-DBST, GHG emissions due to material production is based on estimation of materials required to upgrade /construct of rural road which include cement, steel, gasoline, diesel, and bitumen etc. are the main contributor.

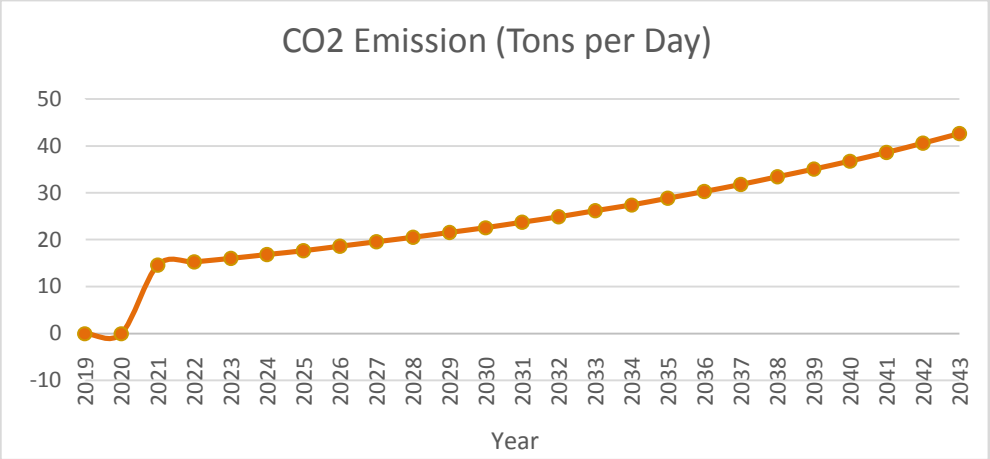
Type ofRoad	Transport emissions	Materiale missions	Machines emissions	Total (t $C0_2$ eq.)
Rural Road—DBST	26	62	14	103

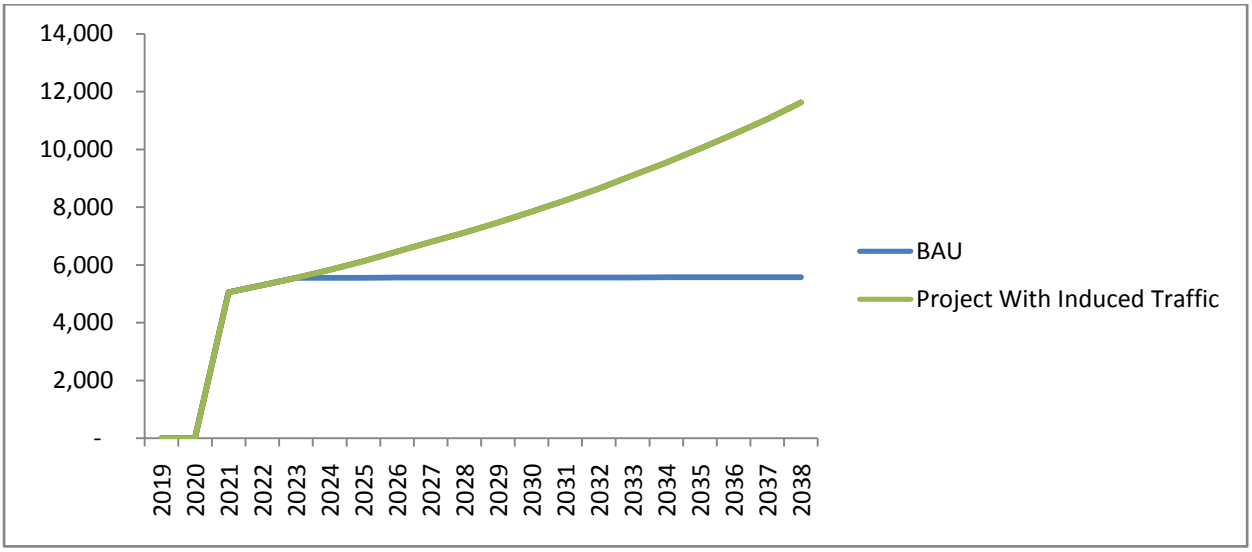
Source: Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation-A Toolkit for Developing Countries

Therefore, for 34.801 km of road construction would result in emission of approximately 3584.50 tonCO2eq.

Operation Phase

The design life of the project road is 20 years. Total annual emission for each year starting from the base year -2019(i.e. without the project) till year 2043 is presented in the figure below.





(Both without and with induced traffic), there will be an increase in the CO_2 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_2 emissions of the project road much below the threshold limit of 100,000 tons/year.

Climate Change Impacts & Risks

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_2) levels in the atmosphere have risen by 35% since the pre-industrial era. Rising CO_2 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.

Temperature & Precipitation:

Meghalaya is one of the important states located at north east of India. Usually four seasons are observed in this beautiful hilly state. As per the rainfall data from 1989 to 2021highest rain fall (31% of south west monsoon rainfall) is observed in month of July. Similarly, the state experiences30% of the south west monsoon rainfall in June. Also, in August and September, 23% and 17% of south west monsoon rainfall wasobserved in the State. Highest annual rainfall was5440.8 mm in the year 1995. Details of rainfall variation is given in the table below:

Table 76;Mean rainfall (mm) and coefficient of variation (CV) of the state for the monsoon months, southwest monsoon season and annual

	June	July	August	September	June-September (JJAS) rainfall	Annual
Mean	801.5	825.1	612.6	463.2	2702.4	3784.3
C V	33.0	40.2	40.4	46.2	24.9	21.5

Comparing[8] to Eastern part, Western part of this state, especially West Garo Hills and East Garo Hills, small increase of minimum temperature is observed and also, high increase around 1.2 degree centigrade in maximum temperature is noticed in Central part and West Khasi hills, South Garo hills and East Khasihills region. Maximum temperatures during summer and winter seasons are 25°C & 16°C, respectively. [9] Minimum temperatures during summer and winter seasons are 15°C & 4°C.

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**: All districts of the state of Meghalaya lie in Zone V. Centered across the state border in Assam, much of Meghalaya was severely jolted especially Shillong.
- **Drought**: The Average Annual Rainfall in Meghalaya is 2818 MM (source: rainwaterharvesting.org), whereas, Sohra or Cherrapunjee and Mawsynram in Meghalaya receive the highest rainfall in the world i.e. about 11000 mm annually, but this huge rainfall is concentrated only in monsoon months. 11, 667 sq km of the State drains into the Brahmaputra basin and the rest 10,650 sq km into the Barak Basin (Source: Central Water Commission). In less than 12 hours all the rainfall runoff water

[8]https://meghalaya.pscnotes.com/meghalaya-geography/climate-of-meghalaya/
[9]https://www.mapsofindia.com/meghalaya/geography.html

reaches the plains of Bangladesh and Assam taking along with-it top soil, boulders and logs besides creating flood-havoc in Bangladesh. In contrast during non-monsoon months, most of the rain-fed surface sources and spring sources get dried up, leading to water scarcity, which is a major problem as the people living in these areas with highly variable rainfall, experience droughts like situation and floods and often have insecure livelihoods. In many dire cases people do not even have regular access to water for drinking purposes.

- **Cyclone** Meghalaya is situated in the north eastern direction of Bangladesh which is highly prone to cyclone/ winds. Every year about 60% of the area is affected by cyclone in Bangladesh. The Districts of West Jaintia Hills and East Jaintia Hills may experience a wind speed of up to 55m/s. Occasional cyclones do occur in western Meghalaya, their severity being more during monsoon season. The districts close to Bangladesh like South West Garo Hills, South Garo Hills, South West Khasi Hills, West Khasi Hills, fall in very high cyclonic zone due to close proximity to Bay of Bengal (which is a cyclone basin). In this zone wind speed can reach up-to 50 m/s, which can cause large scale damages. The Bay of Bengal accounts for seven percent of the annual tropical cyclone activity worldwide; the recorded frequency of cyclones per year along the Bay of Bengal is four and inevitably one of the four transforms into a severe cyclone causing human and property losses
- **Flood**:

  The plain areas of Meghalaya adjoining Assam are affected by flood due to the back flow of water from the River Brahmaputra during the flood season between June and October. The tributaries like Krishnai, Jinari, Jingjiram, Rongai, Dudhnoi, Ringgi, Gohai, Dilni etc cause flood in the plain areas of the State.

  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.

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 below. It must

be noted that all these events either simultaneously or in isolation can generate severe disastrous impacts on road infrastructure.

Table 77;Possible Climate Events, Risks, and Adaptation Measures

Sl.	Climate Change Events	Risks to the Road Infrastructure	Adaptation Measures incorporated in Detailed Design of Project Roads
1	Extreme rainfall events	i. Overtopping and wash away ii. Increase of seepage and infiltration pass iii. Increase of hydrodynamic pressure of roads iv. Decreased cohesion of soil compaction v. Traffic hindrance and safety	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. 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. 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. d. In terms of floodwater conveyance to prevent stagnation, closed concrete drains in settlement pockets have been provided. 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. f. The bottom of the sub-grade has been kept 0.6m above HFL, to avoid over topping, water-logging of the road surface.
2	Changes in seasonal and annual average rainfall	i. Impact on soil moisture levels, affecting the structural integrity of roads, culverts, bridges standing water on the road base ii. Risk of floods from runoff, landslides, slope failures and damage to roads if changes occur in the precipitation pattern	
3	Increased maximum temperature and a higher number of consecutive hot days (heat waves)	i. Concerns regarding pavement integrity, e.g., softening, traffic-related rutting, cracking, fracture, etc. ii. Thermal expansion in bridge expansion joints and paved surfaces Temperature break soil cohesion and increase dust volume which caused health and traffic accidents	a. An adequate binding layer thickness has been proposed to offset the wear, surface fatigue, and rutting under climate stresses. b. In terms of pavement integrity, the choice of viscosity grade VG30 has been maintained.
4	Extreme wind speed under cyclonic conditions	i. The threat to the stability of bridge decks ii. Damage to signs, lighting fixtures and supports	Business As Usual

CHAPTER-VIII: PUBLIC CONSULTATION

Additional Studies has been carried out based on local consultation and discussion. The different additional studies carried out for the project comprising of R & R study, Safety study, SIA study etc. The study also covers all other aspects within this project location and makes a plan to reduce the issues based on consultation of local community, department and nodal officer's recommendations.

Local, Public & Other Stakeholders Consultation

These consultations were held at major settlement areas along the project to inform people about the objectives of the project. Such consultations provided a means to get the opinion of the people and their issues of concern. The focused group discussion and interview survey methods were adopted as tools for community level consultations. In each of the consultation, participants were encouraged to give their observations, suggestions and share experiences on various environmental and road safety issues and suitable mitigation.
Public involvement is one of the most important methods for the success of any project. It is useful for gathering environmental baseline data, understanding likely impacts, determining community and individual preferences, selecting the alternative and for designing sustainable mitigation and compensations plans.
The guiding principles include

- Dissemination of information: - The information regarding the proposed project should be disseminated to the project affected people directly and indirectly.
- Soliciting information: - The basic information regarding various environmental and socio-economic issues is solicited.
- Consultation: - The consultation involves engaging people in dialogue. There has to be a continuous dialogue between the components of the project and the public.

The public consultations are held at all the stages, namely, inception, screening, feasibility, and EIA preparation.

Outcomeof Consultations

Following are the key issues emerged during public consultations during field Study:

- The Local people were satisfied as there is no land acquisition for the proposed project.
- The shops and community structures near the end point are not impacted as the road ends 25m before the market.
- The proposed project should have adequate road safety measures including service roads, traffic signal etc. to minimize increasing road accidents.
- Adequate provision of drainage should be made for catering runoff from surrounding areas as well.
- Tree cutting should be minimized.
- Traffic noise is particularly disturbing for schools, residential complex, hospitals located near to project and appropriate mitigation measures are required.
- Appropriate pollution control measures are required during construction phase.
- Provision of noise barriers for sensitive noise receptors like school and colleges.
- Provision of bus stops with kiosk facilities and landscaping.
- Provision for adequate tree plantation should be made to compensate tree cutting.

Social Impact Assessment (SIA) And R&R

The Social Impact Assessment study of the project State Highway has been carried out as per terms of reference of PWD Meghalaya and guidelines given by the World Bank in accordance with the guidelines of the World Bank. Based on the identification, secondary baseline data were collected and then analyzed to predict the impacts and quantify them. A detailed Social Assessment has been carried out to identify nature and characteristics of losses to individuals and local communities because of the proposed project interventions. The report prepared which gives detailed impacts of the project. A census survey of Project-Affected Persons (PAPs) was carried out along with the land resource survey of the project area. To establish impacts on people and community and consultation with individuals, communities and other stakeholders were done. Based on the findings of this survey and consultation with project-affected persons and other stakeholders a social impact assessment report is prepared.

Introduction

Public consultations or community participation is an integral part and process of any project which involves resettlement or rehabilitation issues. It helps to incorporate valuable indigenous suggestions and perceptions of development. In the process, stakeholders get the opportunity to address issues, which are resolved after making appropriate changes in design and alternative finalization. The stakeholders become aware of the development schemes and at the same time influence and share the control over these initiatives, decisions and resources. Community consultations also help to avoid opposition to the project, which is otherwise likely to occur.

During the course of the social impact assessment, consultation meetings were held to inform the communities and population about the positive as well as negative impacts of the road improvement scheme. Public Consultations were held along the subproject with the displaced households, local persons who will be benefitted from the project and other stakeholders of the sub project. Focus group discussions were held with the youth's group, women's group, farmers, shopkeepers, tenants, interest groups and organisation. Key Informant Interview took place with the village head men, village council members, head of households and important personalities. There was special consultation with the individual women, vulnerable affected persons and tribal persons. These meetings were used to get wider public input from both the primary and secondary stakeholders.

Stakeholders Identification & Analysis

The stakeholders are all the people getting affected by the project or are responsible for the project, whether directly or indirectly. Primary stakeholders included those affected negatively or positively by the project, like the PAPs, project beneficiaries and project implementing agencies. This includes the affected families of residential structures, Commercial structures, affected shopkeepers, tenants, artisans and local communities. Secondary stakeholders included other individuals and groups, with an interest in the project, viz., the State Highway, National Highway users, Government Stakeholders (BDO, CMOs, ANMs, Teachers etc.) and the line departments.

Focus Group Discussion (FGD)

A focus group discussion is held involving local people to discuss the project. It is a form of qualitative research where questions are asked about their perceptions attitudes, beliefs, opinion or ideas. In focus group discussion participants are free to talk with other group members; unlike other research methods it encourages discussions with other participants. Keeping the present Covid-19 situation in view, it was advised by the Block Development

Officer to organize Public Consultation with less than 15 persons at any point of time. The group's composition and the group discussion should be carefully planned to create a non-intimidating environment, so that participants feel free to talk openly and give honest opinions on that particular project. Since participants are actively encouraged to not only express their own opinions, but also respond to other members and questions posed by the leader, focus groups offer a depth, nuance, and variety to the discussion that would not be available through surveys.

Additionally, as FGDs are structured and directed, but also expressive, they can yield a lot of information in a relatively short time. Therefore, FGDs are a good way to gather in-depth information about a community's thoughts and opinions on that specific project.

Need and Usefulness of Focus Group Discussion (FGD)

FGDs involve organized discussion with a selected group of individuals to gain information about their views and experiences on the project. It is particularly suited for obtaining several perspectives about the same topic. Therefore, FGDs help in gaining insights into people's shared understanding of everyday life and the ways in which individuals are influenced by others in a group situation. Moreover, the role of the moderator/convenor is very significant, as good levels of group leadership and interpersonal skill are required to moderate/convey a group successfully.

During FGD, free and open discussion among the respondents results in generation of new ideas that can be very useful for decision-making on that specific project. A focus group is not static. The moderator/convenor can bring any changes, remaining within the Scope of Work, in order to better facilitate the discussion during the group discussion. This dynamism allows better results in terms of information derived by a focus group. Expressions other than those in verbal form such as gestures and stimulated activities can provide researcher with useful insights on that particular project.

Objectives

The community participation programmes in social impact assessment ensured that information is disseminated to all the PAPs and other stakeholders in appropriate ways. The information dissemination has taken place in vernacular, giving details about the main project features and the entitlement framework.The Census/Survey Team carried out preliminary consultations through Focus Group Discussions (FGDs) and meetings with the PAPs as well as the general public in the project area. The local Panchayat leaders were informed through the PIU and the date and venue of the Public Consultation were fixed. Several informal FGDs were conducted primarily in settlements with problems of traffic congestion, dense informal/squatter settlement, close junctions and road intersections, and concentration of PAPs.

Level of Discussion

A detailed public consultation was organized with the potential project affected persons, people's representatives, shopkeepers, businessmen, and others regarding the project benefits and vis-à-vis estimated loss. The main point of discussions were minor realignments to save certain structures, compensation and assistance, road safety etc. It has been observed that the benefits of the proposed project area acknowledged by the local people but they want the Executing Agency to take care of the implementation of the project to bring about promised benefits with proper safety measures.

Due to the extreme Pandemic situation in the whole world, the PIA is not an exception. There is lockdown, social distancing and various conditions that are not conducive for Public Consultation. As per the guidelines only five persons could be called for Consultation at Panchayat Office thus those are the Public Representatives and the Public Consultation is

rather Key Informant Interview in Nature. Informal FGDs have been done at the villages, market place and other common places to gather and disseminate information about the proposed project.

Objectives of the Public Consultation

Stakeholder Engagement Plan (SEP) is an integral part of the project planning and design. The consultations are carried out to develop community /stakeholder's ownership and support for the project; integrate and address their concerns through suitable measures in the project design and implementation. The objectives of undertaking public consultations are listed below.

- Dissemination of information to build awareness among them
- To incorporate community concerns in the project designs for minimizing potential conflicts and resultant delays in implementation
- To document road safety related issues for developing possible mitigation measures
- To appraise gender issues and accordingly incorporate views of women into the project design
- Tounderstandspecificissuesrelatedtotribalpeopleandthoseofvulnerablesections
- Tofacilitatedevelopmentofappropriateandacceptableentitlementoptions
- To understand the priorities / concerns of the communities and the likely adverse and positive socio-economic impacts
- To create a sense of ownership of the project for its sustainability.

9. Methodology for Consultations

Both formal and informal modes of consultation were used in the public consultation process for the project. Consultation with the stakeholders, beneficiaries, and community leaders were carried out using standard structured questionnaires as well as unstructured questionnaires. In addition, focused ground discussions (FGDs) and personal discussions with officials, on-site discussion with project affected stakeholders, and reconnaissance visits have also been made to the project area. The attempts were made to encourage participation in the consultation process of the government officials from different departments that have relevance to the project. Same way, local people from different socio-economic backgrounds in the villages as well as urban areas along the road alignment and at detours, women, residents near the existing road, local commuters, and other concerned were also consulted.

- ## Stakeholder Consultations

Project Stakeholders

Stakeholder analysis typically classifies stakeholders or all those who have an interest in the project, into three categories:

1. Primary stakeholders are those who are directly or indirectly affected by a project, such as the project beneficiaries and the people who are likely to be adversely affected by a project.
2. Secondary stakeholders are those who are involved in the delivery of the project outputs, such as the government, the implementing agency, the executing agency (e.g., contractors, consultants), if any and NGOs, etc.
3. External stakeholders are those who are the ambit of the project activities, but who can influence the outcome of the project, such as the media, politicians, religious leaders and other opinion leaders.

Stakeholders and their level of interest may change as the project progresses, depending on the impacts associated with each stage of planning, construction and post-construction. Table 79 below provides a list of specific stakeholder's involvement and their level of impact and interest during project lifecycle.

Table 78Consultation Methods

Sl.	Categories of Stakeholders	Involvement of Stakeholders			Pre-Construction	
		Planning	Construction	Post Construction	Level of Impact	Level of Interest
1	Displaced Persons (TH & NTH)	Frequent	Occasional	On required basis	High	Low
2	Local Communities	Frequent	Occasional	On required basis	High	Low
3	Village Headmen & Gram Panchayat members (local elected representatives)	Frequent	Occasional	On required basis	High	Low
4	Women's belonging to various socio-economic groups	Frequent	Occasional	On required basis	High	Low
5	Other vulnerable groups	Frequent	Occasional	On required basis	High	Low
6	Local Elected Members	Occasional	On required basis	On required basis	Low	High
7	Concerned Officials from Government	Frequent	Occasional	On required basis	Low	High
8	NGOs and CBOs	Occasional	frequent	As and when required	Low	High

The different methods/tools that will be employed for stakeholder engagement to consult with each of the identified key stakeholder groups under the primary and secondary categories will be either one of the tools listed below or a combination of some of these depending on the category of stakeholders and the requirement of the project. The methods that will be used for obtaining the feedback of the different stakeholders are:

6. Face to face discussions with individual stakeholders
7. Public meetings/open house community forums like Gram Sabha, local health centres or the schools
8. Formal closed-door meetings with the elected representatives or government functionaries
9. Public notices through print in the form of flyers, posters, banners and public announcements**.**
10. Formal correspondence through telephone or email

Engaging in an appropriate way and communicating adequately is fundamental for a good relationship. Engagement methods have been tailored according to the needs and influence of the two categories of stakeholders. A summary of the proposed level of engagement with stakeholders has been presented in table below**.**

Table 79Consultation Methods

No.	Stakeholders	Dialogue Level	Issues for discussion	Frequency of Engagement	Form of Engagement
1	Landowner households	Proactive Information	Issues related to procurement of land on lease and resultant impacts like access, payment of lease rent, temporary employment opportunities	Monthly	Open Dialogue with the affected households

			etc.		
2	Agricultural laborers	Proactive Information	Issues related to livelihood and livelihood and training opportunities in the project and through other programs under CSR	Monthly	Open Dialogue with the affected persons
3	Women and Girls	Direct Contact and discussions	Issues related to GBV, safety, sanitation, and hygiene. Vocational training for women empowerment	Monthly	Open discussions with women and girls through the ANM and school authorities
4	Indigenous people (ST Community)	Contact through the Gram Pradhan	Common interest with that of the local community	Quarterly	Open Dialogue
5	Contractors and Sub-contractors	Regular Direct Contact	Issues of common Interest in the day-to-day functioning of the project.	weekly	Regular Direct Contact
6	Unskilled and semi-skilled local labour	Regular contact through the labour supplier	Issues related to employment opportunities and payments	monthly	Information dissemination and redressal of payments related complaints raised by the laboures.
7	Surrounding Community	Regular Direct Contact	Common Interest on social and environmental issues	Monthly	Community event and open dialogue
8	Gram Panchayat	Regular Direct Contact	Common Interest on employment, livelihood trainings, CSR activities, and social & environmental issues	Monthly	Information dissemination and suggestions and feedback.
9	Tehsil/District Officials	Occasional Direct Contact	Documentation of land deeds and local permits	As required	Formal meetings
10	Central and State Level authorities	Occasional Direct Contact	Permits and clearances	As required	Formal meetings
11	Local Political groups	Occasional Direct Contact	Common interest with that of the local community and administrative issues	As required	Information dissemination
12	NGOs and CBOs	Occasional Direct Contact	Common interest with that of the local community	As required	Information dissemination

Source: Socio-Economic Survey on 2021

4. 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 with regard to 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.

Table 80Brief Description of some Public Consultation

Date / Place	No of Participants	Major Issues	Agreed upon	Mitigation Measures - Input to technical Design
Place: Barishisha Marbaniang Date: 03/09/2021	Total-3 Male-3 Female-0	The town is basically a trading hub. The cultivators as well as the traders are concern of selling their agricultural and industrial output at proper price Though the town lacks in many infrastructural facilities, but they think that with better communication there would be economic development their prosperity. All other issues would be solved automatically. As this proposed road is the only communication to the outer world, they want the road to be completed within schedule time.	The road after constructed would have major impact on both the economic and social life of the locals of the area.	The road is expected to be completed by two years.
Place: Maweit, Date: 03/09/2021	Total-5 Male-3 Female-2	The livelihood loss of the people is apprehended. The local people want some jobs of unskilled labour and petty supplier to the Civil Contractor. The local were positive about development. As per the suggestions received through public consultation, the proposed project and its benefits is the only feasible option for development of the area.	The proposed road project is the only feasible option for development.	The people agreed to cooperate and help in all possible ways for the successful of the project. The PWD assure to provide jobs and petty contract as many as possible to the local people.
Place: Umthli, Date: 03/09/2021	Total-5 Male-4 Female-1	The existing alignment passes through the town area. It is also a junction town and many Goods vehicles passes through the town. There are both commercial and residential establishments along the alignment. As the proposed road will allure the motorist to drive fast there would be increase in road accident	Combined effort of the local authorities with the Government officials as well as the other stake holders would remove all the obstacles for development. Road Safety will be look after	The local authorities also assured that they would help in development of road project. Road safety awareness campaign should be made at schools. There would ample signage and other road furniture to reduce the accident.

Date / Place	No of Participants	Major Issues	Agreed upon	Mitigation Measures - Input to technical Design
Place: Nonglyer. Date: 01/09/2021	Total-5 Male-3 Female-2	A detailed public consultation was organized with the potential project affected persons, people's representatives, shopkeepers, businessmen, and others regarding the project benefits and vis-à-vis estimated loss. The most important topic of discussion was the alignment which passes through the two-market complex, which is fully affected. The residents with their representatives all disagree in demolishing of the market complex, partially or fully.	The local people had agreed in the view of the proposed road project which will bring some hope to the movement of the heavy vehicles and development of the area but against any damages to the market structures.	The PWD officials had agreed to take special care for traffic movement and road safety.
In addition to the above specific public consultations and FGDs the peoples were also consulted. In the villages the impact of social and economic are more. In all the 7 (seven) villages the access to the market would increase and based on this the valuation of land and properties would also increase.				

Table 81:Pictures of the Site

		Special attention is needed on the road crossings/intersections to avoid traffic snarls and accidents. Proper traffic signals and signboards should be present at strategic points not only for the sake of motorists but also for the pedestrians. Place: Barishisha Marbaniang Dated: 03/09/2021 .
Electrical line (high voltage) and OFC cable lying along the road is of great concern for the local people. However, since the electrical line is very much accessible to all hence it can be of very fatal especially during the monsoon. Place: Rimynniar Dated: 03/09/2021		
		Existing condition of the present road which needs immediate upgradation/restoration not only to allow smooth flow of traffic but also to minimize the count of road accident. Moreover, the affected stretches of road turn into nightmare during monsoon. Place: Maweit Dated: 03/09/2021

Upgradation of this earthen portion of the project road is proposed by the local people as this is their only motorable way throughout the year. Moreover, proper signboards/display should be given at U-turns to avoid accidents. Place:Nongpyndeng Maweit Road Dated:03/09/2021.		
		Squatters have been identified on different places on the project road that need to be vacated to upgrade/widen the project road. Place: Umthli Date: 03/09/2021
Renovation of bridge should be on top of the priority list as urged by the local commuters. Place:Nonglyer Dated: 03/09/2021.		

Note: Updated Stakeholders Consultation will be depicted in the Annexure.

Outcome of the Consultations

People were aware about the improvements proposed for the project road but were not aware about specific details of the PRoW, shift in centreline and the method of valuation for land and building, payment of compensation and other rehabilitation and resettlement measures. A detailed public consultation was organized with the potential project displaced persons, people's representatives, shopkeepers, businessmen, and others regarding the project benefits and vis-à-vis estimated loss. The main point of discussions were minor realignments to save certain structures, compensation and assistance, road safety etc. It has been observed that the

benefits of the proposed project area acknowledged by the local people but they want the Executing Agency, to take care of the implementation of the project to bring about promised benefits with proper safety measures.
The information and recommendations gathered from the various stakeholder consultations has been incorporated into the design of the project to ensure that the investments align with local priorities and development plans, and that they will deliver equitable socio-economic benefits to the intended project beneficiaries. The salient points of the consultations are summarised in the following table below

Table 82Summary of Consultation Outcome

Issues Discussed	Outcome
Relocation Options Compensations/Assistance	Displaced Persons whose residential structures are getting affected prefer not to get disturbed and if disturbance is not avoidable then they shall be relocated very nearby. Shop owners and workers raised the issue of loss of their livelihood during the resettlement period due to loss of business. During consultation they were convinced that there will be no permanent impact but temporary impact during the active construction period. There will be economic displacement of petty shop owners and vendors, all non-title holders who will be compensated and/or provided assistance as per the ESMF guidelines.
What are all the facilities provided through this project and to whom should we approach?	Facilities like bus shelters, rest rooms, pavements, drains etc would be provided. Officers such as PWRD Engineerscould be approached for grievances.
Safety due to alignment	People expressed their views on the risk if the road is widened at the dense settlement area affecting structures on both sides. The proposed project does not envisage any widening of the existing roads. Thus, there will be no damage to any structures beyond the existing RoW. About 42 families all non-title holders doing business with the existing RoW will be impacted. During consultation they were convinced that there will be no permanent impact but temporary impact during the active construction period.
Could you inform us the time when our assets be removed?	Would be informed well in advance and compensation will be paid before vacating assets, if required.
Relocation of school buildings Relocation of Bus shelter/CPR	The boundary wall of one school will be impacted which will be compensated. There were differences in opinions among the villagers in demolishing/ shifting the Bus shelter. It was agreed that bus shelter has been proposed in the DPR.
Cross Drainage for alignment	People have shown their concern for the proposed drainage pattern for the alignment of a portion of the project road. In this regard the lined rectangular drains with proper outfall shall be planned as a part of the project design of the main carriageway. Adequate cross drainage structures are planned after study of hydrology of the Survey area.
Utilities and basic infrastructures	People showed their concern about what will happen with the utility lines if the road is widened. Adequate care shall be taken for the shifting of the utilities.
Employment during construction	People were of demand if the local people are given preference for employment during the construction phase of the project. Such options shall be explored to the extent possible and mostly the unskilled worked can be hired from nearby locality.

Issues Discussed	Outcome
Why structures at places along the road were not measured?	If and only the structure to be impacted, measurements are required. Otherwise, there is no requirements of measurements of structures.
What about the loss of livelihood during active phase of construction?	The active phase of construction is planned in such a way that there will be minimum (temporary) loss of access and/or livelihood. If there is any inconvenience of access, loss or damage of structures ofany immovable assets the Civil Contractor will provide necessary access and compensation of the same will be provided as per the ESMF in discussion with the affected party.

Table 83Consultation Conducted on Proposed Road 2nd Phase

Sl.	Location	Date	Participants	Issue discussed
1	Sibsing Memorial School	28.01.20222	2 all Male	The main issue of discussion was the compensation/re-construction of the boundary wall outside the existing RoW.

Minutes of meeting with the DPR consultant

A meeting via video conference was held between ESIA Consultant and the DPR Consultant for discussion on Environmental and Social Impact Assesment on Nongstoin to Maweit Road.

Location: Office of CETEST Pvt. Ltd, Kolkata and CEG Tower, Jaipur vide Video Conference Mode

Date: 21.01.2022

Time: 4.00 pm

Attendees: Mr. Sukesh Gupta, Team Leader, CEG Ltd.
My. Shyam Sundar Khandelway, Asso. Director, CEG Ltd.
Mr. Anirban Nayak, Road Safety Specialist,CETesting
Mr. Supriya Deb, Highway Expert, CETesting
Mr. Swarnava Bandhopadhyay, Environmental Specialist, CETesting
Mr. Suman Sarkar, Social Specialist, CETesting

The proposals mentioned in Draft Project Report for Nongstoin to Maweit Road and their possible Environmental and social effects were discussed along with probable remedies. Following points were discussed in detail.

Table 84:Minutes of the meeting of ESIA and DPR consultant

Sl.	Topic	Details of Discussion	Decision
1	**Land Acquisition**	The ESIA consultants requested for the details of Land Acquisition being done on the project stretch. DPR Consultant informed that, no land is being acquired for this project stretch and the road is being designed to fit within available ROW as advised by the Client. All proposed structures are well within the existing RoW and thus no LA is required for this project.	DPR Consultant has assured that there is no proposal for Land Acquisition.

Sl.	Topic	Details of Discussion	Decision
2	**Demand for all weather road**	ESIA consultants wanted to know the condition of existing road and improvements planned in the design. DPR Consultant deliberated that the existing pavement condition along the road is poor. In some portions of the stretch, the existing pavement is damaged with cracks, ravelling, rutting edge breaking and potholes and in some stretches it is observed that the existing bituminous layer is fully damaged and exposed. The overall pavement condition needs to be improvised.	DPR Consultants clarified that pavement is being designed in compliance with IRC codal provisions along with climate resilient technology.
3	**Road safety**	ESIA Consultants asked about the convex mirror to be installed at turning points, sharp corners of the roads at a suitable height as they allow to see invisible but oncoming vehicles. Hence reducing the probability of road accidents. Proper signage and road furniture are to be integral part of the design.	The DPR consultants clarified that all the required safety measures including Rumble strips, Sign boards, Chevron boards, Road studs, Convex mirrors etc are being provided as per codal provisions so as to make the road safe to drive.
4	**Road safety at Night**	ESIA Consultants recommended for street lighting. Provision of street lighting is absolutely necessary as it not only act as a prevention of accidents but also an important source of public security intended to reduce crime. Studies have shown that darkness results in a large number of crashes and fatalities, especially those involving pedestrians; pedestrian fatalities are 3 to 6.75 times more likely in the dark than in daylight. Several decades ago, when automobile crashes were far more common, street lighting was found to reduce pedestrian crashes by approximately 50%. Road Furniture and Road Signage are to be introduced at all proper and suitable places.	DPR Consultants clarified that street lightings are proposed at built – up areas and other safety measures viz. Chevron sign boards, Road studs are proposed as safety measures at night.
5	**Storm Water Drain**	The Local People demanded storm water drain as much as possible throughout the alignment. At congested area it should also have cover and use as footpath.	DPR Consultants clarified that storm water drains are provided at all required locations. Trapezoidal drains are proposed at hill side locations. At built up areas cover drain cum footpath are already proposed considering the requirement of pedestrians.
6	**Bus Shelter and/or Rain Shed**	Bus Shelter and/or Rain Shed should be proposed at regular intervals.	Bus shelters are proposed in the DPR at all builtup locations where people are expected to use public transport.
7	**Other facilities**	There should be speed breakers in front of school, church and market place	Boundary wall are proposed to completely segregate the school from traffic. Road humps/Rumble

Sl.	Topic	Details of Discussion	Decision
			strips are proposed at cross roads of all junction. Hence safety is given prime consideration in the proposal.
8	**Utility Corridor**	There should be utility corridor at underground near the congested place	Utility corridor will be provided as per actual requirement.
9	**Public Transport**	There are very few public transports in the total alignment. The frequency of public transport should increase.	The matter belongs to Govt. of Meghalaya and ESIA consultants can recommend to increase public transport for betterment of people.
10	**Bridges**	Are there any new bridgesproposed in thealignment for not to disturb the natural flow of water?	Two minor bridges have been proposed for reconstruction. All natural streams have been provided with cross drainage structures viz. minor bridges and culverts. All culverts which are in distressed condition will be replaced
11	**Trees**	Are there any trees proposed in the alignment?	No trees will be cut

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 flooding, 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., Khasiwas shared with the local people as provided in **Annexure 5.**

Table 85Details of Public Consultation at Sibsing Memorial School on 2nd Phase

Date	Issues Discussed	Response	Participant
28.01.2022	During school hours, presence of children are seen, thus must plan the work schedule avoiding the entry and exit timing of the students. The boundary wall should be reconstructed. Maximum students are coming from the Maweit area which takes a lot of time for the children. Thus, this road development will absolutely benefit the students of the school. Noise must be monitored during school hours so that disturbance in class can be avoided	It was assured that the construction work will be stopped during the school hours. It was assured that the boundary wall will be reconstructed outside the RoW. The Contractor will be persuaded to induct the local people as per their skills.	Total = 2 Male = 2 Female = 0

Figure 37: Public Consultation at Sibsing Memorial School

Table 86:Details of Public Consultation at DFO, Nongstoin

Date	Issues Discussed	Response	Participant

Date	Issues Discussed	Response	Participant
28.01.2022	A joint survey is required to identify the way of the road during planning phase. During the implementation phase it is to be identified what trees are required to be felled under the forest sector area are to be surveyed and then finalized. For involving the forest officers, Project award with alignment along with KML file must be submitted to the DFO office from PWD department for receiving the clearance. No wildlife sanctuary is present in the area as the forests are mainly community forest and managed and maintained by local villagers. No forest is involved in the Town roads modification, only in the Nongstoin- Maweit road there are some forests but all are of private in nature. According to the meeting there are around 250 trees having DGH of around 15cm in where continuous 4 hectres are forest. There are no recorded forest found in the Nongstoin-Maweit road according to the last census available. As of wildlife availability, need to talk with Khasi hills Wildlife division, Social and Territorial section for more updates.	A framework has to be develop to address this issues. Alignment of the project road along with KML file will be submitted to DFO Office. Afforestation activity will be done along the project road as per the ratio of 1:10.	1

Figure 38 Public Consultation at DFO Office

CHAPTER-IX: RESETTLEMENT ACTION PLAN

The Resettlement Policy Framework (RPF) provides a guide the preparation of the Resettlement and Rehabilitation Action Plan (R&R Action Plan) depending upon the scale and severity of impacts that may arise, temporary or permanent land acquisition or resettlement and rehabilitation is inevitable. Thus, the objective of the RPF is to ensure that the Project Affected Persons (PAPs) get compensation for their loss, are offered resettlement measures, and are supported in improving or at least restoring their levels of living and income after the project impact to pre-project levels. The RPF is intended to safeguard the interests of the population impacted by the project, especially the poor and vulnerable. The RPF is based on applicable Policies of GoI, State government (herein Govt. of Meghalaya) and the World Bank.

As there is no scope of land acquisition, however there will be economical displacement of the non-title holder doing business within the existing RoW. As per the Census survey about 42 families were identified, mostly petty shop owners and vendors who will be economically impacted due to the proposed project. As per the guidelines of World Bank there will be an ARAP standalone document to be prepared at this stage.

The project is likely to have broadly three type of impacts that require mitigation measures. These are:

- Loss of immovable assets viz., land, house, commercial establishments, wells, pondsetc.
- Loss of livelihood or income opportunities viz, for agriculture labours, helping hands in commercial establishmentsetc.
- Impact on the community in terms of loss of common propertyresources.

The last two categories has been identified due to the proposed development.For the Second Category, the people likely to be affected will be surveyed and registered, and project monitoring and evaluation will compare long term impacts against baseline socio economic data.The third category represents a group impact, where gains and losses of a group-oriented nature arenotquantifiableintermsofimpactontheindividual.Mitigationandsupportmechanismwillbe collectively oriented, and the monitoring will focus on impact on suchgroups.

There is no Tribal PAFs will be required to be re-settled only there is economic resettlement. For tribal the following provisions will be adhered to:

- TheTribal would be eligible for the R&R benefits and in addition would be also eligible for one-time special Vulnerable Allowance.

Some Common Definitions

The following definitions are used in the documents:

Cut-off Date: Inthecasesoflandacquisitionaffectinglegaltitleholdersornon-titleholders, the cut- off date would be the date of issuing the publication of preliminary notification u/s11(I)of RFCTLAR Act, 2013.

Project Affected Person (PAP): Person who is affected in respect of his/her land including homestead land and structure thereon, trade and occupation due to construction of the project.

Project Displaced Person (PDP):A displaced person is a person who is compelled to change his/her place of residence and/or work place or place of business, due to the project.

Projected Affected Family(PAF): Familyincludesaperson,hisorherspouse,minorchildren,minor brothersandminorsister'sdependentonhim.Providedthatwidows,divorceesandwomen deserted by families shall be considered separate families. Additionally, an adult of either gender with or without spouse or children or dependents shall be considered as a separate family for the purpose of this Act.

Encroacher: A person who has trespassed Government/ private/community Land, adjacent to his or her land or asset to which he/she is not entitled and who derives his/her livelihood and housing there from prior to the cut-off date.

Squatter: A squatter is a person who has settled on publicly owned land for housing or livelihood without permission or who has been occupying publicly owned building without authority prior to the cut-off date.

Below Poverty Line (BPL): A household, whose annual income from all sources is less than the designedsumasfixedbytheplanningcommissionofIndia,willbeconsideredtobebelowpoverty line (BPL).

Vulnerable Person: Those people falling under BPL line category/ vulnerable community as defined by the central government. The Vulnerable group may include but not be limited to the following:

- Member of Scheduled caste/tribe community/other backward community.
- Women Headed households.
- Senior citizen-person above the age of 60years.
- Landless
- Village artisan

Process for RAP Preparation

The project roads include rural roads, major district roads and state highways. Different measures will be followed for different categories of road as explained below:

RPF for the Project Road

For rural roads, the existing PMGSY guidelines will be followed. The project will ensure that there is no relocation due to rural roads. The alignment will be finalized in consultation with the community.

Table 87Entitlement Matrix for PAPs/ PAFs

Sl.	Application	Definition of Entitled Unit	Entitlement	Details
A. Loss of Residential/ Commercial Structures to Non-Titled Holders				
1	Structures on Government land	Owners of Structures or Occupants of structures identified as per Project Census Survey	Resettlement & Rehabilitation Assistance	• Non-titleholder shall be given three months' notice to vacate occupied land and provided with cash assistance at replacement cost for loss of structures as described in section 29 of the RFCTLARR Act2013. • Allsquatters(otherthankiosks)willbeeligibleforone-timegrantofrupees thirty-six thousand as subsistence allowance as per section 29 of the RFCTLARR Act 2013.
B. Loss of Livelihood				
2	Families living within the project area	Title Holders/ Non-Title holders/ sharecroppers, Agricultural labourers and employees	Resettlement & Rehabilitation Assistance	Subsistence allowance of rupees thirty-six thousand as one-timegrant. Training Assistance of rupees ten thousand for income generation perfamily.Temporaryemploymentinthe project construction work to project affected persons with particular attention to vulnerable groups by theprojectcontractor during construction, to the extent possible and preference in the employment of semi-skilled and unskilled jobs in the project with adequate training for the job/ orOne time payment of five lakhs rupees per affectedfamily
C. Additional Support to Vulnerable Families				
3	Families within project area	As per definition of vulnerable	Resettlement & Rehabilitation Assistance	One-time additional financial assistance of rupees fifty thousand.
D. Loss of Community Infrastructure/Common Property Resources				
4	Structures & other resources (e.g. land, water, access to structures etc.) within the project area	Affected communities and groups	Reconstruction of community structure and common property resources	Reconstruction of community structure and Common property resources in consultation with the community.

Sl.	Application	Definition of Entitled Unit	Entitlement	Details
E. Temporary Impact During Construction				
5	Land & assets temporarily impacted during construction	Owners of land & Assets	Compensation for temporary impact during construction e.g., damage to adjacent parcel of land / assets due to movement of vehicles for transportation of equipment's, machinery and construction activities for infrastructure development.	Compensation to be paid by the contractor for loss of assets, crops and any other damage as per prior agreement between the 'Contractor' and the 'Affected Party'.

- **Tribal People's Development Plan**

The Tribal People in India are categorized as indigenous community who often become vulnerable indevelopmentprojectsbecauseoftheirculturalautonomy,economicstatus,andenduringspecific disadvantages in terms of social indicators of quality of life, thus usually as subject of social exclusion. Because tribal communities live within varying and changing historical, cultural, political and economic contexts, no precise and coherent term has been found to define them. Under OP 4.10, the determination as to whether a group is to be defined as indigenous peoples is made by reference to the presence (in varying degrees) of four identifyingcharacteristics:

There is no impact on the community structure or community land of cultural or religious sentiment of the ST Population in the Primary PIA. The proposed project will ensure that STs receive culturally appropriate social and economic benefits, do not suffer adverse impacts as a result of projects, and can participate actively in projects that affect them.There is no cultural heritage site of the ST which comes in the way of the road alignment. The 41 ST population among the Surveyed Families inthe PIA are living in the towns and intheduecourseoftimebecamethepartofthemainstreampopulation.PresentlytheimpactedSTpopulationdoesnotfollowanycustomsthatareattachedtotheirlandornaturalhabitatwhichwillbeimpacted. Thus,therewillbenoculturalorsocialimpactontheSTpopulation.The ST population that will compensated as per ESMF.

- **Gender Issues among Tribes**

The tribal women in Meghalaya play an important role in the community and family development. Women normally constitutehalf of the total population. These women mostly work as agricultural labourers and share equal burden with men. Meghalaya being the state with matriarchal society, women are empowered but not necessarily well educated about human and tribal rights.Thus, there no specific requirement to create an institutional framework to make gender sensitive decisions. Women consulted within project associated villages and together identify awareness programs on "women's role in development and maintenance of public assets".

The tribes of Meghalaya whosesocieties are organized on matrifocal principleshave obtained much greater gender equality than the societies (e.g. Hindu and Muslim) that are organized on the patriarchal principles. answered, "Securing equal treatment for men and women in the workplace."

A culturally appropriate and gender-sensitive assessment was carried out for social impacts to assess the potential project impacts, both positive and adverse, on gender issues. It was identified that social and economic benefits for the town dwellers which are culturally appropriate, gender and inter-generationally inclusive and develop measures to avoid, minimize, and/or mitigate adverse impacts on Gender. Suggestion of noise barrier, reduction of dust, providing employment of the female members as unskilled labourers during construction were the results of the focus group discussionsMonitoring Gender Action Plan

The indicators, frequency, and agency recommended for monitoring are presented in the table below.

Table 88Monitoring Indicators for Gender Action Plan

Aspects	Monitoring Indicators (Process and Outcome)	Frequency	Monitoring Responsibility
Economic	• No. of women engaged in different activities and their proportion to the total workforce; • Days of engagement of women in different wage / non-wage activities and proportional days of engagement in comparison to their male counterpart; • Growth in income of women due to such engagements; • Reduction in no. of days of migration (if migrating earlier); • No. of women having additional/new market oriented employable skills for self-engagement; • No. of women accessed differentgovt. schemes/provisions including beneficial enrolment in agricultural interventions;**Im**provement in asset holdingof women (productive and household assets)**.**	• Planning Stage: for the base line data • Half yearly Monitoring • Mid Term Review (MTR)Final Impact Assessment	PMU Third party Monitor along with PMU
Social	Improvement of association of women in local institutional and decision-making process (membership, management position, etc.);	• Planning Stage: for the base line data • Half yearly Monitoring • Mid Term Review (MTR)Final Impact Assessment	PMU Third party Monitor along with PMU

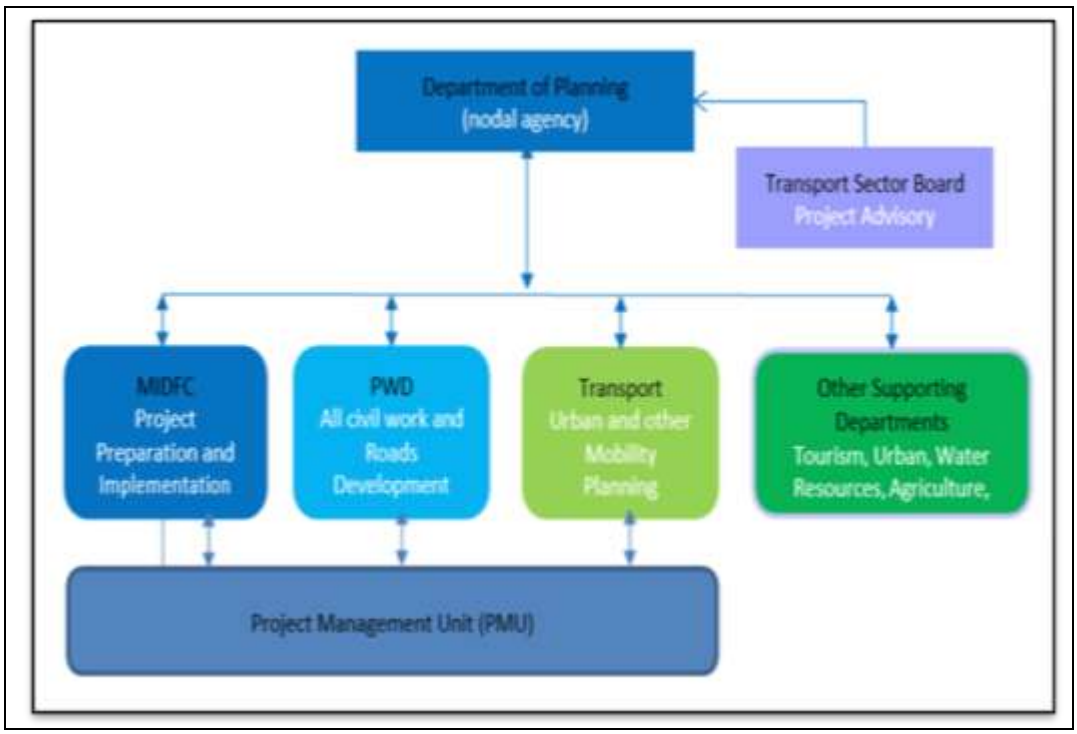
- **Implementation Arrangements**

The preparation, implementation, and monitoring of the Gender Action Plan (GAP) is the responsibility of the project implementing entities. The Social Development specialist, at the PMU level, will facilitate and supervise this process of preparation and implementation of the Action Plan. All efforts will be made to coordinate and work with associated line departments and other department, more specifically the Women and Child Development department, State Livelihood Missionand Rural Development department to help dovetailing with their development programs for the socio-economic development of women.

- **Implementation of ESMP and RAP**

The project activities will be implemented by many agencies: Public Works Department (PWD)and Community and Rural Development Department. Each of the mentioned departments, will depute a Project Director (PD) preferably at the level of a Chief Engineer/Superintending Engineer along with the required supporting staff with the overall responsibility for project implementation with the involvement of the various field divisions and other units at the head-quarters (HQ – Shillong).
PDswillworkundertheoverallguidanceandoversightofaProjectAdvisoryCommitteeheadedby the Secretary of the respective departments.
Meghalaya Infrastructure Finance Development Corporation (MIFDC) set up under the Planning Department will be responsible for overall planning, coordination, implementation and monitoring of the project along with various departments. It will also be responsible for mobilizing private sector finance for the development works. It will ensure that ESIA is conducted and ESMPs are prepared and that the ESMF is followed during project implementation. Additionally, a project management unit (PMU) will be mobilized under MIDFC to support the implementing agencies during project preparation and subsequent implementation. The overall institutional arrangement for the implementation of the project is outlined in the following diagram.

Figure 39 Project Implementation Arrangement



- **Project Management Unit (PMU)**

The Project Management Unit (PMU) will engage a consulting firm, as Project Management Consultant (PMC) for providing technical support to the project and facilitate implementation of project framed activities. The experts of the PMC will assist MIDFC in preparing and updating ESIA (including E&SMPs). The PMC will also assist MIDFC in preparing semi-annual safe guards monitoring reports. Specific roles of the PMC with regard to ESMF implementation would include the followings.

Preparatory Stage:

- Initial field visit to project sites and assessment of environmental and social aspects of project activities;
- Discussion with different stakeholders, including implementing agencies on safeguard measures and their expected role;
- Preparing / finalizing assessment framework in line with the Environment and Social indicators;
- Finalizing TOR of the contractors incorporating safeguard measures to be taken;
- Facilitate / organize training / workshops on safeguard measures for the stakeholders;
- Designing study / assessment tools for periodic assessment, its piloting and finalization.

Implementation Stage:

- Conductingperiodicsitevisitsandobservethemeasurestakenasperthesafeguardnorms;
- On the spot guidance to contractor/s / implementing agencies on safeguards;
- Preparation of site-specific reports and sharing with MIDFC;
- Documentation of learning cases for sharing and dissemination;
- Visual documentation of site-specific safeguard measures;
- Tracking activity specific environmental and social monitoring indicators;
- Organizing / facilitating refresher training courses for stakeholders;
- Monthly and quarterly progress report preparation and submission to MIDFC.

Post-Implementation Stage:

- Consolidation of periodic monitoring reports;
- Support in conducting environment and social audit;
- Consolidation of good practice documents and its submission to MIDFC;
- Final sharing workshop on environment and social safeguard practices and its outcome.

The PMU shall have following experts for implementation of ESMF and E&SMPs: Social cum Gender Expert

The Social cum Gender Expert at the PMU level will guide the overall process related to social and gender aspects. The district/sub-district level implementing agencies will execute and monitor the social / gender components in consultation with the said Expert. She / he will be associated in the screening process of such activities that require acquisition of land and/or involvement of women and/or need special focus on tribal involvement. She/he will monitor the social processes followed in execution of the planned activities and realisation of the social / gender inclusion parameters. She / he will be looking after social / gender aspects of the project, including monitoring of social / gender indicators and coordinating with different agencies / institutions. The expert will be guided by the Project Director from MIDFC and reporting to the Project Director directly.

Environmental Expert

Theenvironmentexpertwilllookafterenvironmentalaspects.She/hewillguidetheprojectteam onenvironmentalaspectsandsupportinbuildingenvironmentalparameterstobebuiltinthebids. She / he will also guide the contracts and monitor their works from time to time. In case of

requirement, she/he will prepare a detail environment management plan for different activities to be executed by the project. The expert will be guided by the MIDFC Project Director and reporting to the Project Director directly.

- **Capacity Building Strategy**

The concerned officials within the project implementation agencies will be oriented on different social and environment aspects by which they will be equipped well to manage the related issues effectively and efficiently.

- **Institutional Capacity to Manage Social Development Aspects**

Autonomous District Councils

As mentioned earlier, ADCs were established under the Sixth Schedule of the Constitution of India (Articles 244(2) and 275(1)) with a view to preserve and protect tribal institutions. It is a system of local administration to give greater autonomy to tribal societies, to preserve and safeguard tribal groups'traditionalpracticeandtoactasaconduitbetweentheformalstategovernmentandthe informal grassroots tribal institutions.

The Project lies within the Khasi Hills Autonomous District Councils. TheADCwith the village councils or looks after the administration of the Council areas.

Grassroots Institutions

The third centre of authority is the grassroots tribal institutions and practices. In the Khasi and Jaintia Hills, these are powers that rest at the village level's elected members to govern the village.

- **Grievance Redressal Committee (GRC)**

- **Grievance Redress Mechanism**

Effective grievance redressal mechanism gives an opportunity to the organization to implement a set of specific measures to ensure good governance accountability and transparency in managing andmitigationofenvironmentalandsocialissueofaparticularproject.Thisconsistsofdefiningthe process for recording/receiving complaints and their redressal in respect of environmental and socialmatters.

An integrated system will be established with Grievance Redressal Cell (GRCs), with necessary officers, officials and systems at MIDFC. Grievances, if any, may be submitted through various mediums, including in person, in written form to a noted address, e-mail, or through direct calls to concerned official/s. The Social and Environmental Expert within PMU shall be responsible for coordination of grievance/complaints received.

Thegrievanceredressmechanismshouldbeinplaceatthetimeofinitiatingtheimplementationof ARAP &RAPandcivilconstructionactivitiesintheprojectarea.Aplatformforgrievanceredressalshould be organized and its regular meetings may be conducted so as to allow people to put forth their grievances. It will help the appropriate authority to find solutions and amicably address the issues. Theproject,apartfromweb-basedmechanism,willhavethree-tiregrievanceredressalmechanism, i.e., (1) at the project site level, (2) State level (PMU level) and (3) Judiciarylevel.

Web based grievance mechanism[11]: In case of grievances received through toll free number or web-based system, a person should be made in-charge of screening and resolution of the same/communicatingwiththeconcerneddivisionsforresolutionofthesame.Thepersonin-charge based on nature of complaint, should forward the same to the concerned official. A ticket or a unique number will be generated for all such complaints. The complainant should follow up based on that unique number. All calls and messages should be responded within 15 days. If response is not received within 15 days, the complaint should be escalated to the ProjectDirector.

Tier I: Under this project, the local VECs and community level organizations will serve as the first- tiermechanismtohandlecomplaintsandgrievances.ThelocalHeadmanwillbethefocalpointwho will receive, address, and keep record of the complaints and feedbacks. The grievance focal point willfirstreviewthegrievancessubmitted.Ifgrievancesordisputescannotbesolvedattheir level within 30 days of the submission of the grievances, the issue will be brought to PMU level for mediation. PMU is expected to inform aggrieved persons or parties to disputes of the resolution in 30 days.

Tier II: If the aggrieved person is not satisfied with the verdict of site level grievance cell, he or she can escalate the grievance to state level grievance cell. The tier II cell will be under the ChairmanshipofSecretary,DepartmentofPlanning.TheothermemberswillincludeChiefEngineer; Project Director and Social Expert of the Project. The second level of grievance cell will provide its view within 30 days of receiving thegrievance.

TierIII:Theaggrievedpersonifnotsatisfiedwiththeverdictgivenby Statelevelgrievancecell,will have the right to approach the Judiciary. Project will help the aggrieved person in all respect if person wants to approach the judiciary. This would include the District Commissioner and Legal courts. If the issue cannot be addressed or is outside the purview of the GRC, then it may be taken by the Office of the District Commissioner or a Legal Court.

- **Grievance management through Electronic Mode**

A simplified mobile based technology feedback system can be used at community level to capture and feed data into the Management Information System of the PMU. A toll-free Helpline number will also be established to make the mechanism widely accessible and gender friendly.

- **Grievance Redressal Mechanism**

There Grievance Redressal Committee (GRC) at the PMU level is in process of formation. Consultation for the formation of GRC for this project at city/ward level is currently being undertaken. Before the start of civil contractor appointment, the GRC at project level will be formed with consultation with the PAPs and Beneficiaries so that the grievances are resolved at the project site only. There should be a Women Cell at the PMU. The contractor and the other stakeholder's office will display the Vishaka Guidelines at their Notice board. The Women helpline Number should be displayed in the Bus Stand, Ticket Counter, all commercial vehicles and any other place as required.

Table 89Details of contact for Grievances

Description	Contact details
Company:	PWD, Meghalaya
To:	Chief Engineer-cum-Project Director
Address:	HV9P+GFJ, Lachumiere, Shillong, Meghalaya 793001
E-mail:	cenhpwd@gmail.com
Website:	http://megpwd.gov.in/contacts.html
Telephone:	Tel: 0364-2224561
Fax:	-

- **Disclosure of Project Information**

In order to make the ARAP implementation process transparent, salient features of ARAP shall be translated in Hindi and disclosed on the Project Authority's website. The documents available in the public domain will include ARAP (summary in Hindi) and the list of affected persons eligible for compensation and R&R assistance. Copy of all documents will be kept in PMU for ready reference. As per Access to Information Policy of the World Bank, all safeguard documents will also be disclosed and available at the World Bank's Portal.

CHAPTER-X: MONITORING & EVALUATION

The M&E framework of ESMF is designed to assess the progress and achievements against the said management plans – both Environment and Social as well as other plans such as R&R, TPP, and GAP. By providing a feedback loop, the M&E plans enable decision makers to take up mid-course corrections if required. The M&E framework is designed to measure the impacts that have taken place, ensure compliance with the legal obligations, evaluate the performance of the mitigation measures applied, and suggest improvements in management plans, if so required.
The M&E is to be undertaken at two levels:

- Monitoring and Evaluation of the ESMF application: i.e. the application and effectiveness of ESMF elements including screening, assessment, formulation and implementation of the ESMPs, monitoring, capacity building and institutional arrangements;and
- Monitoring and Evaluation of E&S management plans at each project site: i.e. to monitor the effectiveness of implementation of the identified mitigation measures, the environmental quality parameters and social management plans relevant to each projectactivity.

M&E of the ESMP application

The PMU's Social cum Gender Expert and Environment Expert will undertake ongoing monitoring of the ESMF implementation in order to identify issues, good practices and required actions. Reports based on the monitoring will be prepared by the PMU at least every quarter and submitted to the Project Director. The reports will be shared with the other implementing agencies. The monitoring of the ESMF implementation will cover the following aspects:
Screening of project activities:

- Hasthecategorizationoftheprojectactivitiesbeendoneaccuratelyandorchanged(Ato B)?
- Has the Environmental and Social Screening Checklist been used in all applicableactivities?
- Has the scoping for further assessment been done comprehensively for all applicable activities?

Monitoring of E&S aspects in project activities:

- Arethecontractorsandimplementingagenciesundertakingperiodicandregularmonitoring of the E&S implementation in the projectactivities?

Capacity building arrangements for management of E&S aspects:

- What training programs on E&S aspects have been organized for the staff of implement agencies?
- What training programs on E&S aspects have been organized for thecontractors?

M&E of E&S Management Plans

Monitoring and evaluation of the project is significant for achieving the project development objective (PDO) within the stipulated time period. The key environmental and social aspects,

those that have been highlighted in each E&SMPs at site level are to be monitored periodically. The approved E&SMPs will give the direction and indicate the milestones achieved as per the national / state benchmarks / norms. The following specific environmental and social parameters should be
quantitatively and qualitatively measured and compared over a period of time to understand the impacts.
The PMU through the respective district level offices of PWD will monitor all projects roads to ensure conformity to the requirements of the ESMF. The monitoring will cover all stages of planning and implementation. The monitoring will be carried out through the safeguard compliance reports that will form a part of Quarterly Progress Reports (QPR) for all sub projects and regular visits by the Social cum Gender and Environmental specialists of the PMU.

Concurrent Monitoring

The PMU's Social cum Gender Expert and Environment Expert will undertake ongoing monitoring of the ESMF implementation in order to identify issues, good practices and required actions. Reports based on the monitoring will be prepared by the PMU at least every quarter and submitted to the Project Director. The reports will be shared with the other implementing agencies.
The PMU will review these reports and identify technical, managerial, policy or regulatory issues with regards to the ESMF compliance. The identified technical issues will be duly incorporated. Policy and regulatory issues will be debated internally by PMU and the need for appropriate interventions will be determined. These interventions could include appropriate revision of ESMF in consultation with the Bank or suitable analytical studies to influence policy or programs of the state, if found necessary / warranted. The table below provides the milestones and process to be followed for monitoring at different stages of project:

Periodic Evaluation

An external evaluation of the safegurad implementation prepared for sub projects will also be undertaken twice during the implementation of the project – midterm and at the end of the implementation. During implementation, meetings will be organized by PMU inviting all PIUs for providing information on the progress of the project work.
Mid-term Assessment Study – this would be undertaken mid-way through the project to ascertain the progress achieved and any mid-course corrections which need to be introduced. It would include indicators to measure progress towards log frame goals and objectives.
End-Term Assessment Study – this will be undertaken at the end of the project period (around the time of project completion) and will assess the achievement of the project during the tenure.

Arrangements for Monitoring

Monitoring is an integral part of successful implementation of the ARAP activities. Internal monitoring will be carried out by the Social Development Expert, PMU and/or the ULB under the supervision of Project Director/Chairman of ULB. Data collected for monitoring activities shall be suitably analysed for project management's learning and experience. Key progress indicators (indicative) for monitoring ARAP implementation are as given below:

- disbursement of compensation and assistance to PAPs, if any
- establishment of grievance redressal mechanism (including processes and timeline for redressal of grievances),
- consultation meetings with PAPs and communities regarding resettlement and rehabilitation issues,

- MIDFC website will include a link where affected person(s) can register their complaints online. A telephone number will also be on the website of MIDFC and the project sites, so that the general public can register their complaint with the PMU office.
- income restoration of affected persons,
- training of the interested PAPs
- grievance handling mechanism

Project monitoring will be the responsibility of the PMU who will submit Quarterly Progress Reports. The reports will compare the progress of the project to targets set up at the commencement of the project. The list of impact performance indicators will be used to monitor project objectives. The socio-economic survey conducted will provide the benchmarks for comparison.

CHAPTER-XI: ENVIRONMENTMANAGEMENT PLAN

The environmental and social management measures shall be implemented during the various stages of the project viz: Pre-construction Stage, Construction Stage and Operational Stage. The environmental and social management plan for the project is described below.

Objectives of EMP

The Environmental Management Plan (EMP) consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operational phases of the project to eliminate adverse environmental impacts, to offset them, or to reduce them to acceptable levels. The main aim of the Environmental Management Plan is to ensure that the various adverse impacts are mitigated and the positive impacts are enhanced. A description of the various management measures against each activity suggested for construction stage is provided in this chapter.

Pre-Construction Stage

Pre-construction activities by PIU/Independent Consultant

Prior to the contractor mobilization, the PIU will ensure that a hindrance free corridor is handed over to enable the start of construction work. Clearance involves for the following activities:

Felling and removal of trees, which should be minimal with due permission.

Relocation of common property resources and community assets like temples, telephone poles, electric poles and hand pumps etc;

Modification (if any), of the contract documents by the Engineer of the Independent Engineer.

Pre-construction activities by Contractor

Pre-construction stage involves mobilisation of the contractor and the activities undertaken by the contractor pertaining to the planning of logistics and site preparation necessary for commencing construction activities. The activities include:

Joint field verification of EMP by the Environment Expert of the Independent Engineer/Authority Engineer and Contractor.

Identification and selection of material sources (quarry and borrow material, water, sand etc).

Procurement of construction equipment / machinery such as crushers, hot mix plants, batching plants and other construction equipment and machinery.

Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc.

Apply for and obtain all the necessary clearances/ NOC's/ consents from the agencies concerned.

Planning traffic diversions and detours including arrangements for temporary land acquisition (if required).

Construction Stage

Construction activities by the Contractor

Construction stage is the most crucial stage in terms of activities that require careful management to avoid environmental impacts. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Costs.

Construction activities by the PIU/ Authority Engineer / Independent Consultants

The PIU/Independent Engineer shall be involved in the smooth execution of the project and assisting the contractor during this phase. Their work shall include but not limited to:

Monitoring and guiding the contractor on adopting good environmental and engineering practices;

Arrangement of plantation through the Forest Department;

Arranging training to the contractor and other stakeholders according to the needs arising; and

Implementation of Environment Management and Monitoring Plan.

Making changes in the design if need so arises.

Operation Stage

The operational stage involves the following activities by PIU:

Monitoring of environmental conditions through approved monitoring agency; and

Monitoring of operational performance of the various mitigation/enhancement measures carried out.

Table 90:Environment Management Plan (EMP)

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
PRE-CONSTRUCTION STAGE					
P1	Alignment,	The alignment as finalized by shifting / adjusting the centerline of the road, adopting of suitable cross-sections and adjustment of the median width to minimize land acquisition, loss of settlements and to avoid environmentally sensitive features compatible with project activities.	Throughout Corridor	PIU, Revenue Dept. NGOs Collaborating Agencies	-
P2	Land Acquisition	The same alignment will be followed for improvement from existing single lane with earthen shoulder to standard single **lane configuration with paved shoulder and geometric correction at few locations. The widening will be generally restricted within the existing ROW, except few locations. The land acquisition for this project not required**.	Throughout Corridor	PIU, Revenue Dept. NGOs Collaborating Agencies	

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		PIU has to ascertain that any additional environmental impacts resulting from acquisition of land are addressed and integrated into the EMP and other relevant documents.			
P3	Preservation of Trees	All efforts will be made to preserve trees including evaluation of minor design adjustments/ alternatives to save trees. Specific attention will be given for protecting giant trees, and locally important trees (religiously important etc.). The amount of tree within toe line due to widening of highway is 166 trees. These trees will betransplanted along the project stretch to restore the green cover In the event of design changes, additional assessments including the possibility to save trees shall be made. Stacking, transport and storage of the wood will be done as per the relevant norms.	Throughout Corridor	PIU Forest Department Contractor	
P4	Relocation of Utilities and Common Property Resources (CPR)	All utilities and CPRs i.e., water supply lines, religious structures, hand pumps will be relocated before the construction starts. The PIU will relocate these properties in consultation and written agreement with the agency/ owner/community. Environmental considerations with suitable/required actions including health and hygiene aspects will be kept in mind while relocating all utilities and CPRs. There are 12 educational institute (ref to table 49) and 6 religious structure are found in this project road which are away (minimum 10 m) from project road.	Throughout Corridor	PIU Concerned Agencies Contractor	
P5	Orientation of Implementing Agency and Contractors	The PIU shall organize orientation sessions and regular training sessions during all stages of the project. This shall include on-site training (general as well as in the specific context of the sub-project). These sessions shall involve all staff of Authority Engineer, field level implementation staff of PIU and Contractor. The contractor will ensure that his staff including	Throughout Corridor	PIU Concerned Agencies Contractor	

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		engineers, supervisors and operators attend the training sessions.			
P6	Joint Field Verification	The Environmental Expert of AE and the Contractor will carry out joint field verification to ascertain any additional possibility to saving trees, environmental and community resources. The verification exercise should assess the need for additional protection measures or changes in design/ scale/ nature of protection measures including the efficacy of enhancement measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.	Throughout out Corridor	Contractor and Environmental Expert of AE	PIU
P7	Assessment of Impacts due to Changes/Revisions/Additions in the Project Work	The Environmental Expert of AE will assess impacts and revise/ modify the EMP and other required sections of the project documents in the event of changes/ revisions (including addition or deletion) in the project's scope of work.	Throughout out Corridor	Contractor Environmental Expert of AE	PIU
P8	Crushers, Hot-mix plants and Batching Plants Location	Hot mix plants and batching plants will be sited sufficiently away from settlements and agricultural operations or any commercial establishments. Such plants will be located at least 1 Km away from the nearest village/ settlement preferably in the downwind direction. The Contractor shall submit a detailed layout plan for all such sites and approval of Environmental Expert of AE/PMC shall be necessary prior to their establishment. Arrangements to control dust pollution through provision of windscreens, sprinklers, and dust encapsulation will have to be provided at all such sites. Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the "PIU through Environmental Expert	Throughout out Corridor	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		of AE/PMC. The Contractor shall not initiate plant/s operation till the required legal clearances are obtained and submitted. The engineer will ensure that the regulatory and legal requirements are being complied with.			
P9	Other Construction Vehicles, Equipment and Machinery	All vehicles, equipment and machinery to be procured for construction will confirm to the relevant Indian Standard (IS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. Noise limits for construction equipments to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced for NH verification whenever required. Mobile equipment shall be placed at least 100 m away from the nearest dwelling.	Throughout out Corridor	Contractor	Environmental Expert of AE and PIU
P10	Borrow Areas	Finalizing borrow areas for borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the contractor. The Contractor will not start borrowing earth from selected borrow areas until the formal agreement is signed between landowner and contractor and a copy is submitted to the PIU/Environmental Expert of AE through the Engineer. Locations finalized by the contractor shall be reported to the Environmental Expert of AE and who will in turn report to PIU. Planning of haul roads for accessing	Along the Project Influence Area	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		borrow materials will be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as far as possible (in case such a land is disturbed, the Contractor will rehabilitate it as per Borrow Area Rehabilitation Guidelines) and will use the existing village roads wherever available. In addition to testing for the quality of borrow materials by the AE, the environmental personnel of the AE will be required to inspect every borrow area location prior to approval The AE will make sure that each such site is in line with IRC and other project guidelines. Necessary clearances need to be obtained prior to operation of Borrow areas.			
P11	Quarry	Authorized Quarries that meet environmental and social standards and the necessary technical specifications will be identified by PIU in the project area Quarries must adhere to World Bank Environmental Health and Safety Guidelines In case of new Quarries, they must have permission from the Department of Mining and Geology and have the necessary clearances from Pollution Control Board and Forest Department and a valid Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA); Quarry should not be operating in any sites of valuable critical or natural habitat Quarry should not be operating in landslide or erosion prone zones Quarry should not disrupt drainage pattern or cause water pollution Quarry should not be operating on the road where operations can disrupt traffic or pose safety risks Quarry workers must have access to Personal Protective Equipment during operations Contractor will finalize the quarry for procurement of construction materials after assessment of the	Along the Project Influence Area	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		availability of sufficient materials and other logistic arrangements In case the contractor decides to use quarries other than recommended by DPR consultant, then will be selected based on the suitability of the materials. The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the PIU through Engineer. Contractor will also work out haul road network and report to Environmental Expert of AE and will inspect and in turn report to PIU before approval.			
P12	Arrangement for Construction Water	To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations and consult the Environmental Expert of AE before finalizing the locations. The contractor will not be allowed to pump from any irrigation canal and surface water bodies used by community. The contractor will need to comply with the requirements of the State Ground Water Department and seek their approval for doing so and submit copies of the permission to AE and PIU prior to initiation of any construction work.	Along the Project Road	Contractor	Environmental Expert of AE and PIU
P13	Labor Requirements	The contractor preferably will use unskilled labor from local communities to give the maximum benefit to the local community.	Along the Project Area	Contractor	Environmental Expert of AE and PIU
P14	Construction Camp Locations – Selection, Design and Lay-out	Sitting of the construction camps will be selected by the contractor as per the guidelines. Construction camps will not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. Location for stockyards for construction materials will be	Along the Project Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp will be designed, built and operated such that no odor is generated.			
P15	Arrangements for Temporary Land Requirement	The contractor as per prevalent rules will carry out negotiations with the landowners for obtaining their consent for temporary use of lands for construction sites/hot mix plants/traffic detours/borrow areas etc. The Contractor will submit a copy of agreement to the Environmental Expert of AE. The Environmental Expert will be required to ensure that the clearing up of the site prior to handing over to the owner (after construction or completion of the activity) is included in the contract.	Along the Project Road	Contractor	Environmental Expert of AE and PIU
P16	Implementation - Information Meetings	The contractor will organize at least 2 implementation information meetings in the vicinity of Project Site (minimum one in each section) for general public to consult and inform people about his plans covering overall construction schedule, safety, use of local resources (such as earth, water), traffic safety and management plans of debris disposal, drainage protection during construction, pollution abetment and other plans, measures to minimize disruption, damage and in convenience to roadside users and people along the road. The first Implementation information meeting be conducted within four weeks of mobilization. The people should be informed about the date, time and venue at least 7 days prior to meetings. Public shall be informed about the meeting through display of posters at prominent public places (panchayat offices, offices of Market committees, Notice board of religious places etc.) and distribution of pamphlets along roadside communities or in any manner deemed fit. The contractor will maintain a	Along the Project Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		channel of communication with the communities through his designated Environment and Safety Officer to address any concern or grievances. Periodic meetings will also be conducted during the construction period to take feedback from communities or their representatives to ensure minimum disturbance. The mechanism and contents for disclosure shall be approved by PIU prior to the meetings.			
P17	Disaster Management and Emergency Response Plan	The Contractor will develop and maintain emergency response systemin order to address any accidents or other emergency situation or disaster at site such as fall of workers from height, collapse of pier,flood, earthquake, accident, etc.	For entire project stretch including bridge locations, camp site and platsite	Contractor	Environmental Expert of AE and PIU
P18	Chance Finds Procedure	As unknown features/objects could be encountered during works, earthworks, a “chance finds procedure” shall be in place to stop works and require investigation by an archaeologist in case of such findings and involvement of relevant state entities	Along the Project Road	Contractor	Environmental Expert of AE and PIU
CONSTRUCTION STAGE					
C1	Clearing and Grubbing	Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert of AE. The Contractor under any circumstances will not cut trees other than those identified for cutting and for which he has written instructions from the PIU. The PIU will issue these instructions only after receiving all stages of clearances from the Forest Department/ MoEF& CC. Vegetation only with girth of over 30 cm will be considered as trees and shall be compensated, in the event of PIU’s instruction to undertake tree	Along the work in progress	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		cutting. The sub grade of the existing pavement shall be used as embankment fill material. The existing base and sub-base material shall be recycled as sub-base of the haul road or access roads. The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes etc.			
C2	Disposal of debris from dismantling structures and road surface	The contractor shall identify disposal sites. The identified locations will be reported to the Environmental Expert of AE. These locations will be checked on site and accordingly approved by Environmental Expert of AE prior to any disposal of waste materials. All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, will be considered incidental to the work and will be planned and implemented by the contractor as approved and directed by the Environmental Expert of AE. The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Environmental Expert of AE. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area.	Along the work in progress	Contractor	Environmental Expert of AE and PIU
C3	Other Construction Waste Disposal	The pre-identified disposal locations will be a part of Comprehensive Waste Disposal Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Expert of AE. Location of disposal sites will be finalized prior to initiation of works on any particular section of the road. The Environmental Expert of AE will approve these disposal sites after	Along the Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		conducting a joint inspection on the site with the Contractor. Contractor will ensure that any spoils of material unsuitable for embankment fill will not be disposed off near any water course, agricultural land, and natural habitat like grass lands or pastures. Such spoils from excavation can be used to reclaim borrow pits and low-lying areas located in barren lands along the project corridors (if so desired by the owner/community and approved by the Environmental Expert of AE). All waste materials will be completely disposed and the site will be fully cleaned and certified by Environmental Expert of AE before handing over. The contractor at its cost shall resolve any claim, arising out of waste disposal or any non-compliance that may arise on account of lack of action on his part.			
C4	Stripping, stocking and preservation of top soil	The topsoil from all areas of cutting and all areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way will be earmarked for storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Expert of AE. The following precautionary measures will be taken to preserve them till they are used: Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, silt fencing will protect the edges of the pile. Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or vegetation. It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before	Along the Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		stripping or when in stockpiles. Such stockpiled topsoil will be utilized for - covering all disturbed areas including borrow areas only in case where these are to be rehabilitated as farm lands (not those in barren areas) top dressing of the road embankment and fill slopes, filling up of tree pits, in the median and in the agricultural fields of farmers, acquired temporarily.			
C5	Accessibility	The contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road. The contractor will take care that schools and religious places are accessible to Public. The contractor will also ensure that the work on / at existing accesses will not be undertaken without providing adequate provisions and to the prior satisfaction of Environmental Expert of AE. The contractor will take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up one after one so that traffic movement in any given area not get affected much.	Along the Road	Contractor	Environmental Expert of AE and PIU
C6	Planning for Traffic Diversions and Detours	Temporary diversions will be constructed with the approval of the Resident Engineer and Environmental Expert of AE for which contractor will seek prior approval for such plans. Detailed Traffic Control Plans will be prepared and submitted to the Resident Engineer for approval, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details diversions; traffic safety arrangement during construction; safety measures for night – time traffic and precautions for transportation of hazardous materials. Traffic control plans shall	Along the Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		be prepared in line with requirements of IRC's SP- 55 document and The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. The contractor will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from AE and PIU. The temporary traffic detours will be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic).			
C7	Earth from Borrow Areas for Construction	No borrow area will be opened without permission of the Environmental Expert of AE. The location, shape and size of the designated borrow areas will be as approved by the Environmental Expert of AE and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). The borrowing operations will be carried out as specified in the guidelines for sitting and operation of borrow areas. The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; will be maintained dust free by the contractor. Sprinkling of water will be carried out twice a day to control dust along such roads during their period of use. During dry seasons (winter and summer) frequency of water sprinkling will be increased in the settlement areas and Environmental Expert of AE will decide the numbers of sprinkling depending on the local requirements. Contractor will rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the guidelines for Redevelopment of Borrow Areas or as suggested by Environmental	Borrow Areas	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		Expert of AE. The final rehabilitation plans will be approved by the Environmental Expert of AE.			
C8	Quarry Operations	The contractor shall obtain materials from quarries only after the consent of the Department of Mining / SPCB (both the states) / District Administration or will use existing approved sources of such materials. Copies of consent/ approval/ rehabilitation plan for opening a new quarry or use of an existing quarry source will be submitted to Environmental Expert of AE and the Resident Engineer. The contractor will develop a Comprehensive Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy to PIU and AE prior to opening of the quarry site. The quarry operations will be undertaken within the rules and regulations in force in the state. Sand, Stone and Aggregate will be from authorized sources that adhere to state regulations as well as World Bank Environmental Health and Safety Guidelines and Safeguard standards as outlined in Annexure 7.	Quarry Areas	Contractor	Environmental Expert of AE and PIU
C9	Transporting Construction Materials and Haul Road Management	Contractor will maintain all roads (existing or built for the project), which are used for transporting construction materials, equipment and machineries as précised. All vehicles delivering fine materials to the site will be covered to avoid spillage of materials. All existing highways and roads used by vehicles of the contractor or any of his sub-contractor or suppliers of materials and similarly roads, which are part of the works, will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. Contractor will arrange for regular water sprinkling as necessary for dust suppression of all such roads and surfaces with specific attention to the settlement areas. The unloading of materials at	All Roads Used	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		construction sites/close to settlements will be restricted to daytime only.			
C10	Construction Water	Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor will submit a list of source/s from where water will be used for the project to 'PIU' through the Engineer. The contractor will source the requirement of water preferentially from ground water but with prior permission from the Central Ground Water Board. A copy of the permission will be submitted to 'PIU' through the Engineer prior to initiation of construction. The contractor will take all precaution to minimize the wastage of water in the construction process/ operation.	Along the Project	Contractor	Environmental Expert of AE and PIU
C11	Disruption to Other Users of Water	While working across or close to any perennial water bodies, contractor will not obstruct/ prevent the flow of water. Construction over and close to the perennial streams shall not be undertaken in any season. The contractor will take prior approval of the River Authority or Irrigation Department for any such activity. The PIU and the Engineer will ensure that contractor has served the notice to the downstream users of water well in advance.	All Water Bodies Used	Contractor	Environmental Expert of AE and PIU
C12	Drainage and Flood Control	Contractor will ensure that no construction materials like earth, stone, ash or appendage is disposed off in a manner that blocks the flow of water of any water course and cross drainage channels. Contractor will take all-necessary measures to prevent any blockage to water flow. In addition to the design requirements, the contractor will take all required measures as directed by the Environmental Expert of AE and the 'Resident Engineer' to prevent temporary or permanent flooding of the site or any adjacent area. Contractor will take all necessary measures to prevent the blockage of water flow. In addition to the design	Drainage line along the road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		requirements, the contractor will take all required measures as directed by the Environmental Expert of the PIU to prevent temporary or permanent flooding of the site or any adjacent area To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like: Drainage line will be constructed all along the project road. Good engineering and construction practice should be followed Use of sediment traps, silt fencing, oil and grease turfing etc. to minimize of the soil movement. Although, effective drainage of water from road side drainage system has been provided throughout the project stretch			
C13	Siltation of Water Bodies and Degradation of Water Quality	The Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction. Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of water bodies (including wells) adjacent to the ROW and around the stockpiles at the construction sites close to water bodies. The fencing will be provided prior to commencement of earthwork and continue till the stabilization of the embankment slopes, on the particular sub-section of the road. The contractor will also put-up sedimentation cum grease traps at the outer mouth of the drains located in truck lay byes and bus bays which are ultimately entering into any surface water bodies / water channels with a fall exceeding 1.5 m. in present case three Sedimentation Cum Grease Trap are proposed, However the item has been kept in case need arises during construction. However, all the water bodies are minimum 2.18 m away from the project road(Refer to Table 24) Contractor will ensure that	All Surface Water Bodies Along the Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby watercourse.			
C14	Slope Protection and Control of Soil Erosion	The contractor will take slope protection measures as per design, or as directed by the Environmental Expert of AE to control soil erosion and sedimentation. Slope protection shall be provided on embankments abutting water bodies by providing stone pitching for slopes b/w 1:4 (V:H) to 1:2 (V:H). Retaining walls shall be provided at high embankments. All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such as no separate payment will be made for them. Contractor will ensure the following aspects: During construction activities on road embankment, the side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Turfing works will be taken up as soon as possible provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization will include mulching netting and seeding of batters and drains immediately on completion of earthworks. In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. Along sections abutting water bodies, stone pitching as per design specification will protect slopes.	Along the Roads	Contractor	Environmental Expert of AE and PIU
C15	Water Pollution from Construction Wastes	The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. Contractor will	Along the road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		avoid construction works close to the streams or water bodies. All waste arising from the project is to be disposed off in the manner that is acceptable and as per norms of the State Pollution Control Board. The Environmental Expert of the PIU will certify that all liquid wastes disposed off from the sites meet the discharge standards.			
C16	Water Pollution from Fuel and Lubricants	The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds. All location and layout plans of such sites will be submitted by the Contractor prior to their establishment and will be approved by the Environmental Expert of AE and PIU. Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas as per the design provided. Oil and grease traps will be provided at fuelling locations, to prevent contamination of water. 'Oil interceptors' shall be provided in wash down areas and re-fuelling areas In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage. Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to AE and PIU) and approved by the Environmental Expert of AE. All spills and collected petroleum products will be disposed off in accordance with MoEF&CC	Along the Roads	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		and state PCB guidelines. Environmental Expert of AE and Resident Engineer' will certify that all arrangements comply with the guidelines of PCB/ MoEF&CC or any other relevant laws.			
C17	Dust Pollution	The contractor will take every precaution to reduce the level of dust from crushers/hot mix plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source and by erection of screen/barriers. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. The contractor will provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation. The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 g/m3. The pollution monitoring is to be conducted as per the monitoring plan. Alternatively, only crushers licensed by the SPCB shall be used. Required certificates and consents shall be submitted by the Contractor in such a case to the Environmental Expert of AE through the 'Engineer'. Dust screening vegetation will be planted on the edge of the ROW for all existing roadside crushers. Hot mix plant will be fitted with dust extraction units.	Along the Roads, Construction Site/ Camps	Contractor	Environmental Expert of AE and PIU
C18	Emission from Construction Vehicles, Equipment and Machineries	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 SPCB. The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. Monitoring results will also be submitted to 'PIU' through the 'Engineer'.	Along the Roads , all vehicles used/ Camps	Contractor	Environmental Expert of AE and PIU
C19	Noise Pollution: Noise from Vehicles, Plants	The Contractor will confirm the following:	Along the Roads , all vehicles	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
	and Equipments	All plants and equipment used in construction shall strictly conform to the MoEF& CC/CPCB noise standards. All vehicles and equipment used in construction will be fitted with exhaust silencers. Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. Maintenance of vehicles, equipment and machinery shall be regular to keep noise levels at the minimum. At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the night time between 10.00 pm to 6.00 am. No construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 10.00 pm to 6.00 am. Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to Environmental Expert of AE through the 'Engineer'. Contractor will provide noise barriers to the suggested locations of select schools (at km 2+900, 3+050, 34+050, 34+100&34+150) because in these locations during the construction noise level will be very high (Refer to Table 56). No noisy construction activities will be permitted around educational	used/Camps		

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 5.00 pm			
C20	Personal Safety Measures for Labour	Contractor will provide: Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete etc. Welder's protective eye-shields to workers who are engaged in welding works Protective goggles and clothing to workers engaged in stone breaking activities and workers will be seated at sufficiently safe intervals Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. Adequate safety measures for workers during handling of materials. The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form. The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.	Along the Roads, all vehicles used/Camps	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		Contractor will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint dry is rubbed and scrapped. The Contractor will mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and will be approved by AE and PIU.			
C21	Traffic and Safety	The contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Environmental Expert of AE and 'Resident Engineer' for the information and protection of traffic approaching or passing through the section of any existing cross roads. The contractor will ensure that all signs, barricades, pavement markings are provided as per the MOSRT&H specifications. Before taking up of construction on any section of the existing lanes of the highway, a Traffic Control Plan will be devised and implemented to the satisfaction of Environmental Expert of AE and ' Resident Engineer'	Along the Roads, all vehicles used/Camps	Contractor	Environmental Expert of AE and PIU
C22	Risk from Electrical Equipment(s)	The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that: No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. 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	Along the Roads	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		maintained as per IS provision and to the satisfaction of the 'Resident Engineer'.			
C23	Risk Force Measure	The contractor will take all reasonable precautions to prevent danger to the workers and public from fire, flood etc. resulting due to construction activities. The contractor will make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment. Construction Safety Plan prepared by the Contractor will identify necessary actions in the event of an emergency.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
C24	First Aid	The contractor will arrange for - a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital Equipment and trained nursing staff at construction camp.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
C25	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required as per IRC and MoRT&H specifications.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
C26	Road side Plantation Strategy	The contractor will do the plantation at median and/or turfing at embankment slopes as per the tree plantation strategy prepared for the project. Minimum 90 percent survival rate of the saplings will be acceptable otherwise the contractor will replace dead plants at his own cost. The contractor will maintain the plantation till they handover the project site to NHAI. Environmental Expert of AE will inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.	Along the Roads	Contractor	Environmental Expert of AE and PIU
C27	Flora and Fauna	The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora	Along the Roads	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		(plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Environmental Expert of AE and carry out the AE instructions for dealing with the same. Environmental Expert of AE will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials. All efforts during the design stage should be made to minimize the tree felling requirement Compensatory plantation should be started during construction phase parallel to the construction activities.			
C28	Chance Found Archaeological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Environmental Expert of AE of such discovery and carry out the AE instructions for dealing with the same, waiting which all work shall be stopped. The AE will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.	Along the Roads, construction sites/Camps	Contractor	Environmental Expert of AE and PIU
C29	Labour Accommodation	Contractor will follow all relevant provisions of the Factories Act, 1948 and the building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp. The location, layout and basic facility	Along the Roads, construction Camps/site	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		provision of each labor camp will be submitted to AE and 'PIU' prior to their construction. The construction will commence only upon the written approval of the Environmental Expert of AE. The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the AE. The sewage system for such camps will be properly designed and built so that no water pollution takes place in adjacent canals			
C30	Potable Water	The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. The Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. Testing of water will be done as per parameters prescribed in IS 10500:1991.	Along the Roads, construction Camps/construction site	Contractor	Environmental Expert of AE and PIU
C31	Sanitation and Sewage System	The contractor will ensure that - the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women Adequate water supply is to be provided in all toilets and urinals	Along the Roads, construction Camps/Construction Sites	Contractor	Environmental Expert of AE and PIU
C32	Waste Disposal	The contractor will provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of AE. Unless otherwise arranged by local	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Environmental Expert of AE will have to be provided by the contractor.			
C33	Consultation	The Environmental Expert of AE will contact the responsible people with the enhancement drawing of the site for which enhancement has been proposed and take their consent before the start of work. Accesses to Different Schools along the road will be developed to the satisfaction of 'PIU'.	Along the Roads	Contractor	Environmental Expert of AE and PIU
C34	Clean-up Operations, Restoration and Rehabilitation	Contractor will prepare site restoration plans, which will be approved by the Environmental Expert of AE. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. The contractor will clear all temporary structures; dispose all garbage, night soils and POL waste as per Comprehensive Waste Management Plan and as approved by AE. All disposal pits or trenches will be filled in and effectively sealed off. Residual topsoil, if any will be distributed in pre identified approved areas or in places suggested by the Environmental Expert of AE areas in a layer of thickness of 75 mm-l50 mm. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, at the contractor's expense, to the entire satisfaction to the Environmental Expert of AE and PIU will certify in this regard.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
OPERATION STAGE					
Activities to be carried Out by PIU					
O1	Monitoring Operation Performance	The PIU will monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. The indicators selected for monitoring	Along the Road	PIU	PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		include the survival rate of trees; utility of enhancement provision, status of rehabilitation of borrow areas and disposal sites.			
O2	Maintenance of Drainage	PIU will ensure that all drains (side drains, median drain and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding. PIU will ensure that all the sediment and oil and grease traps set up at the water bodies are cleared once in every three months.	Along the Road	PIU	PIU
O3	Pollution Monitoring	The periodic monitoring of the ambient air quality, noise level, water quality, soil pollution/contamination in the selected locations as suggested in pollution monitoring plan. PIU will either appoint PCB or its approved pollution-monitoring agency for the purpose	Along the Road	PIU through Pollution Monitoring Agency	PIU
O4	Air Pollution	Ambient air concentrations of various pollutants shall be monitored as envisaged in the pollution-monitoring plan. Bottlenecks should be avoided for smooth flow of traffic. Plantation of pollutant adsorbing trees, such as Spider Plant, Bamboo Palm, etc. Regular maintenance of the road will be done to ensure good surface condition	Along the Road	PIU through Pollution Monitoring Agency	PIU
O5	Noise Pollution	Noise pollution will be monitored as per monitoring plan at sensitive locations. Noise control programs are to be enforced strictly. According to monitoring results, use of sound barriers / trees will be considered where warranted Signs for sensitive zones (health centers / educational institutions etc.) will be put up where horn should not be blown or traffic speed need to be regulated Pressure Horn must be banned in the project road	Along the Road	PIU through Pollution Monitoring Agency	PIU
O6	Water Pollution	Water Quality will be monitored as per monitoring plan	Along the Road	PIU through Pollution Monitoring Agency	PIU
O8	Soil Erosion and Monitoring of Borrow Areas	Visual monitoring and inspection of soil erosion at borrow areas, quarries (if	Along the Road	PIU	PIU

Sl.	Environmental Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		closed and rehabilitated), embankment> 2m. and other places expected to be affected, will be carried out once in every three months as suggested in monitoring plan.In case soils erosion is found, suitable measures should be taken to control the soil erosion.			
O9	Road Safety and Traffic	**Road Safety will be monitored during operation especially at location where traffic-calming measures have been proposed.** **The spills at the accident sites will be cleared immediately and disposed off properly in accordance with Emergency Response Plan** **Traffic management plan will be developed, especially along congested locations and near sensitive locations** **Traffic control measures including speed limits will be enforced strictly.** **Engagement with local community / Awareness Training**	Along the Road	PIU	PIU

Reporting System

The Monitoring and Evaluation of the management measures envisaged are critical activities in implementation of the Project. The rationale for a reporting system is based on accountability to ensure that the measures proposed as part of the Environmental Management Plan get implemented in the Project.
Project Monitoring Cell will be set up in the PIU, which will act as the Contract Management Unit (CMU) and will be responsible for execution of the Project. Project Execution Units will be set up under the supervision of the Contract Management Unit for the Contract Package.

Technical set up

It is proposed that an Environmental Management Implementation Unit (EMIU) will be set up within PIU. The EMIU will have an Environmental Expert who will be responsible for monitoring the implementation of the EMP with the assistance of the Environmental Expert/Specialist of the AE/IE and the Contractor. The Environmental Expert will be assisted by two Environmental Engineers. The EMIU of PIU will assist the CMU and the Project Director and will interact with State Pollution Control Board (SPCB), State Forest Dept., NGO & various Committees for addressable of environmental issues. In the PIU, there will be an Environmental Officer within the Project Management Information System Unit who will assist the Project Director on the environmental matters and also interact with the CMU, PIUs and its EMIUs.

Nonconformity to Environmental Management Plan (EMP)

The Contractor will implement necessary mitigation measures for which responsibility is assigned to him as stipulated in the EMP. Any lapse in implementing the same will attract the damage clause as detailed below:

- Any complaints of public, within the scope of the Contractor, formally registered with the PIU and communicated to the Contractor, which is not properly addressed within the time period intimated by the PIU shall be treated as a major lapse.
- Non-conformity to any of the mitigation measures like unsafe conditions, non-collection of excavated material (during laying of drainage pipes) regularly and other unattended Environment, Health & Safety (EHS) issues, as stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.
- On observing any lapses, PIU shall issue a notice to the Contractor, to rectify the same.
- Any minor lapse for which notice was issued and not rectified, first and second reminders shall be given after ten days from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder.
- If a major lapse is not rectified upon receiving the notice PIU shall invoke reduction, in the subsequent interim payment certificate.
- For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum limit of about 0.5% of the contract value.
- If the lapse is not rectified within one month after withholding the payment, the amount withheld shall be forfeited immediately.

Environmental Monitoring

Environmental monitoring describes the processes and activities that need to take place to characterize and monitor the quality of the environment. Environmental monitoring is used in the preparation of environmental impact assessments, as well as in many circumstances in which human activities carry a risk of harmful effects on the natural environment. All monitoring strategies and program have reasons and justifications which are often designed to establish the current status of an environment or to establish trends in environmental parameters. In all cases the results of monitoring will be reviewed, analyzed statistically and published. The design of a monitoring program must therefore have regard to the final use of the data before monitoring starts.

Monitoring Plans for Environment Condition

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites; frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in **Table 73**
Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining NOC/ consent for plant site operation.

Table 91:Environment Monitoring Plan

Environmental Component	Project Stage	Monitoring					Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Implementation	Supervision
Air	Construction Stage	PM10, PM 2.5, SO_x, NOx, CO	Respirable Dust Sampler to be located 50 m from the plant in the downwind direction. Use method specified by CPCB for analysis	Air (P&CP) Act,1981 and its amendment	Hot mix Plant / Batching Plant. Stretch of the road where construction is in progress at the site. (Total 03 locations)	Three times in a year for two years (Excluding Rainy season)	Contractor through NABL approved monitoring agency	Environment Expert-AE/IE/PIU
	Operational Stage	PM10, PM 2.5, SO_x, NOx, CO	Respirable Dust Sampler to be located 50m from the plant in the downwind direction. Use method specified by CPCB for analysis	Air (P&CP) Act,1981 and its amendment	As directed by the PIU (03 Project locations)	Three times in a year for two years (Excluding Rainy season)	P I U through NABL approved monitoring agency	P I U
Water Quality	Construction Stage	Parameters as per IS: 10500 and standards of surface water	Grab sample collected from source and analyze as per Standard Methods for Examination of Water quality	Water quality standards by CPCB	01 drinking water sample-Labour Camp and 02 surface water samples in project stretch.	Three times in a year for two years (Excluding Rainy season)	Contractor through NABL approved monitoring agency	Environment Expert-AE/IE/PIU

Environmental Component	Project Stage	Monitoring					Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Implementation	Supervision
Water Quality	**Operation Stage**	Parameters as per IS: 10500 and standards of surface water	Grab sample collected from source and analyze as per Standard Methods for Examination of Water quality	Water quality standards by CPCB	As directed by the PIU (03 Project locations)	Three times in a year for two years (Excluding Rainy season)	P I U through NABL approved monitoring agency	P I U
Noise Levels	**Construction Stage**	Noise levels on dB (A) scale	As per CPCB	Noise standards by CPCB	Hot mix Plant / Batching Plant. Stretch of the road where construction is in progress at the site. (Total 03 locations)	Three times in a year for two years.	Contractor through NABL approved monitoring agency	Environment Expert-AE/IE/PIU
	Operation Stage	Noise levels on dB (A) scale	As per CPCB	Noise standards by CPCB	As directed by the PIU (Total 03 locations)	Three times in a year for two years.	PIU through NABL approved monitoring agency	PIU
Soil Erosion	**Construction Stage**	Turbidity in Storm Water Silt load in ponds, water courses	----	As per Standard (ICAR)	01 location construction camp and 02 major construction locations. (Total 03 locations)	Three times in a year for two years	Contractor through NABL approved monitoring agency	Environment Expert-AE/IE/PIU
	O	Turbidity	----	As per	As directed	Three	PIU	PIU

Environmental Component	Project Stage	Monitoring					Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Implementation	Supervision
		in Storm Water Silt load in ponds, water courses		Standard (ICAR)	by the PIU (Total 03 locations)	times in a year for two years.	through NABL approved monitoring agency	

Environmental Monitoring Budget:

The environmental monitoring cost is estimated on the basis of the length and existing environmental scenario of the proposed project. Environmental monitoring cost of 9, 00,000/- is estimated for the construction and Operation stages. The details have been presented in Table 93

Table 92: Environmental Monitoring Cost

Cot of Environment / Migration Plan Description	Unit	Quantity	Unit Rate	Cost
Air quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Construction Stage)	No.	18	9000	162,000
Air quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Operation Stage)	No.	18	9000	162,000
Water quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Construction Stage)	No.	18	7000	126,000
Water quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Operation Stage)	No.	18	7000	126,000
Noise quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Construction Stage)	No.	18	3000	54,000
Noise quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Operation Stage)	No.	18	3000	54,000
Soil quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Construction Stage)	No.	18	6000	108000
Soil quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Operation Stage)	No.	18	6000	108000

Cot of Environment / Migration Plan Description	Unit	Quantity	Unit Rate	Cost
Total				**900000**

Table 93:Environment Management Plan Implementation Budget

Sl.	Environmental Components	Particulars	Unit	Approx. Quantity	Rate In (Rs.)	Total Cost In (Rs.)
		Mitigation / Enhancement Cost				
2		Construction Stage				
2.1	Air	Dust Management with sprinkling of water, covers for vehicles transporting construction material	35 Km	Cost included in Total Civil Cost		
2.2	Water	Provision of Taps	No.	Included in utility shifting and replacement cost.		
	Water Bodies	Enhancement of Road side Ponds	No.	Retaining wall has been proposed to protect this water bodies. Cost of retaining wall is included in total Civil Cost.		
		Oil trap at parking/servicing of construction vehicles (at three location every 14km)-	No.	Ref: Project Cost Estimate		
2.3	Environmental Enhancements	Enhancement of traffic sign outside of most sensitive locations mentioned in EMP, by planting of traffic sign and planting of 1 row of trees at a distance of 3m c/c and as per directions of the Engineer	No.	At this location proper traffic sign has been proposed. The cost of traffic sign is included in total civil cost.		
2.4	Flora	tree within toe line due to widening of highway is 166 trees which will be transplanted.	Nos.	The cost of trees transplantation is included in total civil cost.		
	Provision of Mobile Toilets at Work Site	Supply and commissioning of mobile toilets on wheel (5 units each Toilet and Bathroom) with proper water supply and drainage system, electric supply and safe access at work site locations	Nos.	1	250000	250000
		Maintenance: Daily cleaning twice a day by engaging one permanent helper	Monthly	24	18000	432000
		Painting at every six months	Six Monthly	4	25000	100000
	Noise barrier	Provide the Noise barrier at sensitive areas like schools and hospitals. The noise barriers of hollow brick wall/reinforced concrete panels with height of 3.5m. The design of the noise barrier shall be approved by theengineer in charge**.**		Cost of noise barrier is included in Total Civil Cost.		
2.5	Silt Runoff Control	Slope stabilization, turfing, silt fencing etc		For slope stabilization turfing has been proposed on high embankment. Cost of		

Sl.	Environmental Components	Particulars	Unit	Approx. Quantity	Rate In (Rs.)	Total Cost In (Rs.)
				slope stabilization is included in Total Civil Cost.		
2.6	Slope/ embankment protection measures	Stone pitching, Gabion, Retaining wall, Turfing at toe line, etc		For Slope/ embankment protection Retaining wall, Turfing has been proposed. Cost of Slope/ embankment is included in Total Civil Cost.		
2.7	Relocation of sensitive receptor	Relocation of religious structure, educational properties and health care center		Cost of relocation is included in Total Civil Cost.		
		Total Mitigation / Enhancement Cost				782000
3		**Operation Stage**				
3.1	Soil erosion	Mitigation measure for soil erosion		included in Total Civil Cost		
3.2	Contamination from spills due to traffic and accidents	Clearing of spills at accident site			Average cost	700,000
3.3	Flora	Maintenance of planted trees	Already included in construction phase			
3.4	Safety	Traffic management and Traffic control	Part of project construction cost.			
		Total Mitigation / Enhancement Cost				700,000

Table 94:Summary of Environmental Management Budget

Sl.	Environmental Components	Cost (Rs.)
1	**Construction Phase**	
1.1	Total Mitigation / Enhancement Cost	782000
1.2	Environmental Monitoring Cost	450000
Total Cost in Construction phase		**1232000**
2	**Operation Phase**	
2.1	Total Mitigation / Enhancement Cost	7,00,000
2.2	Environmental Monitoring Cost	450000
Total Cost in Operation Phase		**11,50,000**
3	**Miscellaneous Cost**	
3.1	Environmental Awareness and Training	1,20,000

3.2	Administrative Charges including logistics	4,00,000
Total Cost in Miscellaneous		**5,20,000**
TOTAL BUDGETED COST (1+2+3)		**29,02,000**

An environmental management budget at of INR**29,02,000**has been estimated for implementation of the environmental management plan. This budget includes cost of environmental monitoring and associated trainings.

CHAPTER-XII: CONCLUSION AND RECOMMENDATIONS

The environmental and the social impact assessment have been conducted as per the approach/ methodology for conducting ESIA study for all the eight project corridors. All the potential impacts were identified in relation to pre-construction, construction, and operation phases. Social impact assessment study has done within the proposed corridor. The proposed project interventions shall not attract Environmental Clearance (EC) from the SEIAA.

Focus Group Discussions (FGD's) were conducted to assess the perception of the people about the proposed project. The stakeholders selected included shop keepers, residents along the road, owners/ workers of local commercial establishments etc. The outcome of the consultations depicts the requirement for the road safety measures; road furniture's (including street lights, additional bus bays, signage's, speed breaker etc,).The project is not huge and can be easily completed with the local labour force. There might movement of labour from the neighbouring districts within the state.

In view of the environmental Impact assessment, there will be temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on the project corridors (traffic, dust, safety etc.,), mining of construction material, occupation health and safety aspects, disturbance to the residents, businesses, safety risk to workers, public and nearby buildings due to road excavation works, access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts that are likely to arise during the road construction works in the settlement areas, and there are well developed methods of mitigation that are suggested in the ESMP. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported by the contractor to the CSC/PIU.

The prepared ESMP will assist the Contractor, CSC, and the PIU in mitigating the environmental and social impacts, and guide them in the environmentally sound execution of the proposed project. A copy of the updated ESMP shall be kept on-site during the construction period at all times. The ESMP shall be included in the bidding document along with appropriate contractual clauses for safeguarding the environment during the project construction and operation (maintenance period). As per the World Bank policy requirements, the prepared safeguard documents shall be disclosed in the World Bank website.

Annexure 1: Environmental Screening Checklist

Name of the sub-project	Nongstoin Maweit Road
Size of the project (approx. area in sq. mt/hac or length in mt/km, as relevant)	35 km
Location of the proposed sub-project	Maghalaya, India
Name of the of the district, block	West Khasi Hills
Name of the settlement/ area, where the bridge is located	This road passes through towns/ Villages viz. Nongpyndeng, Mawlait, Nongthraw, Wahlyndoh, Nongsbah, Mawdom, Miangshiang, Nongpathar, Maweit and Nonglyer.
Latitude and longitude	start point- Lat 25°31'40.25"N and long 91°15'24.66"E End Point- Lat 25°25'54.51"N and long 91° 4'20.11"E
New construction/ repair/ rehabilitation/ expansion (if there is an existing bridge, please share picture of old bridge. Also, the approach roads.)	Expansion of the project road
If expansion, then is there any need of new land	No
If yes, please share detail: • **Total requirement** • **Private land** • **Govt. land** • **Forest land**	
What is the High Flood Level in the sub-project area?	

S. No.	Environmental & Social Features	Presence within 500 mts from activity sites (Yes/No) If yes, mention distance in km)	Type of Impact (+ or -)	Significance of Impact (High (H), Medium (M), Low (L))	Likelihood of Impact (Likely, Unlikely)	Description of Impact
Physical Environment						
	Springs	No				
	Standing water bodies (ponds, lakes, etc.)	Yes	_	Low (L)	Likely	
	Flowing water bodies (rivers, rivulets, streams, canals, etc.)	Yes	_	Low (L)	Likely	Increase in turbidity
	Ground water sources (open wells, bore wells, etc.)	No				
	Meandering River	No				
	Erosion prone stretches	Yes	_	Medium (M)	Likely	Problem of soil erosion is expected in some locations. particularly soil erosion due to a lack of drainage facilities.
	Areas with high slope (higher than 15 percent)	Yes	_	Medium (M)	Likely	high slope in almost entire project area which will face problem of soil erosion.
	Landforms (hills, valleys)	Yes	_	Medium (M)	Likely	Project road mostly passing through the hill area will require new hill cutting and steep slopes.
	Coal Mine	No				
Biological Environment						
	National Park / Wildlife Sanctuary	Consider both end of the bridges and within 10km radius as per law				No National Park / Wildlife Sanctuary are locating along the project road
	Reserved Forests	Consider both end of the bridges and within 10km radius as per law				No reserved forest are locating along the project road
	Community Forest/ Fisheries	Local consultation Fish breeding				No

S. No.	Environmental & Social Features	Presence within 500 mts from activity sites (Yes/No) If yes, mention distance in km)	Type of Impact (+ or -)	Significance of Impact (High (H), Medium (M), Low (L))	Likelihood of Impact (Likely, Unlikely)	Description of Impact
		Around the area – unique amphibian species (relevant dept.)				
	Large Trees / Woodland	Visual checks – if found, please click photograph	_	Medium (M)	Likely	Tree cutting cause soil erosion
	Sacred Groves	Discuss with community if found, please click photograph				No sacred groves are founding along the project road
	Presence of endangered species / habitat areas	Consider both end of the bridges and within 10km radius as per law				No
	Migratory routes	Please refer to ESMF and check if any intercepts with the project area				No
	Ecologically sensitive areas	Consider both end of the bridges and within 10km radius as per law				No
Human Environment						
	Settlements/Habitations	Yes	+	Medium (M)	Likely	10 settlements, improve the connectivity
	Sensitive Receptors (schools, hospitals, markets etc.)	Yes	_	Low	Likely	Increase of noise and air pollution.
	Drinking water sources	No				
	Underground utility lines like electricity lines, pipelines for gas, etc	No				
	Physical cultural resources – Protected monuments, historical/ heritage sites etc.	No				
	Physical cultural resources – Religious structures, other sites significant to community	No				

S. No.	Environmental & Social Features	Presence within 500 mts from activity sites (Yes/No) If yes, mention distance in km)	Type of Impact (+ or -)	Significance of Impact (High (H), Medium (M), Low (L))	Likelihood of Impact (Likely, Unlikely)	Description of Impact
	Agricultural land/ Other activities					
	Defence Installations / Airports	No				
	Heavy polluting Industry	No				
	Water or Waste water Treatment Plant	No				
Social Safeguard Issues						
	Any loss / reduction of access to traditional dependent communities (to areas where they earn for their primary or substantial livelihood).					
	Adverse impacts to women, gender issues including economic and safety concerns	Community consultation				
	Presence of Indigenous / vulnerable communities	Community consultation				
	Land acquisition of private land leading to loss of shelter and livelihood					
	Whether land acquired / donated is more than 10% of the total holding					
	Land acquisition resulting to loss of income; livelihood; sources of livelihood; loss of access to common property resources and / or private residential and/or property resources.					
	Possible conflicts with and/or disruption to local community					
	Significant issues raised by the stakeholders during consultation	MoM of the community consultation				

Annexure 2:Baseline Monitoring Result

Air Quality Monitoring

Issued to:

Test Report No.	:	**ITL/ENV/PR/AA/2201240004**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/AA/2201240004** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	:	Air Sample
Date of Sample Collection	:	07/01/2022 to 08/01/2022
Location / Source of Sample	:	Miangkain Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage - 26+000 Km, Distance from alignment – 050 m
Sample Quantity	:	NA
Sample Condition	:	OK
Sampling Method	:	CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S No.	Parameter (s)	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM_{10}), µg/m³	IS 5182 Part 23:2006	69	100
2	Particulate Matter ($PM_{2.5}$), µg/m³	CPCB Method Volume-1, 2011	39	60
3	Sulphur dioxide (SO_2), µg/m³	IS 5182 Part 2:2001	6.1	80
4	Oxide of nitrogen (NO_2), µg/m³	IS 5182 Part 6:2006	11.1	80
5	Carbon monoxide (CO), mg/m³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

Issued to:

Test Report No.	:	**ITL/ENV/PR/AA/2201240003**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/AA/2201240003** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ambient Air Quality Monitoring (AAQM-1)
Type of Sample	:	Air Sample
Date of Sample Collection	:	07/01/2022 to 08/01/2022
Location / Source of Sample	:	Nongstoin Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage - 02+600 Km, Distance from alignment – 050 m
Sample Quantity	:	NA
Sample Condition	:	OK
Sampling Method	:	CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S No.	Parameter (s)	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM_{10}), µg/m³	IS 5182 Part 23:2006	76	100
2	Particulate Matter ($PM_{2.5}$), µg/m³	CPCB Method Volume-1, 2011	42	60
3	Sulphur dioxide (SO_2), µg/m³	IS 5182 Part 2:2001	8.1	80
4	Oxide of nitrogen (NO_2), µg/m³	IS 5182 Part 6:2006	12.1	80
5	Carbon monoxide (CO), mg/m³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

Issued to:

Test Report No.	:	**ITL/ENV/PR/AA/2201240002**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	07/01/2022
Analysis Date	:	07/01/2022 to 12/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/AA/2201240002** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	:	Air Sample
Date of Sample Collection	:	03/01/2022 to 04/01/2022
Location / Source of Sample	:	Miangkain Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage - 26+000 Km, Distance from alignment – 050 m
Sample Quantity	:	NA
Sample Condition	:	OK
Sampling Method	:	CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S No.	Parameter (s)	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM_{10}), µg/m³	IS 5182 Part 23:2006	67	100
2	Particulate Matter ($PM_{2.5}$), µg/m³	CPCB Method Volume-1, 2011	38	60
3	Sulphur dioxide (SO_2), µg/m³	IS 5182 Part 2:2001	6.4	80
4	Oxide of nitrogen (NO_2), µg/m³	IS 5182 Part 6:2006	10.4	80
5	Carbon monoxide (CO), mg/m³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

Issued to:

Test Report No.	:	**ITL/ENV/PR/AA/2201240001**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	07/01/2022
Analysis Date	:	07/01/2022 to 12/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/AA/2201240001** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ambient Air Quality Monitoring (AAQM-1)
Type of Sample	:	Air Sample
Date of Sample Collection	:	03/01/2022 to 04/01/2022
Location / Source of Sample	:	**Nongstoin** Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage - 02+600 Km, Distance from alignment – 050 m
Sample Quantity	:	NA
Sample Condition	:	OK
Sampling Method	:	CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S No.	Parameter (s)	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM_{10}), µg/m³	IS 5182 Part 23:2006	72	100
2	Particulate Matter ($PM_{2.5}$), µg/m³	CPCB Method Volume-1, 2011	41	60
3	Sulphur dioxide (SO_2), µg/m³	IS 5182 Part 2:2001	7.4	80
4	Oxide of nitrogen (NO_2), µg/m³	IS 5182 Part 6:2006	11.2	80
5	Carbon monoxide (CO), mg/m^3	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

Noise Monitoring

Issued to:	***Test Report No.***	: **ITL/ENV/PR/NS/2201240007-08**
	Report Issue Date	: 24/01/2022
	Sample Receipt Date	: NA
	Analysis Date	: NA
	Lab Sample No. & Date	: **ITL/ENV/PR/NS/2201240007-08 & 24/01/2022**
	Reference No.	: PI/CTKI21-24/WO/GEMPL/1
	Date	: 00/00/0000

Nature and Description of Sample	:	Noise Level Monitoring (NM-2)
Type of Sample	:	Noise Level
Date of Sample Collection	:	Mentioned below in results table
Location / Source of Sample	:	**Miangkain** Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage :- 26+000 Km
Sample Quantity	:	NA
Sample Condition	:	NA
Sampling Method	:	NA
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin Maweit Road**

Test Results

Time	Results as per noise monitoring date	
	03/01/2022	07/01/2022
Day 6.00	37.9	38.2
7.00	40.1	39.8
8.00	42.4	43.2
9.00	46.5	45.1
10.00	48.2	47.6
11.00	46.2	47.2
12.00	52.1	51.2
13.00	50.4	50.6
14.00	51.2	50.8
15.00	52.1	51.2
16.00	51.2	51.2
17.00	50.2	50.2
18.00	49.3	47.2
19.00	47.2	46.2
20.00	47.6	45.6
21.00	46.2	44.2
Night 22.00	43.2	42.1
23.00	40.2	39.1
24.00	42.1	39.4
1.00	41.2	38.7
2.00	39.5	39.2
3.00	38.4	38.9
4.00	38.2	38.5
5.00	38.2	38.4
Maximum	**52.1**	**51.2**
Minimum	**37.9**	**38.2**
Ld	**48.2**	**47.7**
Ln	**39.4**	**38.3**
Ldn	**48.6**	**47.9**

Issued to:	*Test Report No.*	: ITL/ENV/PR/NS/2201240005-06
	Report Issue Date	: 24/01/2022
	Sample Receipt Date	: NA
	Analysis Date	: NA
	Lab Sample No. & Date	: ITL/ENV/PR/NS/2201240005-06 & 24/01/2022
	Reference No.	: PI/CTKI21-24/WO/GEMPL/1
	Date	: 00/00/0000

Nature and Description of Sample	:	Noise Level Monitoring (NM-1)
Type of Sample	:	Noise Level
Date of Sample Collection	:	Mentioned below in results table
Location / Source of Sample	:	**Nongstoin** Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage :- 02+600 Km
Sample Quantity	:	NA
Sample Condition	:	NA
Sampling Method	:	NA
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya.** **Nongstoin Maweit Road**

Test Results

Time	Results as per noise monitoring date	
	03/01/2022	07/01/2022
Day 6.00	39.4	38.4
7.00	40.1	39.1
8.00	44.2	43.2
9.00	46.2	47.2
10.00	48.2	46.5
11.00	51.2	50.1
12.00	52.1	51.2
13.00	51.2	51.4
14.00	52.3	52.1
15.00	52.1	50.1
16.00	50.1	49.1
17.00	49.2	48.4
18.00	48.2	47.5
19.00	48.9	46.1
20.00	47.2	45.7
21.00	45.2	43.4
Night 22.00	42.1	41.2
23.00	38.4	37.8
24.00	37.5	36.8
1.00	36.2	37.5
2.00	37.2	36.5
3.00	36.2	37.5
4.00	35.2	36.4
5.00	37.5	37.2
Maximum	**52.3**	**52.1**
Minimum	**35.2**	**36.4**
Ld	**48.6**	**47.7**
Ln	**36.4**	**36.5**
Ldn	**48.0**	**47.4**

Groundwater Monitoring

Issued to:

Test Report No.	:	**ITL/ENV/PR/GW/2201240010**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/GW/2201240010** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ground Water
Type of Sample	:	Water Sample
Date of Sample Collection	:	08/01/2022
Location / Source of Sample	:	Nonglver Latitude- 26.694302 N, longitude- 94.413154 E Chainage - 34+050 Km, Distance from alignment - 100m
Sample Quantity	:	2.5 liter
Sample Condition	:	Sealed properly
Sampling Method	:	IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	19	-	-
4	pH Value at 25°C	IS 3025 Part 11	6.64	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	284	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	185	500 Max	2000 Max
7	Calcium (as Ca) mg/l	IS 3025 Part 40	16.8	75 Max	200 Max
8	Magnesium (as Mg), mg/l	IS 3025 Part 46	10.5	30 Max	100 Max
9	Sodium (as Na), mg/l	IS 3025 Part 45	20.9	-	-
10	Potassium (as K), mg/l	IS 3025 Part 45	8.4	-	-
11	Alkalinity (as HCO_3), mg/L	IS 3025 Part 23	92	-	-
12	Sulphate (as SO4), mg/l	IS 3025 Part 24	32	200 Max	400 Max
13	Chloride (as Cl) mg/l	IS 3025 Part 32	18.4	250 Max	1000 Max
14	Nitrate (as NO3), mg/l	IS 3025 Part 34	0.8	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO_2), mg/L	IS 3025 Part 34	0.05	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO_4), mg/L	IS 3025 Part 31	BDL	-	-
19	Total Hardness (as $CaCO_3$), mg/L	IS 3025 Part 21	85	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	

Issued to:

Test Report No.	:	**ITL/ENV/PR/GW/2201240009**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/GW/2201240009** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ground Water
Type of Sample	:	Water Sample
Date of Sample Collection	:	08/01/2022
Location / Source of Sample	:	Nongstoin Latitude- 26.694302 N, longitude- 94.413154 E Chainage - 02+900 Km, Distance from alignment - 100m
Sample Quantity	:	2.5 liter
Sample Condition	:	Sealed properly
Sampling Method	:	IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	18	-	-
4	pH Value at 25°C	IS 3025 Part 11	6.67	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	357	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	232	500 Max	2000 Max
7	Calcium (as Ca), mg/l	IS 3025 Part 40	22.4	75 Max	200 Max
8	Magnesium (as Mg), mg/l	IS 3025 Part 46	13.5	30 Max	100 Max
9	Sodium (as Na), mg/l	IS 3025 Part 45	24.1	-	-
10	Potassium (as K), mg/l	IS 3025 Part 45	11.2	-	-
11	Alkalinity (as HCO_3), mg/L	IS 3025 Part 23	109	-	-
12	Sulphate (as SO4), mg/l	IS 3025 Part 24	36	200 Max	400 Max
13	Chloride (as Cl), mg/l	IS 3025 Part 32	21.4	250 Max	1000 Max
14	Nitrate (as NO3), mg/l	IS 3025 Part 34	1.1	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO_2), mg/L	IS 3025 Part 34	0.06	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO_4), mg/L	IS 3025 Part 31	BDL	-	-
19	Total Hardness (as $CaCO_3$), mg/L	IS 3025 Part 21	111	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	

Surface Water Monitoring

Issued to:

Test Report No.	:	**ITL/ENV/PR/SW/2201240012**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/SW/2201240012** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Surface Water
Type of Sample	:	Water Sample
Date of Sample Collection	:	07/01/2022
Location / Source of Sample	:	Maweit Latitude- 26.700120 N longitude- 94.437104 E Chainage - 33+300 Km, Distance from alignment - 100m
Sample Quantity	:	2.5 Liter
Sample Condition	:	OK
Sampling Method	:	IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	6.78	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	21.1	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	204	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	133	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	6	-	-
8	Total Solids, mg/l	IS 3025 Part 15	139	-	-
9	Calcium (as Ca), mg/l	IS 3025 Part 40	14.4	75 Max	200 Max
10	Magnesium (as Mg), mg/l	IS 3025 Part 46	6.1	30 Max	100 Max
11	Sodium (as Na), mg/l	IS 3025 Part 45	15.2	-	-
12	Potassium (as K), mg/l	IS 3025 Part 45	5.4	-	-
13	Total Alkalinity (as CaCO3), mg/l	IS 3025 Part 23	64	200 Max	600 Max
14	Sulphate (as SO4), mg/l	IS 3025 Part 24	28	200 Max	400 Max
15	Chloride (as Cl), mg/l	IS 3025 Part 32	12.4	250 Max	1000 Max
16	Nitrate (as NO3), mg/l	IS 3025 Part 34	1.5	45 Max	No Relaxation
17	Ammonia (as NH3), mg/l	IS 3025 Part 34	0.24	0.5 Max	No Relaxation
18	Iron (as Fe), mg/l	IS 3025 Part 53	0.08	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO4), mg/l	IS 3025 Part 31	0.7	-	-
20	Total Hardness (as CaCO3), mg/l	IS 3025 Part 21	61	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	02	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	11	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	6.5	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.8	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

Issued to:

Test Report No.	:	**ITL/ENV/PR/SW/2201240011**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/SW/2201240011** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Surface Water
Type of Sample	:	Water Sample
Date of Sample Collection	:	07/01/2022
Location / Source of Sample	:	Nongstoin Latitude- 25.700120 N longitude- 94.437104 E Chainage - 04+450 Km, Distance from alignment - 100m
Sample Quantity	:	2.5 Liter
Sample Condition	:	OK
Sampling Method	:	IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.14	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	19.2	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	240	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	156	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	4	-	-
8	Total Solids, mg/l	IS 3025 Part 15	160	-	-
9	Calcium (as Ca), mg/l	IS 3025 Part 40	15.2	75 Max	200 Max
10	Magnesium (as Mg), mg/l	IS 3025 Part 46	8.4	30 Max	100 Max
11	Sodium (as Na), mg/l	IS 3025 Part 45	16.5	-	-
12	Potassium (as K), mg/l	IS 3025 Part 45	6.4	-	-
13	Total Alkalinity (as CaCO3), mg/l	IS 3025 Part 23	71	200 Max	600 Max
14	Sulphate (as SO4), mg/l	IS 3025 Part 24	34	200 Max	400 Max
15	Chloride (as Cl), mg/l	IS 3025 Part 32	16.2	250 Max	1000 Max
16	Nitrate (as NO3), mg/l	IS 3025 Part 34	1.2	45 Max	No Relaxation
17	Ammonia (as NH3), mg/l	IS 3025 Part 34	0.28	0.5 Max	No Relaxation
18	Iron (as Fe), mg/l	IS 3025 Part 53	0.04	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO4), mg/l	IS 3025 Part 31	0.4	-	-
20	Total Hardness (as CaCO3), mg/l	IS 3025 Part 21	72.4	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	02	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	09	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	6.2	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.6	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

Soil Monitoring Report

Issued to:

Test Report No.	:	**ITL/ENV/PR/SS/2201240014**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/SS/2201240014** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Soil Sample
Type of Sample	:	Soil Sample
Date of Sample Collection	:	07/01/2022
Location / Source of Sample	:	**Miangkain** Latitude- 26.704350 N Longitude- 94.440923 E Chainage - 26+000 Km, Distance from alignment - 150m
Sample Quantity	:	5 kg
Sample Condition	:	Sealed, Ok
Sampling Method	:	ITL/SOP/Soil/01
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Silty Clay Soil
2	Soil Colour	ITL/SOP/ENV/Soil/08		Greyish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.88
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	714
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	9.5
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.29
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.17
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	22.8
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	3.99
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	68.4
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	59
12	Nitrate as NO3	ITL/SOP/ENV/Soil/12	mg/Kg	104
13	Sulphate as SO4	ITL/SOP/ENV/Soil/14	mg/Kg	14.2
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	5.9
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	4.9
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	6.2
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	13.4
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	18.2
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	39.2
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	42.6

Issued to:

Test Report No.	:	**ITL/ENV/PR/SS/2201240013**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/SS/2201240013** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Soil Sample
Type of Sample	:	Soil Sample
Date of Sample Collection	:	07/01/2022
Location / Source of Sample	:	**Nongstoin** Latitude- 26.704350 N Longitude- 94.440923 E Chainage - 02+600 Km, Distance from alignment - 150m
Sample Quantity	:	5 kg
Sample Condition	:	Sealed, Ok
Sampling Method	:	ITL/SOP/Soil/01
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Silty Clay Soil
2	Soil Colour	ITL/SOP/ENV/Soil/08		Greyish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	8.15
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	677
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	9.1
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.30
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.22
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	25.1
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	4.21
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	73.1
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	64
12	Nitrate as NO3	ITL/SOP/ENV/Soil/12	mg/Kg	101
13	Sulphate as SO4	ITL/SOP/ENV/Soil/14	mg/Kg	13.4
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	5.2
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	4.5
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	6.5
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	14.2
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	23.4
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	34.1
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	42.5

Annexure 3: Air Modelling Report

Introduction

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, smoothened 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_2, NO_x, 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 e AERMOD View™ model based on Gaussian Equation. The current and projected traffic volume of **A20_2 (Balighat Tiniali to Nakachari)** road has been used for the prediction. The modeling was carried out using AERMOD developed by USEPA. The AERMOD air dispersion model is USEPAs official "Appendix A" air dispersion model for regulatory use and was developed by the AERMIC (The American Meteorological Society/EPA Regulatory Model Improvement Committee) work group (Cimorelli et al., 2004). AERMOD aims at modeling short-range (up to 50 km) dispersion from a variety of polluting sources (e.g., point, area, and volume sources) using a number of model configurations. These configurations include different sets of urban or rural dispersion coefficients as well as simple and complex topography. The model has the capacity to employ hourly sequential pre-processed meteorological data to estimate concentrations of pollutants at receptor locations at different time scales ranging from 1 h to 12 months. AERMOD is an advanced plume model that incorporates updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of terrain interactions.

Objectives of the Study

5. To estimate the emission inventory of the various sources around the project.
6. To estimate the emission inventory with the project development
7. To assess regulatory requirements
8. To recommend the prevention and mitigation measures to reduce the impacts

Tools and Methods

The major source of pollutants from the proposed project road is vehicular exhaust i.e. line source during the operational phase. Source dispersion analysis is assumed based on the AERMOD ViewTM model. This model enables analysis with respect to PM, and NOx, and gives results in easy-to-understand graphical format.

The following steps are involved in the analysis:

9. Inputs are entered into the software as per the general modeling parameters.
10. Information on the roadway network, traffic volume, and receptors are added to the software.

11. The analysis process is done by the model.

Input(s) and assumptions

Sl. no	Input Required		Availability for project
1.	Traffic Parameters	Traffic Volume	Yes
		Traffic Composition	Yes
		Type of Fuel used by each category	Yes
		Average Speed of the Vehicles	Yes
2.	Meteorological Parameters	Wind Speed, Wind Direction, Cloud Cover, Temperature, Humidity, Station Pressure, etc	IMD Weather data
3.	Emission Parameters	Expressed in grams/distance travelled	CPCB 2011
		Expressed in grams/m2/second emitted	US-EPA, AP42
		Expressed in grams/second emitted	US-EPA, AP42
4.	Road Geometry	Road Width	Actual
		Median Width	Actual
5.	Receptor	Uniform grid	Uniform grid

Model Inputs

AERMOD View™ was used for evaluating the emission scenarios for the proposed project. The inputs to the model are defined in 5 functional pathways as represented in the following sections. Each of these functional parameters includes several options that may be user-defined or set as default, the details of some of these essential elements of AERMOD View™ runs were explained in the discussions.

Control pathway inputs

12. **Default option**
13. **Calculate the concentration**
14. **Averaging period of 24hr and 1hr depending on the NAAQS and pollutant type**

Source pathway inputs

15. **Includes definition of source, its locations**
16. **Vehicle source parameter include emissions (g/m^2/s)**
17. **Construction and haul road within; area source parameter include emissions (g/m^2 /s)**

Receptors pathway inputs

18. **Cartesian grid starting at the SE corner of the ward with 400m increment over X & Y coordinates, thus forming a receptor output grid radius of 1km**
19. **Uniform grid is selected with 10x10 cell size**

Meteorology pathways inputs

20. **One hourly regional data was used as an input in the meteorology processor to generate model ready input surface & profile meteorology files.**

21. **Roughness length of 1m of measurement height, displacement height of 0.2m, Albedo of 0.2 & measurement height of 14m i.e. the height at which measurements of meteorology have been done**
22. **The minimum wind speed (0.5 m/s lower than 1m/s considered as calm by IMD), minimum mixed layer height (50m), and minimum heat flux 20 W/M2/s).**
23. **The potential temperature gradient above the mixed layer**
24. **The weather data for Thane base station provided by the Indian Meteorological Department (IMD) have been used for the present project. The data was compiled in the AERMET module of A ERMOD View™ and the results of this final analysis were used as input meteorological data**.

Output Pathway

The model ran for 1 hr average as per the pollutant type and the NAAQS standards criteria. The contour for 1st highest reading is shown for each pollutant based on construction and operational scenarios.

Model outputs were obtained for emissions of each of the pollutants in each of the 500m x 500m receptor grid spread across the gridded impact zone. A contour map is plotted for each of the study pollutants and the impact by the line source i.e. operational scenario including additional vehicle assumed to be added due to project. This map is superimposed on the road tile map of the proposed location. The maximum ground level concentration of criterion pollutants modeled by AERMOD ViewTM for the construction and operational scenarios are added to the average value of observed value of criterion pollutant from Ambient Air Quality Monitoring Report at project site to assess the impact of project on air quality.

The results of modeled maximum ground level concentrations of pollutants for both construction and operation phase were presented in the below table.

Description of the component	Chainage	Easting	Northing	PM10 Base	PM10 2041	Nox base	Nox 2041
Church	1+950	325015.18	2823450	0.01046	0.01536	1.15545	0.66448
Church	2+800	324340.30	2823289	0.26455	0.38855	29.2193	16.78559
School	2+900	324237.30	2823244	0.13802	0.20272	15.2442	8.75733
School	3+050	324104.80	2823208	0.12473	0.18320	13.7764	7.91412
School	3+050	324133.00	2823190	0.35469	0.52094	39.17497	22.50477
Educational Institute	**3+550**	323633.20	2823089	0.09273	0.13619	10.24182	5.88360
School	3+850	323520.80	2822841	0.03191	0.04687	3.52472	2.02484
Church	4+250	323198.60	2822682.6	0.02173	0.03192	2.40015	1.37881
School	4+250	323139.15	2822713.3	0.02377	0.03491	2.62507	1.50802
School	4+300	323116.10	2822715	0.02445	0.03591	2.70081	1.55153
Church	14+850	314655.30	2821203	0.05683	0.08347	6.27701	3.60670
Graveyard	15+150	314465.56	2820939.6	0.13103	0.19692	14.80812	9.89731
School	34+150	306245.75	2814632.1	0.12821	0.18836	14.16489	8.15349

Annexure 4: Noise Modelling Report

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:

1. 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.
2. Medium trucks: all cargo vehicles with two axles and six tires – generally with gross vehicle weight between 4500 kg and 12000 kg.
3. Heavy trucks: All cargo vehicles with three or more axles, generally with gross vehicle weight more than 12000 kg.
4. Buses: all vehicles designed to carry more than nine passengers
5. 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:

6. Identification of various receivers,
7. Determination of land uses and activities which may be affected by the noise generated
8. Assemble input parameters
9. Application of the model

- 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: AADT at Thahkanar (6th Km)

Year	Growth Factors	AAD															TotalinNumbers	TotalinPCU
		Two Wheeler	Car/Jeep/ Van/Taxi/Auto	Mini/RTVs Bus	Stand.Bus	LCV	2-Axle	3-Axle	Multi-Axle	Agri.Tract. WithTrailor	Agri.Tract. WithoutTrailor	Cycle	Cycle Rickshaw	HandCart	BullockCart	HorseCart		
2021	5.0%	5	52	2	2	40	638	106	0	8	0	0	0	0	0	0	853	2390
2022	5.0%	6	55	2	2	42	670	111	0	8	0	0	0	0	0	0	895	2509
2023	5.0%	6	57	2	2	44	703	116	0	9	0	0	0	0	0	0	940	2635
2024	5.0%	6	60	2	2	46	738	122	0	9	0	0	0	0	0	0	987	2766
2025	5.0%	6	63	2	2	49	775	128	0	10	0	0	0	0	0	0	1036	2905
2026	5.0%	7	66	3	3	51	814	135	0	10	0	0	0	0	0	0	1088	3050
2027	5.0%	7	70	3	3	54	855	142	0	11	0	0	0	0	0	0	1143	3202
2028	5.0%	8	73	3	3	56	897	149	0	11	0	0	0	0	0	0	1200	3363
2029	5.0%	8	77	3	3	59	942	156	0	12	0	0	0	0	0	0	1260	3531
2030	5.0%	8	81	3	3	62	989	164	0	12	0	0	0	0	0	0	1323	3707
2031	5.0%	9	85	3	3	65	1039	172	0	13	0	0	0	0	0	0	1389	3893
2032	5.0%	9	89	3	3	68	1091	181	0	14	0	0	0	0	0	0	1458	4087
2033	5.0%	10	93	4	4	72	1145	190	0	14	0	0	0	0	0	0	1531	4291
2034	5.0%	10	98	4	4	75	1202	199	0	15	0	0	0	0	0	0	1608	4506
2035	5.0%	11	103	4	4	79	1263	209	0	16	0	0	0	0	0	0	1688	4731
2036	5.0%	11	108	4	4	83	1326	220	0	17	0	0	0	0	0	0	1773	4968
2037	5.0%	12	114	4	4	87	1392	231	0	17	0	0	0	0	0	0	1861	5216
2038	5.0%	12	119	5	5	92	1462	242	0	18	0	0	0	0	0	0	1954	5477

2039	5.0%	13	125	5	5	96	1535	254	0	19	0	0	0	0	0	0	2052	5751
2040	5.0%	13	131	5	5	10	1611	267	0	20	0	0	0	0	0	0	2155	6039
2041	5.0%	14	138	5	5	10	1692	280	0	21	0	0	0	0	0	0	2262	6340
2042	5.0%	15	145	6	6	11	1777	294	0	22	0	0	0	0	0	0	2375	6658
2043	5.0%	16	152	6	6	11	1865	309	0	23	0	0	0	0	0	0	2494	6990
2044	5.0%	16	160	6	6	12	1959	325	0	25	0	0	0	0	0	0	2619	7340

Table B:AADT at Nonglyndoh (20th Km)

Year	Growth Factors	AAD															Totalin Number s	TotalinPCU
		Two Wheeler	Car/Jeep/ Van/Taxi/Auto	Mini/RTVs Bus	Stand.Bus	LCV	2-Axle	3-Axle	Multi-Axle	Agri.Tract. WithTrailor	Agri.Tract. WithoutTrailor	Cycl	Cycle	HandCart	BullockCart	HorseCart		
2021	5.0%	5	42	2	2	40	637	102	0	7	0	0	0	0	0	0	838	2364
2022	5.0%	6	44	2	2	42	669	107	0	8	0	0	0	0	0	0	880	2483
2023	5.0%	6	46	2	2	44	703	112	0	8	0	0	0	0	0	0	924	2607
2024	5.0%	6	48	2	2	46	738	118	0	8	0	0	0	0	0	0	970	2737
2025	5.0%	6	51	2	2	49	775	124	0	9	0	0	0	0	0	0	1018	2874
2026	5.0%	7	53	3	3	51	813	130	0	9	0	0	0	0	0	0	1069	3018
2027	5.0%	7	56	3	3	54	854	137	0	10	0	0	0	0	0	0	1123	3168
2028	5.0%	8	59	3	3	56	897	144	0	10	0	0	0	0	0	0	1179	3327
2029	5.0%	8	62	3	3	59	942	151	0	11	0	0	0	0	0	0	1238	3493
2030	5.0%	8	65	3	3	62	989	158	0	11	0	0	0	0	0	0	1299	3668
2031	5.0%	9	68	3	3	65	1038	166	0	12	0	0	0	0	0	0	1364	3851
2032	5.0%	9	71	3	3	68	1090	174	0	13	0	0	0	0	0	0	1433	4044

2033	5.0%	10	75	4	4	72	1145	183	0	13	0	0	0	0	0	0	1504	4246
2034	5.0%	10	79	4	4	75	1202	192	0	14	0	0	0	0	0	0	1580	4458
2035	5.0%	11	82	4	4	79	1262	202	0	15	0	0	0	0	0	0	1659	4681
2036	5.0%	11	87	4	4	83	1325	212	0	15	0	0	0	0	0	0	1741	4915
2037	5.0%	12	91	4	4	87	1391	223	0	16	0	0	0	0	0	0	1829	5161
2038	5.0%	12	96	5	5	92	1461	234	0	17	0	0	0	0	0	0	1920	5419
2039	5.0%	13	10	5	5	96	1534	245	0	18	0	0	0	0	0	0	2016	5690
2040	5.0%	13	10	5	5	10	1611	258	0	19	0	0	0	0	0	0	2117	5975
2041	5.0%	14	11	5	5	10	1691	271	0	19	0	0	0	0	0	0	2223	6273
2042	5.0%	15	11	6	6	11	1776	284	0	20	0	0	0	0	0	0	2334	6587
2043	5.0%	16	12	6	6	11	1864	298	0	21	0	0	0	0	0	0	2450	6916
2044	5.0%	16	12	6	6	12	1958	313	0	23	0	0	0	0	0	0	2573	7262

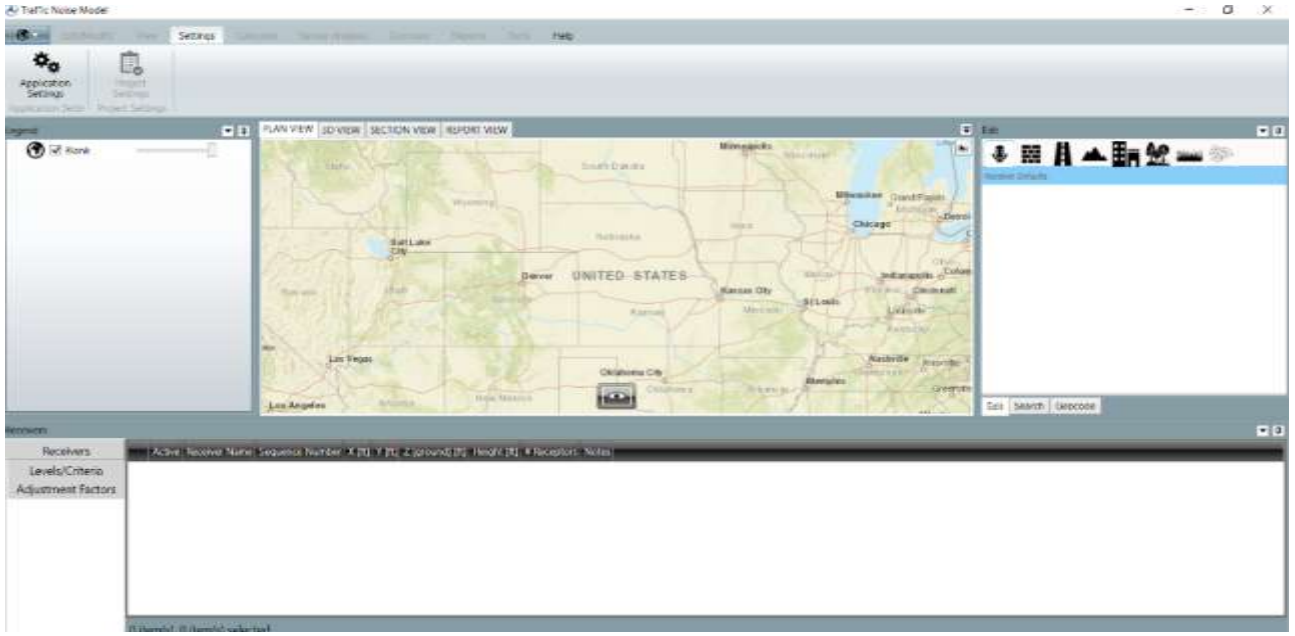


Figure 40: Layout of FHWA's Traffic Noise Model(3.0)

Output of Noise Prediction:

For Year 2021:

REPORT:	**Results: Sound Levels - Input Heights**		
TNM VERSION:	3.0.7.60002	REPORT DATE:	25 January 2022
CALCULATED WITH:	3.0.7.60002	CALCULATION DATE:	25-01-2022 14:29:40
CASE:	Nongstoin-Maweit	ORGANIZATION:	Bongs Prayukti International
ANALYSIS BY:	Anushka Chakraborty	PROJECT/CONTRACT:	Demo
DEFAULT GROUND TYPE:	HardSoil		
ATMOSPHERICS:	20°C, 50%	Average pavement type shall be used unless a state highway agency	
PAVEMENT TYPE(S) USED:	Average	substantiates the use of a different type with approval of FHWA.	

			Noise Reduction			Barrier Cost			
			Min	Avg	Max	Area / Volume	Lineal	Total	Total/DUs
Results for:		DUs	dB	dB	dB	$	$	$	$
Receivers in the Barrier Design:	All	17	0.0	0.0	0.0	0	0	0	0
	All Impacted	4	0.0	0.0	0.0	0	0	0	0
Meeting Noise Reduction Goal:	All	0	---	---	---	0	0	0	---
	All Impacted	0	---	---	---	0	0	0	---

Receiver				Modeled Traffic Noise Levels								
				All Abatement Barriers at Zero Height					With Abatement Barriers			
				LAeq		Increase over Existing				Noise Reduction		Calc.
			Existing LAeq	Calc.	Absolute Criterion	Calc.	Relative Criterion	Type of	Calc. LAeq	Calc.	Goal	Minus Goal

Name	No.	DUs	dBA	dBA	dBA	dBA	dBA	Impact	dBA	dBA	dBA	dBA
CHC 1.950-1	1	1	---	57.0	50.0	---	---	Sound Level	57.0	0.0	8.0	-8.0
CHC 2.800-2	2	1	---	45.6	50.0	---	---	None	45.6	0.0	8.0	-8.0
SCH 2.900-1	3	1	---	36.7	50.0	---	---	None	36.7	0.0	8.0	-8.0
SCH 3.050-2	4	1	---	38.4	50.0	---	---	None	38.4	0.0	8.0	-8.0
SCH 3.050-3	5	1	---	37.2	50.0	---	---	None	37.2	0.0	8.0	-8.0
INS 3.550-1	6	1	---	40.7	50.0	---	---	None	40.7	0.0	8.0	-8.0
SCH 3.850-4	7	1	---	38.5	50.0	---	---	None	38.5	0.0	8.0	-8.0
CHC 4.250-3	8	1	---	52.7	50.0	---	---	Sound Level	52.7	0.0	8.0	-8.0
SCH 4.250-5	9	1	---	44.0	50.0	---	---	None	44.0	0.0	8.0	-8.0
SCH 4.300-6	10	1	---	41.3	50.0	---	---	None	41.3	0.0	8.0	-8.0
CHC 14.850-4	11	1	---	47.1	50.0	---	---	None	47.1	0.0	8.0	-8.0
GY 15.150-1	12	1	---	58.5	50.0	---	---	Sound Level	58.5	0.0	8.0	-8.0
CHC 20.300-5	13	1	---	36.6	50.0	---	---	None	36.6	0.0	8.0	-8.0
SCH 34.050-7	14	1	---	41.7	50.0	---	---	None	41.7	0.0	8.0	-8.0
SCH 34.100-8	15	1	---	58.1	50.0	---	---	Sound Level	58.1	0.0	8.0	-8.0
SCH 34.150-9	16	1	---	43.4	50.0	---	---	None	43.4	0.0	8.0	-8.0
SCH 34.250-10	17	1	---	42.8	50.0	---	---	None	42.8	0.0	8.0	-8.0

For year 2044:

REPORT:	**Results: Sound Levels - Input Heights**		
TNM VERSION:	3.0.7.60002	REPORT DATE:	25 January 2022
CALCULATED WITH:	3.0.7.60002	CALCULATION DATE:	25-01-2022 15:51:00
CASE:	Nongstoin-Maweit	ORGANIZATION:	Bongs Prayukti International
ANALYSIS BY:	Anushka Chakraborty	PROJECT/CONTRACT:	Demo

DEFAULT GROUND TYPE:	HardSoil	
ATMOSPHERICS:	20°C, 50%	Average pavement type shall be used unless a state highway agency
PAVEMENT TYPE(S) USED:	Average	substantiates the use of a different type with approval of FHWA.

Results for:		DUs	Noise Reduction Min dB	Noise Reduction Avg dB	Noise Reduction Max dB	Barrier Cost Area / Volume $	Barrier Cost Lineal $	Barrier Cost Total $	Barrier Cost Total/DUs $
Receivers in the Barrier Design:	All	17	0.0	0.0	0.0	0	0	0	0
	All Impacted	6	0.0	0.0	0.0	0	0	0	0
Meeting Noise Reduction Goal:	All	0	---	---	---	0	0	0	---
	All Impacted	0	---	---	---	0	0	0	---

Receiver				Modeled Traffic Noise Levels								
				All Abatement Barriers at Zero Height					With Abatement Barriers			
				LAeq		Increase over Existing				Noise Reduction		Calc.
Name	No.	DUs	Existing LAeq dBA	Calc. dBA	Absolute Criterion dBA	Calc. dBA	Relative Criterion dBA	Type of Impact	Calc. LAeq dBA	Calc. dBA	Goal dBA	Minus Goal dBA
CHC 1.950-1	1	1	---	61.8	50.0	---	---	Sound Level	61.8	0.0	8.0	-8.0
CHC 2.800-2	2	1	---	50.4	50.0	---	---	Sound Level	50.4	0.0	8.0	-8.0
SCH 2.900-1	3	1	---	41.5	50.0	---	---	None	41.5	0.0	8.0	-8.0
SCH 3.050-2	4	1	---	43.2	50.0	---	---	None	43.2	0.0	8.0	-8.0
SCH 3.050-3	5	1	---	42.0	50.0	---	---	None	42.0	0.0	8.0	-8.0
INS 3.550-1	6	1	---	45.5	50.0	---	---	None	45.5	0.0	8.0	-8.0
SCH 3.850-4	7	1	---	43.3	50.0	---	---	None	43.3	0.0	8.0	-8.0

CHC 4.250-3	8	1	---	57.5	50.0	---	---	Sound Level	57.5	0.0	8.0	-8.0
SCH 4.250-5	9	1	---	48.8	50.0	---	---	None	48.8	0.0	8.0	-8.0
SCH 4.300-6	10	1	---	46.2	50.0	---	---	None	46.2	0.0	8.0	-8.0
CHC 14.850-4	11	1	---	51.8	50.0	---	---	Sound Level	51.8	0.0	8.0	-8.0
GY 15.150-1	12	1	---	63.3	50.0	---	---	Sound Level	63.3	0.0	8.0	-8.0
CHC 20.300-5	13	1	---	41.3	50.0	---	---	None	41.3	0.0	8.0	-8.0
SCH 34.050-7	14	1	---	46.4	50.0	---	---	None	46.4	0.0	8.0	-8.0
SCH 34.100-8	15	1	---	62.8	50.0	---	---	Sound Level	62.8	0.0	8.0	-8.0
SCH 34.150-9	16	1	---	48.1	50.0	---	---	None	48.1	0.0	8.0	-8.0
SCH 34.250-10	17	1	---	47.5	50.0	---	---	None	47.5	0.0	8.0	-8.0

Annexure 5: Record of Public Consultation

Figure 41: Public Consultation at Sibsing Memorial School

Figure 42:Public Consultation at DFO Office

Annexure 6: Select Picture Plate

Annexure 7: World Bank Environmental Health and Safety Guidelines for Quarry

Authorized Quarries that meet environmental and social standards and the necessary technical specifications will be identified by PIU in the project area.

25. Quarries must adhere to World Bank Environmental Health and Safety Guidelines
26. In case of new Quarries, they must have permission from the Department of Mining and Geology and have the necessary clearances from Pollution Control Board and Forest Department and a valid Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA);
27. Quarry should not be operating in any sites of valuable critical or natural habitat
28. Quarry should not be operating in landslide or erosion prone zones
29. Quarry should not disrupt drainage pattern or cause water pollution
30. Quarry should not be operating on the road where operations can disrupt traffic or pose safety risks
31. Where possible, quarry must include a rehabilitation plan
32. Quarry workers must have access to Personal Protective Equipment during operations
33. Quarry workers do not employ child labour
34. Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials and other logistic arrangements In case the contractor decides to usequarries other than recommended by DPR consultant, then will beselected based on the suitability of the materials.
35. The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the PIU and Environmental Expert of the SC.
36. Contractor will also work out haul road network and report to Environmental Expert of the PIU and SC will inspect and in turn report to PIU before approval.

Authorized sources of sand that meet environmental and social standards and the necessary technical specifications will be identified by PIU in the project area.

37. Authorized Sources of Sand that meet environmental and social standards and technical specifications identified and supply chain with contractor established
38. Sources of Sand adhere to World Bank Environmental Health and Safety Guidelines
39. Environmental safeguards: As per the Meghalaya Minor Minerals Concession Rules, 2016 (MMMCR), sand mining is treated as a quarry which requires a permit from the Divisional Forest Officer and the Principle Chief Conservator of Forest & HOFF of the Forest Department.
40. Permission will not be allowed during the month from June to August, since it is breeding season for the aquatic life.
41. Source of sand should not be from sites of critical or natural habitat, fish spawning sites, nesting sites or have the presence of known herpetofauna.
42. In case source of sand is from a river bed, the following should be ensured:
43. Sand removal rates, and processes of collection and transportation should not cause any changes to channel morphology, increased erosion, impact to aquatic or riparian habitats, decrease in flood control properties of the sand bank or pollute the river.
44. Sand removal incisions should not be from sites that could undermine the stability of support structures such as bridges

45. Sites should not lead to the creation of deep pools that could lead to an increase in vector borne disease
46. Sand mining operators have access to appropriate Personal Protective Equipment during operations
47. Mining operations should not impact other riparian livelihoods such as fishing
48. Sand mining operations should not employ child labour
49. Sand mining from any sources that could impact ecosystem structure, process or biodiversity in rivers is strictly prohibited and will be ascertained by the environment expert, PIU
50. In case identified source of sand is from a river, the following guidelines are to be followed:http://mines.bih.nic.in/Docs/Sustainable-Sand-MiningManagement-Guidelines-2016.pdf